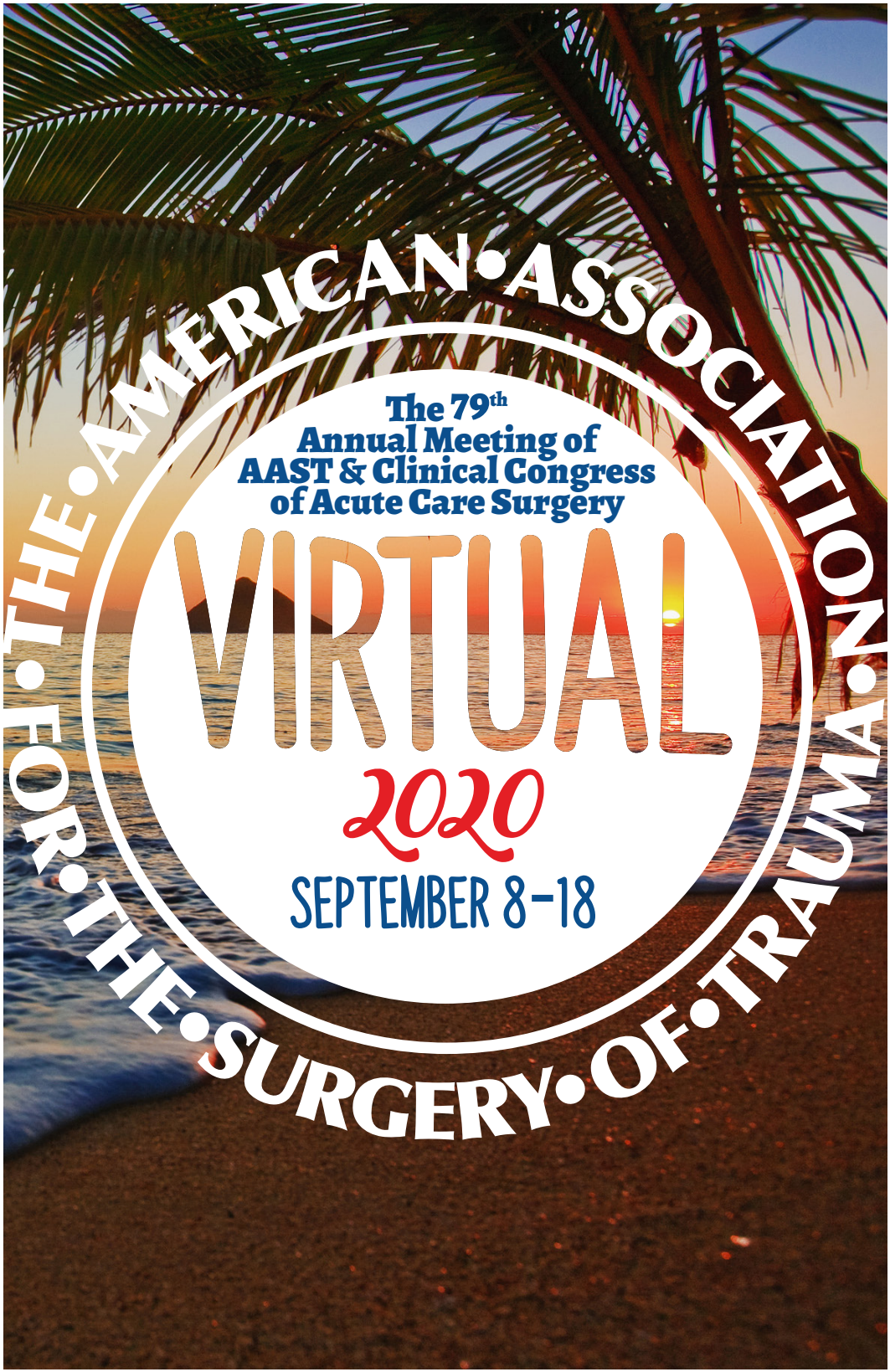
THE AMERICAN ASSOCIATION FOR THE SURGERY OF TRAUMA
The 79th Annual Meeting of AAST & Clinical Congress of Acute Care Surgery
VIRTUAL
2020
SEPTEMBER 8–18

Program Requirements

1. Continuing Medical Education Credit Information

CONTINUING MEDICAL EDUCATION CREDIT INFORMATION

Accreditation

This activity has been planned and implemented in accordance with the Essential Areas and Policies of the Accreditation Council for Continuing Medical Education (ACCME) through the joint providership of the American College of Surgeons and the American Association for the Surgery of Trauma. The American College of Surgeons is accredited by the ACCME to provide continuing medical education for physicians.

AMA PRA Category 1 Credits™

The American College of Surgeons designates this live activity for a maximum of 62.25 *AMA PRA Category 1 Credits™*. Physicians should claim only the credit commensurate with the extent of their participation in the activity.

Of the *AMA PRA Category 1 Credits™* listed above, a maximum of 5.00 credits meet the requirements for Self-Assessment.

Of the *AMA PRA Category 1 Credits™* listed above, a maximum of 62.25 hours meet the requirements for Trauma.*

Of the *AMA PRA Category 1 Credits™* listed above, a maximum of 18.00 hours meet the requirements for Pediatric Trauma. *

Of the *AMA PRA Category 1 Credits™* listed above, a maximum of 15.50 hours meet the requirements for Surgical Critical Care.*

**The content of this activity may meet certain mandates of regulatory bodies. Please note that ACS has not and does not verify the content for such mandates with any regulatory body. Individual physicians are responsible for verifying the content satisfies such requirements.*

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AMERICAN COLLEGE OF SURGEONS
DIVISION OF EDUCATION

2. PROGRAM OBJECTIVES

- Exchange knowledge pertaining to current research practices and training in the surgery of trauma
- Design research studies to investigate new methods of preventing, correcting and treating traumatic injuries

3. DISCLOSURE INFORMATION

In accordance with the ACCME Accreditation Criteria, the American College of Surgeons must ensure that anyone in a position to control the content of the educational activity (planners and speakers/authors) has disclosed all financial relationships with any commercial interest.

The ACCME also requires that ACS manage any reported conflict and eliminate the potential for bias during the educational activity. Any conflicts noted below have been managed to our satisfaction. The disclosure information is intended to identify any commercial relationships and allow learners to form their own judgments. However, if you perceive a bias during the educational activity, please report it on the evaluation.

For additional information, please visit the ACCME website (see below for definitions).

Commercial Interest: The ACCME defines a "commercial interest" as any entity producing, marketing, re-selling, or distributing health care goods or services used on or consumed by patients. Providers of clinical services directly to patients are NOT included in this definition.
Financial Relationships: Relationships in which the individual benefits by receiving a salary, royalty, intellectual property rights, consulting fee, honoraria, ownership interest (e.g., stocks, stock options or other ownership interest, excluding diversified mutual funds), or other financial benefit. Financial benefits are usually associated with roles such as employment, management position, independent contractor (including contracted research), consulting, speaking and teaching, membership on advisory committees or review panels, board membership, and other activities from which remuneration is received, or expected. ACCME considers relationships of the person involved in the CME activity to include financial relationships of a spouse or partner.
Conflict of Interest: Circumstances create a conflict of interest when an individual has an opportunity to affect CME content about products or services of a commercial interest with which he/she has a financial relationship.

DISCLOSURE INFORMATION

79th Annual Meeting of AAST & Clinical Congress of Acute Care Surgery
September 8 -18, 2020
Virtual Meeting

Program Committee Disclosures:

	Nothing to Disclose	Disclosure		
		Company	Role	Received
Rosemary Kozar	No			
Robert Winchell	Yes	Stryker Corporation	Consultant for device development	Consulting Fee
Kimberly A. Davis	No			
Timothy Fabian	No			
David Livingston	No			
Lou Magnotti	No			
Patrick Reilly	No			
Susan Rowell	No			
Ali Salim	No			
Jason Smith	No			
Ernest Moore	Yes	Haemonetics, Instrumentation Laboratory, Stago, ThromboTherapeutics	PI, Co-founder	Research support, stock
Clay Burlew	No			
David Spain	No			

Speaker Disclosures:

	Nothing to Disclose	Disclosure		
		Company	Role	Received
Khaled Abdul				
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Suresh Agarwal	No			
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Gary Bass	No			
Robert Becher	No			
Tiffany Bee	No			
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Annika Bickford	No			
Walter Biffl	No			
Joshua Billings	No			
Jonathan Black	No			
Stephanie Bonne	No			
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Benjamin Braslow	No			

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A. Britton	No			
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Eileen Bulger	No			
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Clay Burlew	No			
Sigrid Burruss	No			
Karyn Butler	No			
Rachael Callcut	No			
Brendan Campbell	No			
Andre Campbell	No			
Jeremy Cannon	No			
Matthew Carr	No			
Manuel Castillo-Angeles	No			
Anthony Charles	No			
Mohamad Chehab	No			
William Chiu	No			
Jeff Choi	No			
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Jeffrey Claridge	No			
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Stephen Cohn	No			
Raul Coimbra	No			
Jamie Coleman	No			
Julia Coleman	No			
Zara Cooper	No			
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Bryan Cotton	Yes	Haemonetics Corp	Consultant Services	Consultant Fees
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James Davis	No			
Tracey Dechert	No			
Demetrios Demetriades	No			
Terri deRoon-Cassini	No			
Michael DeWane	No			
Chathurika Dhanasekara	No			
Rochelle Dicker	No			
Lawrence Diebel	No			
Jody DiGiacomo	No			

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Sharmila Dissanaike	No			
Jay Doucet	Yes	UpToDate	Module author	Honorarium
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Juan Duchesne	No			
Linda Dultz	No			
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Phil Efron	No			
Mohammad El	No			
Anuoluwapo Elegbede	No			
Mohamed Elsaadani	No			
Thomas Esposito	No			
Susan Evans	No			
Samir Fakhry	No			
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David Feliciano	No			
Paula Ferrada	No			
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Nina Glass	No			
Nicole Goulet	No			
Daniel Grabo	No			
Arthur Grimes	No			
Oscar Guillamondegui	No			
Jennifer Gurney	No			
Matthew Guttman	No			
Bachar Halimeh	No			
David Harrington	No			
Jennifer Hartwell	No			
Carl Hauser	No			
Elliott Haut	Yes	Vizient	Consulting/speaking	Consulting/speaking fees
Jason Hecht	No			
Sharon Henry	No			
Vanessa Ho	Yes	Zimmer Biomet, Sig Medical, Atricure, Medtronic	Consultant	Spouse/consulting fees
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Dara Horn	No			
August Houghton	No			

Peter Hu	No			
Jennifer Hubbard	No			
Kenji Inaba	No			
Joshua Jaramillo	No			
Molly Jarman	No			
Faisal Jehan	No			
Aaron Jensen	No			
Michael Jones	No			
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D'Andrea Joseph	No			
Bellal Joseph	No			
Gregory Jurkovich	No			
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Muhammad Khurrum	No			
Jennifer Knight	No			
Lisa Knowlton	No			
Rosemary Kozar	No			
Leandra Krowsoski	No			
Kali Kuhlenschmidt	No			
Deborah Kuhls	No			
Daniel Lammers	No			
Michael Lekawa	No			
Jennifer Leonard	No			
Richard Lewis	No			
Eric Ley	No			
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Andrea Long	No			
Lawrence Lottenberg	No			
Louis Magnotti	No			
Ajai Malhotra	No			
Alicia Mangram	No			
Nathan Manley	No			
M. Margaret	No			
Daniel Margulies	No			
Matthew Martin	Yes	Z-Medica	Advisory Board	Stipend
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Constance McGraw	No			

Robert McInyre	Yes	Atox-Bio, OctaPharma, Medtronic, Genentech	PI	Grant
Morgan McMonagle	No			
Michelle McNutt	No			
Ashley Meagher	No			
April Mendoza	No			
John Michel-Ruddy	No			
Christopher Michetti	No			
Preston Miller	No			
Joseph Minei	No			
Jason Miner	No			
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Laura Moore	Yes	Frontline Medical Technologies, DecisioHealth	Clinical Founder	Equity, consulting fees, stock
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Natsuhiro Morita	No			
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Bindi Naik-Mathuria	No			
Nicholas Namias	No			
Avery Nathens	No			
Adam Nelson	No			
Raminder Nirula	No			
Mina Nordness	No			
Adrian Ong	No			
Brandy Padilla-Jones	No			
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Shibani Pati	No			
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Ruben Peralta	No			
Alice Piccinini	No			
Fredric Pieracci	No			
Travis Polk	No			
John Porter	No			
Maxwell Presser	No			
Timothy Pritts	No			

Sydney Radding	No			
Todd Rasmussen	No			
Rishi Rattan	No			
Caroline Reinke	No			
Katherine Reitz	No			
Christina Riojas	No			
Frederick Rogers	No			
Anna Romagnoli	No			
Samuel Ross	No			
Scott Sagraves	No			
Noelle Saillant	No			
Joseph Sakran	No			
Edgardo Salcedo	No			
Ali Salim	No			
Heena Santry	No			
Babak Sarani	No			
Jack Sava	No			
Stephanie Savage	No			
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Jessica Schucht	No			
Kevin Schuster	No			
John Scott	No			
Catherine Seger	No			
Carrie Sims	No			
Michael Sise	No			
Jason Smith	No			
David Spain	No			
Jason Sperry	No			
Nicole Stassen	No			
Kristan Staudenmayer	No			
Deborah Stein	No			
Sharven Taghavi	No			
Goro Tajima	No			
Andrew Tang	No			
Leah Tatebe	No			
Bourke Tillmann	No			
S Robb Todd	No			
Gail Tominaga	No			
Ronald Tompkins	No			
Eric Toschlog	No			
Colleen Trevino	No			
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Glenn Wakam	No			
Eric Walser	No			
Michael Wandling	No			
Jordan Weinberg	No			
Thomas Weiser	No			
Michaela West	No			
Brian Williams	No			
Alison Wilson	No			
Robert Winchell	Yes	Stryker Corporation	Consultant	Consulting Fees
Ben Zarzaur	No			
Muhammad Zeeshan	No			
Christina Zhang	No			
Cheryl Zogg	No			

Schedule

Tuesday, September 8, 2020

9:00 AM - 9:30 AM — Presidential Introduction
David Spain, MD

9:30 AM - 12:30 PM — **Session I: Plenary Papers 1-9**
Moderator: David Spain, MD

Paper 1 **9:30 AM - 9:50 AM**
AFTER 800 MTP EVENTS, MORTALITY DUE TO HEMORRHAGIC SHOCK REMAINS HIGH AND UNCHANGED DESPITE SEVERAL HEMORRHAGE CONTROL ADVANCEMENTS; IS IT TIME TO MOVE THE PENDULUM?
Presenter: Juan Duchesne, MD Discussant: Jeremy Cannon, MD

Paper 2 **9:50 AM - 10:10 AM**
DYNAMIC USE OF FIBRINOGEN UNDER VISCOELASTIC ASSESSMENT RESULTS IN REDUCED NEED FOR PLASMA AND DIMINISHED OVERALL TRANSFUSION REQUIREMENTS IN SEVERE TRAUMA
Presenter: Marta Barquero López, MD Discussant: Mitchell Cohen, MD

Paper 3 **10:10 AM - 10:30 AM**
PLASMA RESUSCITATION WITH ADJUNCTIVE PERITONEAL RESUSCITATION REDUCES ISCHEMIA-INDUCED INTESTINAL BARRIER BREAKDOWN FOLLOWING HEMORRHAGIC SHOCK
Presenter: Jessica Schucht, MD Discussant: Donald Jenkins, MD

Paper 4 **10:30 AM - 10:50 AM**
INFLATE AND PACK! PELVIC PACKING COMBINED WITH REBOA DEPLOYMENT PREVENTS HEMORRHAGE-RELATED DEATHS IN UNSTABLE PELVIC FRACTURES
Presenter: Clay Cothren Burlew, MD Discussant: Carrie Sims, MD

Paper 5 **10:50 AM - 11:10 AM**
CRITICAL CARE ULTRASOUND IN GERIATRIC TRAUMA RESUSCITATION LEADS TO DECREASED FLUID ADMINISTRATION AND VENTILATOR DAYS
Presenter: Elaine Cleveland, MD Discussant: Paula Ferrada, MD

Paper 6 **11:10 AM - 11:30 AM**
OUTCOMES OF STANDARDIZED NONOPERATIVE MANAGEMENT OF HIGH-GRADE PANCREATIC TRAUMA IN CHILDREN: A STUDY FROM THE PEDIATRIC TRAUMA SOCIETY PANCREATIC TRAUMA STUDY GROUP
Presenter: Bindi Naik-Mathuria, MD, MPH Discussant: Kathryn Bass, MD

Paper 7 **11:30 AM - 11:50 AM**
ANTIPLATELET AND ANTICOAGULANT AGENTS, ALONE AND IN COMBINATION, HAVE MINIMAL IMPACT ON TRAUMATIC BRAIN INJURY (TBI) INCIDENCE, NEED FOR SURGERY, AND MORTALITY IN GERIATRIC GROUND-LEVEL FALLS (GLFS): A MULTI-INSTITUTIONAL ANALYSIS OF 33,710 PATIENTS
Presenter: Samir Fakhry, MD Discussant: Scott Sagraves, MD

Paper 8 **11:50 AM - 12:10 PM**
MEAN ARTERIAL PRESSURE MAINTENANCE FOLLOWING SPINAL CORD INJURY: DOES MEETING THE TARGET MATTER?
Presenter: Jordan Weinberg, MD Discussant: Deborah Stein, MD, MPH

Paper 9 **12:10 PM - 12:30 PM**
FIREARM STORAGE PRACTICES OF U.S. MEMBERS OF THE AMERICAN COLLEGE OF SURGEONS
Presenter: Brendan Campbell, MD Discussant: Tracey Dechert, MD

12:30 PM - 1:00 PM Break

1:00 PM - 2:00 PM Business Meeting

2:00 PM - 6:00 PM **Add-on Session:** Communications Committee, *"Trends, Updates, and Controversies in Acute Care Surgery"*

6:00 PM - 7:00 PM Happy Hour with AAST President! **Registration required*

Wednesday, September 9, 2020

12:00 PM - 1:00 PM **Lunch Session:** Palliative Care and Geriatrics Committees: *"Making Your Geriatric and Palliative Programs a Strength: TQIP Guideline Implementation and the VRC Perspective"*

1:00 PM - 2:40 PM **Session II: Papers 10-13**
Moderator: Rosemary Kozar, MD

Paper 10 **1:00 PM - 1:20 PM**
ANTITHROMBIN III AMELIORATES POST-TBI CEREBRAL LEUKOCYTE-ENDOTHELIAL CELL INTERACTIONS AND BLOOD BRAIN BARRIER (BBB) PERMEABILITY IN VIVO
Presenter: Mohamed Elsaadani, MD Discussant: Hasan Alam, MD

Paper 11 **1:20 PM - 1:40 PM**
THE EXPRESSION OF REPULSIVE GUIDANCE MOLECULE A (RGMA) AFTER TRAUMATIC BRAIN INJURY: THE TIME-COURSE GENE EXPRESSION CHANGES IN THE MURINE-CONTROLLED CORTICAL IMPACT MODEL
Presenter: Eri Uemura, MD Discussant: Eric Ley, MD

Paper 12 **1:40 PM - 2:00 PM**
ACTIVE MONOCYTE EXOCYTOSIS OF MITOCHONDRIAL DAMPS SUPPRESSES NEUTROPHIL FUNCTION
Presenter: Carl Hauser, MD Discussant: Raul Coimbra, MD, PhD

Paper 13 **2:00 PM - 2:20 PM**
FREEZE-DRIED PLATELETS REPAIR AND STABILIZE THE VASCULAR ENDOTHELIUM IN HEMORRHAGIC SHOCK
Presenter: Shibani Pati, MD, PhD Discussant: Ernest Moore, MD

2:20 PM - 2:40 PM — Break

2:40 PM - 3:00 PM — Scholarship Presentations

3:00 PM - 4:40 PM — **Session III: Papers 14-18**
Moderator: Christopher Michetti, MD

Paper 14 — **3:00 PM - 3:20 PM**
ASSOCIATION OF TIMING OF INITIATION OF PHARMACOLOGIC VENOUS THROMBOEMBOLISM PROPHYLAXIS WITH OUTCOMES IN TRAUMA PATIENTS
Presenter: Jason Hecht, MD, PharmD — Discussant: Elliott Haut, MD, PhD

Paper 15 — **3:20 PM - 3:40 PM**
RISK OF THROMBOEMBOLIC EVENTS AFTER THE USE OF TXA IN TRAUMA PATIENTS
Presenter: Marianna Fischmann, MD — Discussant: Michelle McNutt, MD

Paper 16 — **3:40 PM - 4:00 PM**
HEAD IN THE SAND? THE VALUE OF ROUTINE DUPLEX ULTRASOUND SCREENING FOR VENOUS THROMBOEMBOLISM IN THE TRAUMA PATIENT: A RANDOMIZED VANGUARD TRIAL
Presenter: Annika Bickford Kay, PA — Discussant: M. Margaret Knudson, MD

Paper 17 — **4:00 PM - 4:20 PM**
HYBRID EMERGENCY ROOM SHOWS THE MAXIMUM EFFECT ON TRAUMA RESUSCITATION WHEN USED IN PATIENTS WITH HIGHER SEVERITY
Presenter: Natsuhiro Mortia, MD — Discussant: Laura Moore, MD

Paper 18 — **4:20 PM - 4:40 PM**
REAL-TIME BEDSIDE MANAGEMENT AND TITRATION OF PARTIAL REBOA WITHOUT AN ARTERIAL LINE: GOOD FOR PRESSURE, NOT FOR FLOW!
Presenter: Matthew Carr, MD — Discussant: Megan Brenner, MD, MSc

5:00 PM - 8:00 PM — Poker Night! **Registration required**

Thursday, September 10, 2020

9:00 AM - 10:20 AM — **Session IV: Papers 19-22**
Moderator: Kimberly Davis, MD, MBA

Paper 19 — **9:00 AM - 9:20 AM**
GALLSTONE-RELATED COMPLICATIONS AFTER UNTREATED BILIARY COLIC: A SIX-MONTH READMISSIONS STUDY
Presenter: Faisal Jehan, MD — Discussant: James Davis, MD

Paper 20 — **9:20 AM - 9:40 AM**
BILE DUCT CLEARANCE AND CHOLECYSTECTOMY FOR CHOLEDOCOLITHIASIS: ONE-STAGE LAPAROSCOPIC CHOLECYSTECTOMY WITH INTRA-OPERATIVE ENDOCOPIC RETROGRADE CHOLANGIOPANCREATOGRAPHY (ERCP) PROCEDURE VS TWO-STAGE PROCEDURE
Presenter: Gary Bass, MD, PhD, MBA, MSc — Discussant: Caroline Reinke, MD

Paper 21 — **9:40 AM - 10:00 AM**
EVALUATING THE ASSOCIATION BETWEEN AAST EMERGENCY GENERAL SURGERY SEVERITY GRADES AND OUTCOMES USING NATIONAL CLAIMS DATA
Presenter: John Scott, MD, MPH — Discussant: Heena Santry, MD

Paper 22 **10:00 AM - 10:20 AM**
READMISSION FOR VENOUS THROMBOEMBOLISM AFTER EMERGENCY GENERAL SURGERY IS UNDERREPORTED AND INFLUENCED BY INSURANCE STATUS
Presenter: Rishi Rattan, MD Discussant: Myung Park, MD

10:20 AM - 10:35 AM Break

10:35 AM - 12:55 PM **Session V: Papers 23-29**
Moderator: Clay Cothren Burlew, MD

Paper 23 **10:35 AM - 10:55 AM**
UNIVERSAL SCREENING FOR BLUNT CEREBROVASCULAR INJURY
Presenter: Jonathan Black, MD Discussant: Walter Biffl, MD

Paper 24 **10:55 AM - 11:15 AM**
THE IMPACT OF DELAYED HIP FRACTURE MANAGEMENT ON HEALTH OUTCOMES FOR AFRICAN AMERICAN OLDER ADULTS
Presenter: Molly Jarman, PhD, MPH Discussant: Anne Mosenthal, MD

Paper 25 **11:15 AM - 11:35 AM**
A NATIONWIDE PROSPECTIVE MULTICENTER STUDY ON DEFINITIVE SURGERY FOR ISOLATED HIP FRACTURE WITHIN 24 HOURS
Presenter: Darwin Ang, MD, PhD, MPH Discussant: Alicia Mangram, MD

Paper 26 **11:35 AM - 11:55 AM**
A MULTICENTER TRIAL OF THE EVOLVING DIAGNOSIS AND MANAGEMENT OF HIGH-GRADE PANCREATIC INJURIES
Presenter: Walter Biffl, MD Discussant: Babak Sarani, MD

Paper 27 **11:55 AM - 12:15 PM**
HARD SIGNS GONE SOFT
Presenter: Anna Romagnoli, MD Discussant: Enrique Ginzburg, MD

Paper 28 **12:15 PM - 12:35 PM**
PROSPECTIVE STUDY OF SHORT-TERM QUALITY OF LIFE AFTER TRAUMATIC RIB FRACTURES
Presenter: Jeff Choi, MD Discussant: Suresh Agarwal, Jr., MD

Paper 29 **12:35 PM - 12:55 PM**
ACQUISITION OF MEDICAID AT THE TIME OF INJURY: AN OPPORTUNITY FOR SECURING INSURANCE COVERAGE
Presenter: Joshua Jaramillo, MD Discussant: Kevin Schuster, MD, MPH

12:55 PM - 1:00 PM Break

1:00 PM - 2:00 PM **Lunch Session:** Equity, Diversity, and Inclusion Committee: *"Achieving and Maintaining a Diverse Workforce: Lofty Goals and Strategic Plans are Not Enough!"*

2:10 PM - 6:10 PM **Add-on Session:** Acute Care Surgery Committee, *"The New Surgeon: Life After Residency and Fellowship"*

6:30 PM - 7:30 PM Meet the Leadership: Sip and Chat with Dr. Mary Fallat
**Registration required*

Friday, September 11, 2020

8:55 AM - 9:00 AM — Moment of Silence — Remembering 9/11

9:00 AM - 11:40 AM — **Session VI: Papers 30-37**
Moderator: David Livingston, MD

Paper 30 **9:00 AM - 9:20 AM**
TIME IS OF THE ESSENCE: THE RELATIONSHIP BETWEEN TIMING OF AMPUTATION AND COMPLICATIONS AMONG PATIENTS WITH A MANGLED LOWER EXTREMITY
Presenter: Bourke Tillmann, MD — Discussant: Kenji Inaba, MD

Paper 31 **9:20 AM - 9:40 AM**
EXTRATHORACIC POLYTRAUMA DYSREGULATES NEUTROPHIL FUNCTION AND EXACERBATES PNEUMONIA-INDUCED LUNG INJURY
Presenter: Christina Zhang, MD — Discussant: Addison May. MD. MBA

Paper 32 **9:40 AM - 10:00 AM**
TRAUMA PATIENT VS. CAREGIVER SATISFACTION WITH DELIVERY OF PALLIATIVE CARE: WHO FACES THE BURDEN?
Presenter: Costance McGraw, MPH — Discussant: Leah Tatebe, MD

Paper 33 **10:00 AM - 10:20 AM**
ARE LEGALLY PURCHASED GUNS TO BLAME FOR OVERALL FIREARM MORTALITY? A STATE-LEVEL ANALYSIS OF THE ASSOCIATION BETWEEN FIREARM RETAIL AVAILABILITY AND FIREARM MORTALITY
Presenter: August Houghton, BS — Discussant: Nina Glass, MD

Paper 34 **10:20 AM - 10:40 AM**
DEVELOPING COMMUNITY-BASED SOLUTIONS TO INTERPERSONAL FIREARM VIOLENCE: THE DIFFERING PERSPECTIVES OF SURVIVORS AND TRAUMA SURGEONS
Presenter: Bachar Halimeh, MBBS — Discussant: Stephanie Bonne, MD

Paper 35 **10:40 AM - 11:00 AM**
CAUGHT IN THE CROSSFIRE: 37 YEARS OF FIREARM VIOLENCE AFFLICTING AMERICA'S YOUTH
Presenter: Nathan Manley, MD — Discussant: Dennis Vane, MD, MBA

Paper 36 **11:00 AM - 11:20 AM**
A PSEUDO-DILEMMA: ARE WE OVER-DIAGNOSING AND OVER-TREATING TRAUMATIC SPLENIC INTRAPARENCHYMAL PSEUDOANEURYSMS?
Presenter: Sydney Radding, MD — Discussant: Ben Zarzaur, Jr., MD, MPH

Paper 37 **11:20 AM - 11:40 AM**
ENHANCING TRAUMA REGISTRIES BY INTEGRATING TRAFFIC RECORDS AND GEOSPATIAL ANALYSIS TO IMPROVE BICYCLIST SAFETY
Presenter: Jay Doucet, MD, MSc — Discussant: Louis Magnotti, MD

11:40 AM - 12:00 PM — Break

12:00 PM - 1:00 PM — **Lunch Session:** Critical Care Committee: *"Surgical Critical Care: Challenge the Experts"*

1:00 PM - 1:30 PM — Diversity and Inclusion Committee Statement

2:00 PM - 3:00 PM — Virtual Escape Room **Registration required*

Saturday, September 12, 2020

9:00 AM - 1:00 PM — **Add-on Session:** Education Committee, *"Cutting Edge Case Management in Trauma, ICU, and Emergency Surgery: Continuous Certification 2020 Course"*

1:00 PM - 2:00 PM — Yoga Session

Sunday, September 13, 2020

1:00 PM - 3:00 PM — COVID-19 Panel

3:00 PM - 4:00 PM — **Lunch Session:** Military Liaison Committee: *"Challenges and Opportunities for Conducting Research Studies in the Deployed Setting"*

4:00 PM - 5:00 PM — Acute Care Surgery and ABS Certification: *Opportunities and Challenges*

5:00 PM - 6:00 PM — Meet the Leadership: Sip and Chat with Dr. David Livingston **Registration required*

6:00 PM - 7:00 PM — Virtual Comedy Show

Monday, September 14, 2020

9:00 AM - 11:20 AM — **Session VII: Papers 38-44**
Moderator: Robert Winchell, MD

Paper 38 **9:00 AM - 9:20 AM**
REGIONALIZATION OF TRAUMA CARE BY OPERATIVE EXPERIENCE: DOES THE VOLUME OF EXPLORATORY LAPAROTOMY MATTER?
Presenter: Andrew Tang, MD Discussant: Brian Eastridge, MD

Paper 39 **9:20 AM - 9:40 AM**
USE OF RESUSCITATIVE ENDOVASCULAR BALLOON OCCLUSION OF THE AORTA IN TRAUMATIC BRAIN INJURY PATIENT: A NATIONWIDE ANALYSIS
Presenter: Muhammad Khurrum, MD Discussant: A. Britton Christmas, MD

Paper 40 **9:40 AM - 10:00 AM**
MULTI-INSTITUTIONAL VALIDATION STUDY OF THE INJURED TRAUMA SURVIVOR SCREEN (ITSS)
Presenter: Joshua Hunt, PhD Discussant: Rachael Callcut, MD

Paper 41 **10:00 AM - 10:20 AM**
ROADWAY FEATURES ASSOCIATED WITH ELDERLY MOTOR VEHICLE COLLISIONS
Presenter: Maxwell Presser, BA Discussant: Robert Barraco, MD, MPH

Paper 42 **10:20 AM - 10:40 AM**
RECENT RELEASE FROM PRISON – A NOVEL RISK FACTOR FOR INTIMATE PARTNER HOMICIDE
Presenter: Justin Cirone, MD Discussant: D'Andrea Joseph, MD

Paper 43 **10:40 AM - 11:00 AM**
A CLINICAL PRACTICE GUIDELINE USING PERCENTAGE OF PREDICTED FVC IMPROVES RESOURCE ALLOCATION FOR RIB FRACTURE PATIENTS
Presenter: Joshua Billings, MD Discussant: Fredric Pieracci, MD, MPH

Paper 44 **11:00 AM - 11:20 AM**
DISTINCT IMMUNOLOGIC ENDOTYPES ARE ASSOCIATED WITH CLINICAL TRAJECTORY AFTER SEVERE BLUNT TRAUMA AND HEMORRHAGIC SHOCK
Presenter: Scott Brakenridge, MD Discussant: Ronald Tompkins, MD

11:20 AM - 12:00 PM Break

12:00 PM -1:00 PM **Lunch Session:** Program Committee: *"How Do I Get Out of This? Managing Complex Emergency General Surgery Issues"*

1:00 PM - 2:00 PM **Lunch Session:** International Relations Committee: *"Global Surgery: Establishing Long-term, Sustainable, Bidirectional Programs"*

2:00 PM - 3:30 PM Paint and Pour
**Registration required*

4:00 PM - 5:00 PM International Session *(Formerly International Breakfast)*

Tuesday, September 15, 2020

3:00 PM - 4:00 PM Meet the Leadership: Coffee Time with Dr. Reilly
**Registration required*

4:00 PM - 6:20 PM **Session VIII: Papers 45-51**
Moderator: Mary Fallat, MD

Paper 45 **4:00 PM - 4:20 PM**
PEDIATRIC ADJUSTED REVERSE SHOCK INDEX MULTIPLIED BY GLASGOW COMA SCALE OUTPERFORMS PEDIATRIC ADJUSTED SHOCK INDEX IN PEDIATRIC WAR-ZONE TRAUMA
Presenter: Daniel Lammers, MD Discussant: Randall Burd, MD, PhD

Paper 46 **4:20 PM - 4:40 PM**
COMPARISON OF MASSIVE AND EMERGENCY TRANSFUSION PREDICTION SCORING SYSTEMS AFTER TRAUMA WITH A NEW BLEEDING RISK INDEX SCORE APPLIED IN-FLIGHT
Presenter: Peter Hu, MD Discussant: Bryan Cotton, MD

Paper 47 **4:40 PM - 5:00 PM**
TRANSFUSION OF A SINGLE "DISCRETIONARY" UNIT OF RED BLOOD CELLS IS ASSOCIATED WITH WORSE CLINICAL OUTCOMES IN TRAUMA PATIENTS: A TRAUMA QUALITY IMPROVEMENT PROGRAM (TQIP) STUDY
Presenter: Khaled Abdul Jawad, MD Discussant: Jeffrey Kerby, MD, PhD

Paper 48 **5:00 PM - 5:20 PM**
CLAMSHELL THORACOTOMY BETTER FACILITATES THORACIC LIFE-SAVING PROCEDURES WITHOUT INCREASED COMPLICATIONS COMPARED TO ANTEROLATERAL APPROACH TO RESUSCITATIVE THORACOTOMY: RESULTS FROM THE AAST AORTA REGISTRY
Presenter: Joseph DuBose, MD Discussant: Elizabeth Benjamin, MD, PhD

Paper 49 **5:20 PM - 5:40 PM**
LONG-TERM OUTCOMES OF ILLICIT DRUG USE IN TRAUMA PATIENTS: A MULTI-CENTER PATIENT-REPORTED OUTCOMES STUDY
Presenter: Mohammad El Moheb, MD Discussant: Michael Lekawa, MD

Paper 50 **5:40 PM - 6:00 PM**
MODIFIABLE FACTORS TO IMPROVE WORK-LIFE BALANCE FOR TRAUMA SURGEONS
Presenter: Carlos Brown, MD Discussant: Jamie Coleman, MD

Paper 51 **6:00 PM - 6:20 PM**
RECTAL DELIVERY OF OXYGEN MICROBUBBLES AUGMENTS SYSTEMIC OXYGEN-ATION IN PORCINE MODEL OF SMOKE-INHALATION-INDUCED ACUTE RESPIRATORY DISTRESS SYNDROME
Presenter: Keely Buesing, MD Discussant: George Kasotakis, MD, MPH

6:20 PM - 6:40 PM Break

6:40 PM - 7:40 PM **Lunch Session:** Education Committee: *"Regionalization of Acute Care Surgery"*

7:40 PM - 8:00 PM Chair Yoga

8:00 PM - 9:00 PM **Lunch Session:** Program Committee: *"Cellular Therapy for Trauma Patients: The Future is Now"*

Wednesday, September 16, 2020

12:00 PM - 2:40 PM **Session IX: Papers 52-59**
Moderator: Sharon Henry, MD

Paper 52 **12:00 PM - 12:20 PM**
ALIVE AND AT HOME: 5-YEAR OUTCOMES IN OLDER ADULTS FOLLOWING EMER-GENCY GENERAL SURGERY
Presenter: Matthew Guttman, MD Discussant: Zara Cooper, MD, MSc

Paper 53 **12:20 PM - 12:40 PM**
FAST-TRACK PATHWAY PROVIDES SAFE, VALUE-BASED CARE ON BUSY ACUTE CARE SURGERY SERVICE
Presenter: Kali Kuhlenschmidt, MD Discussant: Lillian Kao, MD, MS

Paper 54 **12:40 PM - 1:00 PM**
WHAT HAPPENS WHEN THEY'RE GONE? THE IMPACT ON HOSPITAL REVENUE AND OPERATIVE CASELOADS WHEN EMERGENCY GENERAL SURGERY OPERATIONS ARE REGIONALIZED
Presenter: Robert Becher, MD Discussant: Jennifer Knight, MD

Paper 55 **1:00 PM - 1:20 PM**
MULTICENTER VALIDATION OF THE AAST GRADING SCALE FOR ACUTE CHOLE-CYSTITIS
Presenter: Kevin Schuster, MD, MPH Discussant: Eric Toschlog, MD

Paper 56 **1:20 PM - 1:40 PM**
WILL TRAUMA SYSTEMS WORK FOR EGS? QUANTIFYING GEOGRAPHIC PROXIMI-TY BETWEEN LOWER AND HIGHER PERFORMING EMERGENCY GENERAL SUR-GERY HOSPITALS
Presenter: Michael DeWane, MD Discussant: Avery Nathens, MD, PhD, MPH

Paper 57 **1:40 PM - 2:00 PM**
TRAUMA HEALTH LITERACY: STEPS TOWARD REMEDIATION
Presenter: Catherine Seger, MD Discussant: Cherisse Berry, MD

Paper 58 **2:00 PM - 2:20 PM**
DEPRESSION PREDICTS LONG-TERM COGNITIVE IMPAIRMENT IN SURVIVORS OF CRITICAL ILLNESS
Presenter: Mina Nordness, MD Discussant: Matthew Lissauer, MD

Paper 59 **2:20 PM - 2:40 PM**
PATIENTS FOLLOW DIFFERENT FINANCIAL HARDSHIP TRAJECTORIES IN THE YEAR AFTER INJURY
Presenter: Ben Zarzaur, Jr., MD, MPH Discussant: Joseph Minei, MD, MBA

2:40 PM - 3:00 PM Break

3:00 PM - 4:00 PM **Lunch Session:** Program Committee:
"Open vs. Endovascular Approaches to Vascular Trauma - Complementary, Not Competitive"

4:00 PM - 5:00 PM Game Night Out
**Registration required*

Thursday, September 17, 2020

2:00 PM - 4:00 PM **Session X: Papers 60-65**
Moderator: Ajai Malhotra, MD

Paper 60 **2:00 PM - 2:20 PM**
ENDOVASCULAR VS. OPEN MANAGEMENT OF TRAUMATIC ILIAC ARTERY INJURIES: A REVIEW OF THE AMERICAN ASSOCIATION FOR THE SURGERY OF TRAUMA PROSPECTIVE OBSERVATIONAL VASCULAR INJURY TRIAL (PROOVIT) REGISTRY
Presenter: Jason Miner, MD Discussant: Nicole Stassen, MD

Paper 61 **2:20 PM - 2:40 PM**
BEYOND THE HEADLINES: A DETAILED ANALYSIS OF 19 YEARS OF MASS SHOOTINGS ACROSS THE UNITED STATES
Presenter: Richard Lewis, MD Discussant: Deborah Kuhls, MD

Paper 62 **2:40 PM - 3:00 PM**
THE PREHOSPITAL USE OF YOUNGER AGE WHOLE BLOOD IS ASSOCIATED WITH AN IMPROVED ARRIVAL COAGULATION PROFILE
Presenter: Thomas Clements, MD Discussant: Jason Sperry, MD, MPH

Paper 63 **3:00 PM - 3:20 PM**
VALIDATION OF A NOMOGRAM PREDICTING BLEEDING CONTROL INTERVENTIONS AFTER HIGH-GRADE RENAL TRAUMA
Presenter: Sorena Keihani, MD, MSc Discussant: Andre Campbell, MD

Paper 64 **3:20 PM - 3:40 PM**
PROLONGED METABOLOMIC ALTERATIONS CHARACTERIZE PERSISTENT INFLAMMATION, IMMUNOSUPPRESSION, AND CATABOLISM SYNDROME AFTER SEVERE TRAUMA
Presenter: Dara Horn, MD Discussant: Paul Bankey, MD

Paper 65 **3:40 PM - 4:00 PM**
TRAUMA BAY VIRTUAL REALITY - A GAME CHANGER FOR ATLS INSTRUCTION AND ASSESSMENT
Presenter: Raminder Nirula, MD, MPH Discussant: Daniel Grabo, MD

4:00 PM - 4:20 PM Break

4:20 PM - 5:20 PM **Lunch Session:** Palliative Care Committee:
"It Keeps Me Up at Night: Ethical and Legal Challenges in Acute Care Surgery"

5:20 PM - 5:35 PM Break

5:35 PM - 6:35 PM **Lunch Session:** Communications Committee:
"Burnout is a Threat to the Validity of our Profession: Insights and Advice from a Multigenerational Panel of Experts"

6:35 PM - 6:40 PM **Annual Meeting Awards Presentation**

7:00 PM - 8:00 PM Meet the Leadership: Sip and Chat with Dr. Sharon Henry
**Registration required*

Friday, September 18, 2020

9:00 AM - 10:18 AM **Session XI: Quickshot Session 1 1-13**
Moderator: Jeff Claridge, MD

Quickshot 1 **9:00 AM - 9:06 AM**
PATTERN-BASED ANALYSIS OF GENE EXPRESSION PROFILE BY CANONICAL DISCRIMINANT ANALYSIS COULD IDENTIFY THE PATHOPHYSIOLOGY REGARDLESS OF THE SEVERITY
Presenter: Goro Tajima, MD, PhD Discussant: Lawrence Diebel, MD

Quickshot 2 **9:06 AM - 9:12 AM**
CAN THE USE OF A PUBLICLY AVAILABLE SAFETY ALERT APP IMPROVE URBAN TRAUMA TEAM PREHOSPITAL NOTIFICATION?
Presenter: Leandra Krowsoski, MD Discussant: John Porter, MD

Quickshot 3 **9:12 AM - 9:18 AM**
DAYS THAWED DOES NOT AFFECT SURVIVAL, BLEEDING, OR BIOMARKERS IN PATIENTS RECEIVING PREHOSPITAL FRESH FROZEN PLASMA: PAMER SECONDARY ANALYSIS
Presenter: Katherine Reitz, MD Discussant: Martin Schreiber, MD

Quickshot 4 **9:18 AM - 9:24 AM**
STANDARDIZATION OF OPIOID PRESCRIPTION AFTER TRAUMA (STOP TRAUMA): A PROSPECTIVE INTERVENTION TO REDUCE EXCESSIVE OPIOID PRESCRIPTION.
Presenter: Eric Walser, MD Discussant: Alexandra Briggs, MD

Quickshot 5 **9:24 AM - 9:30 AM**
THE RELATIONSHIP BETWEEN CORTISOL REPONSE AND THE DEVELOPMENT OF CHRONIC PAIN IN TRAUMATICALLY INJURED PATIENTS
Presenter: Colleen Trevino, PhD Discussant: Preston Miller, MD

Quickshot 6 **9:30 AM - 9:36 AM**
TRAUMA CENTER DESIGNATION CAN NULIFY THE EFFECT OF CARE DISCONTINUITY
Presenter: Manuel Castillo-Angeles, MD, MPH Discussant: Daniel Margulies, MD

Quickshot 7 **9:36 AM - 9:42 AM**
APHERESIS PLATELETS HAVE COMPROMISED AGGREGATION COMPARED TO POOLED PLATELETS
Presenter: Christina Riojas, MD Discussant: Noelle Saillant, MD

Quickshot 8 **9:42 AM - 9:48 AM**
TRAUMA PATIENT TRANSPORT TIMES AND MORTALITY UNCHANGED DESPITE TRAUMA CENTER PROLIFERATION
Presenter: Michael Jones, MD Discussant: Nicholas Namias, MD, MBA

Quickshot 9 **9:48 AM - 9:54 AM**
IMMUNE SIGNATURES CORRELATE WITH CLINICAL OUTCOMES AFTER TRAUMA INJURY
Presenter: April Mendoza, MD, MPH Discussant: Jennifer Leonard, MD, PhD

Quickshot 10 **9:54 AM - 10:00 AM**
THE EFFECT OF THE AFFORDABLE CARE ACT ON RATES OF INPATIENT REHABILITATION HOSPITAL ADMISSION IN A MATURE TRAUMA SYSTEM
Presenter: Frederick Rogers, MD Discussant: Edward Cornwell, MD

Quickshot 11 **10:00 AM - 10:06 AM**
PREDICTORS OF SURVIVAL AFTER CRANIOTOMY IN GERIATRIC PATIENTS WITH TRAUMATIC BRAIN INJURY
Presenter: Muhammad Zeeshan, MD Discussant: Jennifer Hubbard, MD

Quickshot 12 **10:06 AM - 10:12 AM**
ADMINISTRATION OF VALPROIC ACID IN CLINICALLY APPROVED DOSE IMPROVES NEUROLOGIC RECOVERY AND DECREASES BRAIN LESION SIZE IN SWINE SUBJECTED TO HEMORRHAGIC SHOCK AND TRAUMATIC BRAIN INJURY
Presenter: Glenn Wakam, MD Discussant: Ali Salim, MD

Quickshot 13 **10:12 AM - 10:18 AM**
TRENDS IN UTILIZATION OF WHOLE-BODY COMPUTED TOMOGRAPHY IN BLUNT TRAUMA: A 9-YEAR RETROSPECTIVE STUDY USING TRAUMA QUALITY IMPROVEMENT PROJECT (TQIP) DATABASE
Presenter: Corinne Bunn, MD Discussant: Sharmila Dissanaike, MD

10:18 AM - 10:30 AM Break

10:30 AM - 11:48 AM **Session XII: Quickshot Session II 14-26**
Moderator: Robert McIntyre, MD

Quickshot 14 **10:30 AM - 10:36 AM**
THE EXTENT TO WHICH GEOGRAPHY EXPLAINS ONE OF TRAUMA'S TROUBLING TRENDS: INSURANCE-BASED DIFFERENCES IN APPROPRIATE INTER-FACILITY TRANSFER
Presenter: Cheryl Zogg, PhD, MSc, MPH Discussant: Kristan Staudenmayer, MD, MSc

Quickshot 15 **10:36 AM - 10:42 AM**
PERSISTENT INFLAMMATORY CATABOLIC SYNDROME AFTER HYPOTHERMIA IN TRAUMA PATIENTS
Presenter: David Miranda, MD, MSc Discussant: Susan Evans, MD

Quickshot 16 **10:42 AM - 10:48 AM**
RESUMPTION OF LONG-TERM ANTICOAGULATION AFTER TRAUMATIC INTRACRANIAL HEMORRHAGE IN GERIATRIC PATIENTS — A BAD IDEA?
Presenter: Adrian Ong, MD Discussant: Jody DiGiacomo, MD

Quickshot 17 **10:48 AM - 10:54 AM**
CAN VARIATIONS IN INSULIN REQUIREMENTS BE AN EARLY INDICATOR OF SEPSIS IN BURN PATIENTS?
Presenter: Chathurika Dhanasekara, PhD Discussant: David Harrington, MD

Quickshot 18 **10:54 AM - 11:00 AM**
CALCIUM SIGNALING DRIVES FEMALE-SPECIFIC PLATELET HYPERACTIVITY: A MECHANISTIC EXPLORATION OF SEX DIMORPHISMS IN PLATELET FUNCTION
Presenter: Julia Coleman, MD, MPH Discussant: Stephen Cohn, MD

Quickshot 19 **11:00 AM - 11:06 AM**
MANAGING ACUTE UNCOMPLICATED APPENDICITIS IN FRAIL GERIATRIC PATIENTS: A SECOND HIT MAY BE TOO MUCH
Presenter: Mohamad Chehab, MD Discussant: Joseph Sakran, MD, MPA, MPH

Quickshot 20 **11:06 AM - 11:12 AM**
DIFFERENCES IN RATE OF INTERVENTION FOR BLUNT SPLENIC INJURY IN ADOLESCENTS BETWEEN ADULT AND COMBINATION ADULT/PEDIATRIC CENTERS
Presenter: Arthur Grimes, MD Discussant: Mary Edwards, MD

Quickshot 21 **11:12 AM - 11:18 AM**
HOSPITAL COSTS FOR FIREARM INJURIES BY U.S. REGION, 2005-2015
Presenter: Thomas Weiser, MD, MPH Discussant: Sigrid Burruss, MD

Quickshot 22 **11:18 AM - 11:24 AM**
COMPARISON OF SURGICAL RIB FIXATION BETWEEN PATIENTS WITH AND WITHOUT FLAIL CHEST
Presenter: Alice Piccinini, MD Discussant: Raminder Nirula, MD, MPH

Quickshot 23 **11:24 AM - 11:30 AM**
LAPAROSCOPIC TRANSCYSTIC COMMON BILE DUCT EXPLORATION IMPROVES OUTCOMES IN EMERGENCY GENERAL SURGERY (EGS) PATIENTS WITH CHOLEDOCHOLITHIASIS
Presenter: John Michel-Ruddy, MD Discussant: Edgardo Salcedo, MD

Quickshot 24 **11:30 AM - 11:36 AM**
MULTICENTER VALIDATION OF THE BOWEL INJURY PREDICTION SCORE (BIPS) FOR IDENTIFYING PATIENTS REQUIRING SURGERY
Presenter: Michael Wandling, MD, MSc Discussant: Ruben Peralta, MD

Quickshot 25 **11:36 AM - 11:42 AM**
READY FOR PRIME TIME? PGY-5 RESIDENT AUTONOMY AND PERFORMANCE IN EMERGENCY GENERAL SURGERY USING SIMPLE CASE EVALUATION DATA
Presenter: Adam Nelson, MD Discussant: Michael Cripps, MD

Quickshot 26 **11:42 AM - 11:48 AM**
DO PATIENTS WITH MINIMAL BLUNT THORACIC AORTIC INJURY (BTAI) REQUIRE TEVAR?
Presenter: Joseph DuBose, MD Discussant: Demetrios Demetriades, MD, PhD

11:48 AM - 12:00 PM Break

12:00 PM - 1:00 PM	**Lunch Session:** Associate Member Committee: *"How to be Productive and Build Your Academic Career"*
1:00 PM - 2:00 PM	Associate Member Happy Hour! **Registration required*
2:00 PM - 3:30 PM	Virtual Farewell Concert **Registration required*

Ongoing

Posters

Group One: Abdominal Trauma	*Poster Professors:* Neil Parry, MD; Jason Smith, MD
Group Two: Critical Care	*Poster Professors:* Karyn Butler, MD; Tiffany Bee, MD
Group Three: Emergency General Surgery	*Poster Professors:* Linda Ding, MD Benjamin Braslow, MD
Group Four: Extremity and Vascular Trauma	*Poster Professors:* Brian Williams, MD; Morgan McMonagle, MD, MB, BCh, BAO
Group Five: Geriatrics	*Poster Professors:* Nicole Goulet, MD; Scott Armen, MD; Sasha Adams, MD
Group Six: Neurologic Trauma	*Poster Professor:* Gail Tominaga, MD
Group Seven: Outcomes / Guidelines	*Poster Professors:* Scott D'Amours, MD; S. Rob Todd, MD; William Chiu, MD; Nancy Parks, MD; Sarah Moore, MD
Group Eight: Pediatric Trauma	*Poster Professor:* Aaron Jensen, MD, MS, Med
Group Nine: Pre-Clinical / Translational	*Poster Professors:* Michaela West, MD, PhD; Phil Efron, MD
Group Ten: Shock / Transfusions	*Poster Professors:* Zsolt Balogh, MD, PhD; Andrea Long, MD; Travis Polk, MD
Group Eleven: Soft Tissue / Head and Neck Trauma	*Poster Professor:* Sharven Taghavi, MD, MPH
Group Twelve: Thoracic Trauma	*Poster Professor:* Lawrence Lottenberg, MD
Group Thirteen: Trauma Systems and Epidemiology	*Poster Professors:* Thomas Esposito, MD, MPH; Lisa Knowlton, MD, MPH; Kimberly Joseph, MD; Christine Cocanour, MD

AAST Information

Historical Background of AAST

The American Association for the Surgery of Trauma started with conversations at the meetings of the Western Surgical Association and Southern Surgical Association in December1937. The 14 founders, who were present at one or both of these meetings, sub-subsequently invited another 68 surgeons to a Founding Members meeting in San Francisco on June 14, 1938. The first meeting of the AAST was held in Hot Springs, Virginia, in May, 1939, and Dr. Kellogg Speed's first Presidential Address was published in *The American Journal of Surgery* 47:261–264, 1940. Today, the Association holds an annual scientific meeting, owns and publishes *The Journal of Trauma and Acute Care Surgery*, which was initiated in 1961, and has approximately1,700 members from 30 countries.

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SPINE TRAUMA-CHILD
Lillian Kao, MD, MS (2020)
Houston, Texas

CHEST WALL PAIN
Sarah Majercik, MD, MBA (2020)
Murray, Utah

FACIAL FRACTURES, SUSPECTED AND POST X-RAY
Elizabeth Benjamin, MD, PhD (2021)
Los Angeles, California

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Trauma Association of Canada (TAC)
World Coalition for Trauma Care (WCTC)
The College of Surgeons of East, Central and Southern Africa (COSECSA)
International Society of Surgery (ISS/SIC)
Korean Society of Acute Care Surgery
Lusitanian Association for Trauma and Emergency Surgery
Society of Trauma Nurses
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FUTURE AAST MEETINGS

2021

80th Annual Meeting of the American Association for the Surgery of Trauma and Clinical Congress of Acute Care Surgery
September 29-October 2, 2021
Hilton Atlanta
Atlanta, GA

2022

81st Annual Meeting of the American Association for the Surgery of Trauma and Clinical Congress of Acute Care Surgery
September 21-24, 2022
Hyatt Regency Chicago
Chicago, IL

2023

82nd Annual Meeting of the American Association for the Surgery of Trauma and Clinical Congress of Acute Care Surgery
September 20-23, 2023
Hilton Anaheim
Anaheim, CA

2024

83rd Annual Meeting of the American Association for the Surgery of Trauma and Clinical Congress of Acute Care Surgery
September 11-15, 2024
Paris Hotel
Las Vegas, NV

PAST PRESIDENTS AND MEETING SITES

2019	Dallas, Texas	Martin A. Croce, M.D.
2018	San Diego, California	Michael F. Rotondo, M.D.
2017	Baltimore, Maryland	Raul Coimbra, M.D., Ph.D.
2016	Waikoloa, Hawaii	Grace S. Rozycki, M.D.
2015	Las Vegas, Nevada	Thomas M. Scalea, M.D.
2014	Philadelphia, Pennsylvania	William G. Cioffi, M.D
2013	San Francisco, California	Robert C. Mackersie, M.D.
2012	Kauai, Hawaii	J. Wayne Meredith, M.D.
2011	Chicago, Illinois	L.D. Britt, M.D., M.P.H.
2010	Boston, Massachusetts	Andrew B. Peitzman, M.D.
2009	Pittsburgh, Pennsylvania	Gregory J. Jurkovich, M.D.
2008	Maui, Hawaii	Timothy C. Fabian, M.D.
2007	Las Vegas, Nevada	David V. Feliciano, M.D.
2006	New Orleans, Louisiana	C. William Schwab, M.D.
2005	Atlanta, Georgia	Steven R. Shackford, M.D.
2004	Maui, Hawaii	H. Gill Cryer, M.D., Ph.D.
2003	Minneapolis, Minnesota	David B. Hoyt, M.D.
2002	Orlando, Florida	Ronald V. Maier, M.D.
2001	No Meeting Due to 9/11	Ronald V. Maier, M.D.
2000	San Antonio, Texas	Frank R. Lewis, Jr., M.D.
1999	Boston, Massachusetts	J. David Richardson, M.D.
1998	Baltimore, Maryland	Anna M. Ledgerwood, M.D.
1997	Waikoloa, Hawaii	Anthony A. Meyer, M.D., Ph.D.
1996	Houston, Texas	Kenneth L. Mattox, M.D.
1995	Nova Scotia, Canada	Cleon W. Goodwin, M.D.
1994	San Diego, California	Ernest E. Moore, M.D.
1993	New Orleans, Louisiana	C. James Carrico, M.D.
1992	Louisville, Kentucky	Lewis M. Flint, M.D.
1991	Philadelphia, Pennsylvania	F. William Blaisdell, M.D.
1990	Tucson, Arizona	P. William Curreri, M.D.

1989	Chicago, Illinois	H. David Root, M.D., Ph.D.
1988	Orange County, California	Donald S. Gann, M.D.
1987	Montreal, Canada	Donald D. Trunkey, M.D.
1986	Honolulu, Hawaii	Francis C. Nance, M.D.
1985	Boston, Massachusetts	David S. Mulder, M.D.
1984	New Orleans, Louisiana	George F. Sheldon, M.D.
1983	Chicago, Illinois	Basil A. Pruitt, Jr., M.D.
1982	Colorado Springs, Colorado	Robert J. Freeark, M.D.
1981	Hot Springs, Virginia	Charles R. Baxter, M.D.
1980	Phoenix, Arizona	Leonard F. Peltier, M.D.
1979	Chicago, Illinois	Roger Sherman, M.D.
1978	Lake Tahoe, Nevada	William R. Drucker, M.D.
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1976	Colorado Springs, Colorado	Joseph D. Farrington, M.D.
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1961	Chicago, Illinois	Harrison L. McLaughlin, M.D.
1960	Coronado, California	James K. Stack, M.D.
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1958	Chicago, Illinois	W.L. Estes, Jr., M.D.
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1950	Salt Lake City, Utah	Gordon M. Morrison, M.D.
1949	Atlantic City, New Jersey	Paul B. Magnuson, M.D.
1948	Chicago, Illinois	Casper F. Hegner, M.D.
1947	Atlantic City, New Jersey	Ralph G. Carothers, M.D.
1946	San Antonio, Texas	Grover C. Penberthy, M.D.
1945	No Meeting Due to War	Charles S. Venable, M.D.
1944	Chicago, Illinois	Charles S. Venable, M.D.
1943	No Meeting Due to War	Henry C. Marble, M.D.
1942	Boston, Massachusetts	Henry C. Marble, M.D.
1941	Montreal, Canada	Fraser B. Gurd, M.D.
1940	Atlantic City, New Jersey	Edgar L. Gilcreest, M.D.
1939	Hot Springs, Virginia	Kellogg Speed, M.D.

AAST Abstracts of Papers

79th Annual Meeting of the American Association for the Surgery of Trauma and Clinical Congress of Acute Care Surgery

AMA PRA Category 1 Credits™ will be awarded based upon actual hours attended. Total number of hours will be calculated from information individual physicians provide in the online CME evaluation forms.

Presidential Introduction

Tuesday, September 8, 2020
9:00 AM - 9:30 AM
David Spain, MD

Session I: Plenary Papers 1-9

Tuesday, September 8, 2020
9:30 AM - 12:30 PM
Moderator: David Spain, MD

September 8-18, 2020

Session I: Plenary Papers 1-9
Paper 1: 9:30 AM - 9:50 AM

AFTER 800 MTP EVENTS, MORTALITY DUE TO HEMORRHAGIC SHOCK REMAINS HIGH AND UNCHANGED DESPITE SEVERAL HEMORRHAGE CONTROL ADVANCEMENTS; IS IT TIME TO MOVE THE PENDULUM?

Juan C. Duchesne MD, Chrissy Guidry MSc, DO, Charles Harris MD, Sharven Taghavi MD, Rebecca Schroll MD, McGrew Patrick MD, Clifton McGinness MD, Danielle Tatum PhD
Tulane School of Medicine

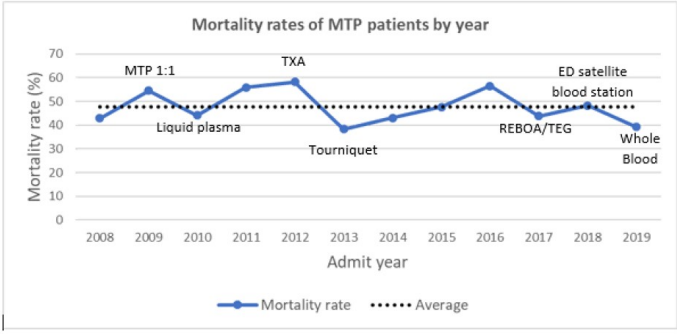
Invited Discussant: Jeremy Cannon, MD

Introduction: Numerous advancements in hemorrhage control have been implemented in the last decade, including balanced massive transfusion protocol (MTP), re-emergence of tourniquets, thromboelastography (TEG), and resuscitative endovascular balloon occlusion of the aorta (REBOA). We examined the effect of these interventions and others in an MTP population and hypothesized that mortality would be decreased in later years, which would have utilized many of these advancements.

Methods: This was a retrospective review of all MTP patients treated at a large regional Level I trauma center from 2008 – 2019. Interventions by year of implementation examined included MTP 1:1 ratio (2009), liquid plasma (2010), tranexamic acid (TXA) (2012), tourniquets (2013), REBOA/ TEG (2017), ED satellite blood station (2018), and whole blood transfusion (2019).

Results: There were 824 MTP patients included. The cohort was primarily male (80.6%), African American (70.1%), injured by penetrating mechanism (68.1%) with median (IQR) age 31 years (23 – 44) and ISS 25 (16 – 34). Overall mortality was 52.8% with no difference in ISS ($P = 0.10$). During the 12-year analysis the overall mortality per year was unchanged 38.3% to 56.6% ($P = 0.26$). Pre-hospital transport time did differ significantly ($P < 0.001$) with the longest median times in 2018 and 2019 but was not associated with increase in-hospital mortality ($P = 0.15$). Although no intervention when examined by logistic regression was significantly associated with mortality reduction, the implementation of tourniquet and whole blood transfusion conveyed the lowest in-hospital mortality.

Conclusions: Despite significant advancements in damage control resuscitation and volume preservation strategies, mortality rates due to severe hemorrhage have not improved in the past 12 years at our high MTP volume institution. This suggests that implementation of new in-hospital strategies is insufficient to move the pendulum of mortality. Future efforts should be directed towards moving targeted hemorrhage control and effective resuscitation interventions to the injury scene.



Session I: Plenary Papers 1-9
Paper 2: 9:50 AM - 10:10 AM

DYNAMIC USE OF FIBRINOGEN UNDER VISCOELASTIC ASSESSMENT RESULTS IN REDUCED NEED FOR PLASMA AND DIMINISHED OVERALL TRANSFUSION REQUIREMENTS IN SEVERE TRAUMA

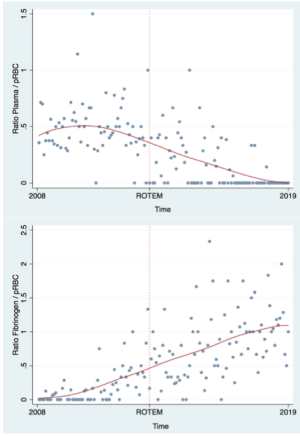
Marta Barquero Lopez MD, Javier Martinez-Cabanero MD, Clara Saez MD, Marta De la Rosa-Estadella MD, Alejandro Munoz-Valencia MD, Aurora Gil MD, Gemma Pujol MD, Andrea Campos-Serra MD, Salvador Navarro-Soto MD, PhD, Juan Carlos Puyana MD
Bellvitge University Hospital

Invited Discussant: Mitchell Cohen, MD

Introduction: Hypofibrinogenemia is a major component of Trauma Induced Coagulopathy (TIC) and it is associated with increased transfusion needs and mortality. Fibrinogen concentrate (FC) has advantages, as thawing is not necessary and it obviates the need for blood type compatibilities. Our understanding of the implementation of a fibrinogen based protocol resuscitation guided by hemostatic competency monitoring (ROTEM™) has resulted in a reduction of the use of plasma. We hypothesized that the use of FC reduces use of blood products and outlined the evolution of our resuscitation strategy over time.

Methods: We identified 150 severe trauma patients (January 2008-July 2019), all patients requiring a minimum of 3 packed red blood cells (pRBCs) within the first 24 hours. We established three treatment groups, reflecting a different stage in the evolution of our strategy (n=135, overlapped in time n=15): plasma (P), plasma and fibrinogen concentrate (PF) and only fibrinogen concentrate (FC). Linear regression analyses were conducted.

Results: Group P had 28 patients, PF=65 and FC=42. There were no significant differences in mechanism of trauma, ISS and physiological status upon arrival. Progressive implementation of ROTEM™ resulted in a significantly increased use of FC over time (use of ROTEM™ in P group 0%, PF group 49.23%, FC group 100%; p < 0.001). A regression model showed significant differences in the number of pRBCs transfused within the first 24 hours, (P group 9.5, PF group 11.62, FC group 7.48; p=0.005). The number of patients who required platelets transfusion within 24 hours was significantly lower in the FC (P 57.14%, PF 73.85%, FC 45.24%; p=0.01). A total of 11 patients (26.19%) in the FC needed supplementation with prothrombin complex concentrate (mean dose 1000UI), versus P = 0% and PF = 15.38%, p=0.012. FC patients had less pneumonia (P 35%, PF 42.5%, FC 12.9%; p=0.019) and multi-organ failure (P 60%, PF 35%, FC 6.5%; p < 0.001). No differences were observed for sepsis, ARDS, AKI or thromboembolic events, mechanical ventilation days, ICU days and length of hospitalization. Overall mortality was not significantly different among the three groups (P 35.71%, PF 44.62%, FC 30.95%). However, a separate analysis comparing exclusively the mortality due to massive hemorrhage in the FC group [n=6/53 (11.32%)] versus all patients receiving plasma [P+PF combined n=25/97 (25.77%)] was significantly different p=0.037. Figures outline use of blood products over time.



Conclusion: Titrated reposition with FC under viscoelastic monitoring resulted in a significant reduction of pRBCs transfused within 24 hours. Supplemental dose of coagulation factors was required in 26.19% of FC. This protocol was associated with a decreased incidence of pneumonia, multi-organ failure, and reduced mortality in patients with massive hemorrhage.

Session I: Plenary Papers 1-9
Paper 3: 10:10 AM - 10:30 AM

PLASMA RESUSCITATION WITH ADJUNCTIVE PERITONEAL RESUSCITATION REDUCES ISCHEMIA INDUCED INTESTINAL BARRIER BREAKDOWN FOLLOWING HEMORRHAGIC SHOCK

Jason W. Smith MD,PhD,MBA, **Jessica Schucht MD,** Brian G. Harbrecht MD, Paul Matheson PhD
University of Louisville

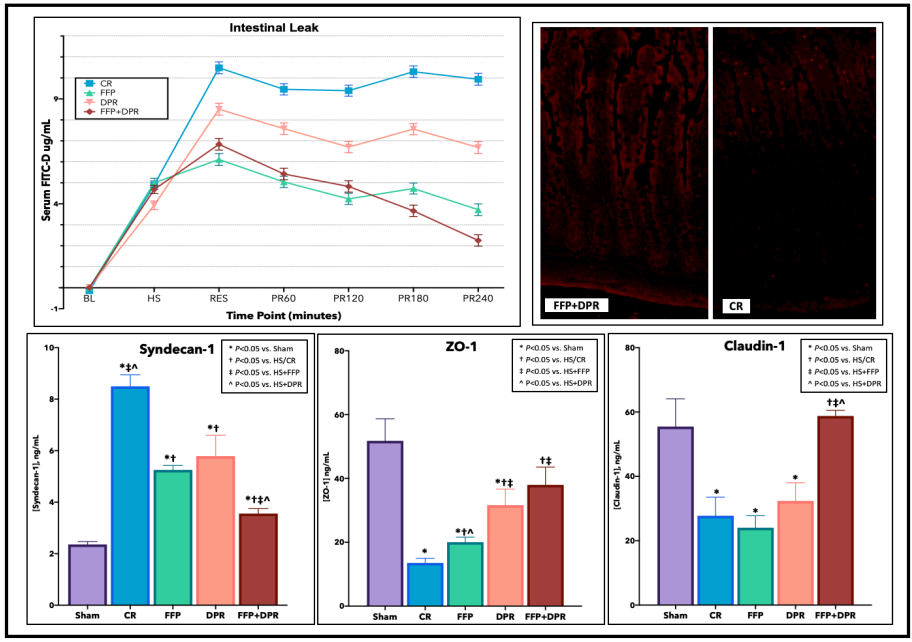
Invited Discussant: Donald Jenkins, MD

Introduction: Hemorrhagic shock and resuscitation (HS/RES) leads to an ischemia induced increase in intestinal permeability. This results from intestinal barrier breakdown, damage to the endothelium, and disruption of tight junction (TJ) complex between enterocytes. It is unclear how hemostatic resuscitation (with blood products) following HS may affect this phenomenon. We previously demonstrated that resuscitation with Fresh Frozen Plasma (FFP) with and without Directed Peritoneal Resuscitation (DPR) improves blood flow and alleviates signs of organ injury and enterocyte damage following HS. We postulate these findings would translate into decreased tight junction injury and attenuated ischemia induced permeability across the intestine following HS.

Methods: Sprague Dawley rats underwent HS(40% mean arterial pressure) for 60-minutes and randomly assigned to a resuscitation group (n=8): ***Sham*; Crystalloid Resuscitation** (CR) (shed blood+two volumes CR); ***CR +DPR*** (intraperitoneal 2.5% peritoneal dialysis fluid (IP)); ***FFP*** (shed blood+two volumes FFP); ***FFP+DPR*** (IP dialysis fluid+two volumes FFP). FITC-Dextran was instilled into the GI tract prior to hemorrhage; UV spectrometry was used to measure serum levels at various time points. Plasma syndecan-1 and ileum tissue concentrations of TJ proteins were measured using ELISAs. Immunofluorescence was used to visualize claudin-4 concentrations at 4-hours following HS/RES.

Results: Following HS, FFP attenuated FITC-Dextran leak across the intestine at all time points compared to CR and DPR alone. This response was significantly improved with the adjunctive DPR at 3-and 4-hours post-resuscitation ($p < 0.05$) (Figure 1). Resuscitation with FFP+DPR increased intestinal tissue concentrations of TJ proteins and decreased plasma syndecan-1 (Figures 3-5). Immunofluorescence demonstrated decreased mobilization of claudin-4 in both FFP and FFP+DPR groups (Figure 2).

Conclusion: FFP based resuscitation improves intestinal tight junction and endothelial integrity. The addition of DPR can further stabilize TJs and attenuate intestinal permeability. Combination therapy with DPR and FFP to mitigate intestinal barrier breakdown following shock could be a novel method of reducing ischemia induced intestinal permeability and systemic inflammation after trauma.



Session I: Plenary Papers 1-9
Paper 4: 10:30 AM - 10:50 AM

INFLATE AND PACK! PELVIC PACKING COMBINED WITH REBOA DEPLOYMENT PREVENTS HEMORRHAGE RELATED DEATHS IN UNSTABLE PELVIC FRACTURES

Clay C. Burlew MD, Julia R. Coleman MD, MPH, Mari Freedberg MD, MSc, Alicia Heelan Gladden MD, Ernest E. Moore MD, Cyril Mauffrey MD, Melanie Hoehn MD, K B. Platnick MD, Mitchell J. Cohen MD, Jamie J. Coleman MD, Eric Campion MD, Ryan Lawless MD, Nicole Werner MD, Alexis Cralley BS, Fredric M. Pieracci MD, MPH
Denver Health Medical Center

Invited Discussant: Carrie Sims, MD

Introduction: Resuscitative endovascular balloon occlusion of the aorta (REBOA) has been advocated for hemorrhage control in pelvic fracture patients in shock. We evaluated REBOA use in patients undergoing pelvic packing (PP) for pelvic fracture hemorrhage.

Methods: Since 2004 our management for pelvic bleeding with hemodynamic instability despite 2 units red blood cells (RBCs) is PP. In 2015 REBOA was considered for systolic blood pressure < 80mmHg.

Results: During the study period (January 2015 - January 2019), 652 pelvic fracture patients were admitted; 78 consecutive patients underwent PP. Median RBCs at PP completion compared to 24 hours post-packing were 11 versus 3 units ($p < 0.05$). Median time to operation was 65 minutes. After PP, 7 (9%) patients underwent angioembolization.

Patients who received REBOA had a significantly higher injury severity score, lower SBP, and higher heart rate (Figure 1). Despite severe injury there were no deaths due to pelvic fracture-related hemorrhage. Overall mortality in this high-risk group was 14%. For the 11 patients that died, life sustaining support was withdrawn, most commonly due to neurologic insults (TBI/fat emboli = 6, stroke/spinal cord injury = 3).

Conclusion: PP with REBOA was utilized in more severely injured patients with greater physiologic derangements. Although REBOA patients required greater transfusion requirements, there were no deaths due to acute pelvic hemorrhage. This suggests the combination of REBOA with PP provides life-saving hemorrhage control in otherwise devastating injuries.

Variable	REBOA (+) (n=31)	REBOA (-) (n=47)	P-Value
Age (years)	45.4 (18-89)	46.8 (13-80)	0.72
Male (%)	23 (74.2%)	32 (68.1%)	0.56
Injury Severity Score (ISS)	**48.8 (29-75)**	**39.6 (16-75)**	**<0.01****
Emergency Department			
Systolic Blood Pressure (SBP)	**64.5 (50-84)**	**71.9 (41-113)**	**0.02****
Heart Rate	**129 (62-179)**	**117 (51-168)**	**0.04****
Time in ED	51 (16-217)	76 (0-290)	0.07
Red Blood Cells (RBCs)	3 (1-11)	4 (0-13)	0.31
Additional Procedures	2.6 (0-9)	2.1 (0-9)	0.25
RBCs pre-ICU	**16 (2-44)**	**7 (2-21)**	**<0.01****
RBCs subsequent 24 hours	3 (0-15)	3 (0-25)	0.81
FFP pre-ICU	**9 (0-39)**	**4 (0-16)**	**<0.01****
FFP subsequent 24 hours	2 (0-13)	2 (0-10)	0.36
Pelvic infection (%)	1 (4.4%)	1 (3.3%)	0.81
Alive (%)	26 (83.9%)	41 (87.2%)	0.68

Session I: Plenary Papers 1-9
Paper 5: 10:50 AM - 11:10 AM

CRITICAL CARE ULTRASOUND IN GERIATRIC TRAUMA RESUSCITATION LEADS TO DECREASED FLUID ADMINISTRATION AND VENTILATOR DAYS

Elaine M. Cleveland MD, Y. Everett Warren MD, Rathna Shenoy MD, Margaret Lewis MD, Kyle Cunningham MD, MPH, Huaping Wang PhD, Rita Brintzenhoff MD
Atrium Health Carolinas Medical Center

Invited Discussant: Paula Ferrada, MD

Introduction: Geriatric trauma populations respond differently than younger trauma populations. Critical Care Ultrasound (CCUS) can guide resuscitation, and has been shown to decrease intravenous fluid (IVF), lower time until operation, and lower mortality in trauma. CCUS guided resuscitation has not yet been studied in geriatric trauma. We hypothesized that incorporation of CCUS into the resuscitative strategy of geriatric trauma patients would decrease amount of IVF administered, decrease time to initiation of vasopressors, and decrease end organ dysfunction.

Methods: A PRE-CCUS geriatric trauma group was identified and resuscitated per standard practice. A POST-CCUS group was identified and resuscitated based on CCUS performed by trained intensivist upon admission to the ICU and 6 hours after initial ultrasound. The PRE-CCUS and POST-CCUS groups underwent propensity score matching based on injury severity score (ISS), age, and gender, yielding 60 enrollees in each arm. Retrospective review was conducted on both groups including demographics, clinical outcomes, and primary endpoints including amount of IVF in the first 48 hours, duration to initiation of vasopressor use in the first 48 hours, and end organ dysfunction. Wilcoxon two-sample, chi-square tests, and Kappa statistics were performed to check associations between groups.

Results: There was no statistical difference between PRE-CCUS and POST-CCUS with regards to demographics and ISS scores. IVF's within 48 hours decreased from median [interquartile range] 4941mL[4019mL] in the PRE-CCUS group to 2633mL[3671mL] in the POST-CCUS group ($p=0.0003$). There was no significant difference between the two groups in the time to initiation of vasopressor therapy, pressor duration, lactate clearance, ICU length of stay, or hospital length of stay. There was a significant decrease in prolonged ventilation, with 26.7% of patients in the PRE-CCUS requiring ventilation > 2 days, and only 6.7% of patients in the POST-CCUS group requiring ventilation > 2 days ($p=0.0033$). While not statistically significant, there was a decrease in mortality rates, with 10.0% mortality in the PRE-CCUS group and 3.3% in the POST-CCUS group.

Conclusions: CCUS can be a useful addition to resuscitation strategies in geriatric trauma. The POST-CCUS group received less IV fluid and had a decreased frequency of prolonged ventilator days. While mortality, lactate clearance, complications, and hospital stay were not statistically different, there was a perception that CCUS was a useful adjunct for assessing volume status and cardiac function in the geriatric population.

Session I: Plenary Papers 1-9
Paper 6: 11:10 AM - 11:30 AM

OUTCOMES OF STANDARDIZED NON-OPERATIVE MANAGEMENT OF HIGH-GRADE PANCREATIC TRAUMA IN CHILDREN: A STUDY FROM THE PEDIATRIC TRAUMA SOCIETY PANCREATIC TRAUMA STUDY GROUP

Bindi Naik-Mathuria MD, MPH, Richard A. Falcone, Jr. MD, Peter Ehrlich MD, Brendon Campbell MD, Robert Russell MD, Marianne Beaudin MD, Chad Hamner MD
Baylor College of Medicine

Invited Discussant: Kathryn Bass, MD

Background: Non-operative management (NOM) for pancreatic trauma with duct disruption has been shown to be variable among pediatric trauma centers, and outcomes are unclear regarding optimal management for these rare injuries. Our group proposed a "Less is More" NOM clinical pathway in 2017 to standardize management that recommends early oral feeding, limited imaging and labs, and discharge based on symptom improvement. The purpose of this study is to assess outcomes of patients who were managed by this pathway.

Method: Prospective, multicenter study of seven pediatric trauma centers (2018-2019). Children with blunt pancreatic injury with duct disruption (AAST grade III) who presented within 48 hours of injury were managed per the NOM clinical pathway and short and long-term outcomes were collected prospectively. Outcomes were compared to a historical cohort from thirteen centers prior to protocol implementation (2010-2015).

Results: Of 11 patients, the median age was 7 years (range 12 months-15 years). Handlebar injury was the most common mechanism (7/11, 64%). Clear liquid diet was started at mean 3.5 days (range 1-14) and low-fat diet at 6.7 days (range 2-24). Three patients (27%) failed diet advancement and required TPN or jejunal feeds. Endoscopic pancreatic duct stent was placed in 3/11 patients (27%). Mean length of stay (LOS) was 9.9 days (range 2-41). One patient who had pancreatic ascites at presentation developed a symptomatic pseudocyst that required endoscopic cyst-gastrostomy and developed exocrine pancreatic insufficiency. There were no other complications, additional interventions or hospitalizations.

Compared to the historical cohort (32 patients), TPN use was significantly lower (pre-protocol 56% vs post 18%, p=0.03) and organized fluid collection/pseudocyst was also lower (pre-protocol 81% vs post 18%, p=0.0004). Time to tolerating low-fat diet was shorter (pre-protocol 11.6 days vs post 6.7 days) and LOS was shorter (pre-protocol 13.6 days vs post 9.9 days), but neither were statistically significant.

Conclusion: Children with pancreatic injury with duct disruption can be safely managed and have rapid recovery using the "Less is More" standard NOM clinical pathway. Pancreatic ascites at presentation may be an indication to consider operative management or expect prolonged recovery with NOM. Further study is needed.

Session I: Plenary Papers 1-9
Paper 7: 11:30 AM - 11:50 AM

ANTIPLATELET AND ANTICOAGULANT AGENTS, ALONE AND IN COMBINATION, HAVE MINIMAL IMPACT ON TRAUMATIC BRAIN INJURY (TBI) INCIDENCE, NEED FOR SURGERY, AND MORTALITY IN GERIATRIC GROUND LEVEL FALLS (GLFS): A MULTI-INSTITUTIONAL ANALYSIS OF 33,710 PATIENTS

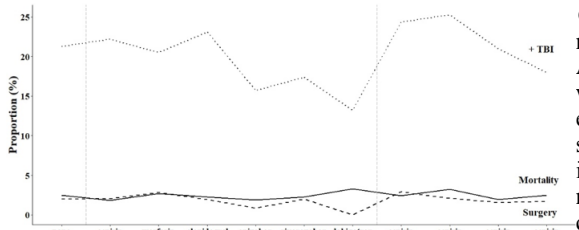
Samir M. Fakhry MD, Jennifer Morse, Jeneva Garland, Nina Wilson, Dorraine Watts PhD
Center for Trauma and Acute Care Surgery Research, CSG, HCA Healthcare

Invited Discussant: Scott Sagraves, MD

Introduction: Falls are the leading cause of TBI and TBI-related deaths for older persons (age>65). Antiplatelet and/or anticoagulant therapy (antithrombotics, ATs) is generally felt to increase this risk, but the literature is inconsistent. The purpose of this study was to determine the impact of AT use on the rate, severity and outcomes of TBI in older patients following GLFs.

Methods: GLF patients from 90 hospitals' trauma registries were selected. Patients were excluded if <65 years or had an AIS > 2 in a region other than head. EMR data for preinjury AT therapy were obtained. Patients were grouped by regimen for no AT, single, or multiple agents. Groups were compared on rates of diagnosed TBI, TBI surgery, and mortality.

Results: TThere were 33,710 patients (35% male, mean age 80.5, mean GCS 14.6), with 47.6% on single or combination AT therapy. The proportion of TBI diagnoses did not differ between those on No AT (21.25%) vs AT (21.61% p=0.418). Apixaban (15.7% p<0.001) and Rivaroxaban (13.19% p=0.011) were associated with lower rates of TBI, and ASA + Clopidogrel was associated with a higher TBI rate (24.34% p=0.002) vs. No AT. ASA + Clopidogrel was associated with a higher cranial surgery rate (2.9% p=0.006) vs No AT (1.96%), but surgery rates were similar for all other regimens. No regimen was associated with higher mortality.



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+ TBI	21.25%	22.2%	20.49%	23.08%	*15.7%**	17.37%	*13.19%**	*24.34%**	25.24%	21%	17.96%
Surgery	1.96%	2.01%	2.82%	1.94%	0.85%	1.99%	0%	*2.9%**	2.1%	1.54%	1.63%
Mortality	2.48%	*1.82%**	2.7%	2.24%	1.88%	2.25%	3.3%	2.39%	3.24%	1.93%	2.45%

** Group is statistically significantly different from No Antithrombotic Group (p<.01)*

Conclusions: In this large, multicenter study, the intake of ATs in older patients with GLFs was associated with inconsistent effects on risk of TBI and no significant increases in mortality, indicating AT use may have negligible impact on patient clinical management. A large, confirmatory, prospective study is needed, as the commonly held belief that ATs uniformly increase the risk of traumatic intracranial bleeding and mortality is not supported.

Session I: Plenary Papers 1-9
Paper 8: 11:50 AM - 12:10 PM

MEAN ARTERIAL PRESSURE MAINTENANCE FOLLOWING SPINAL CORD INJURY: DOES MEETING THE TARGET MATTER?

Jordan A. Weinberg MD, Kristina Chapple PhD, Louay Kalamchi BS, Harrison Farber MD, Scott Brigeman MD, Michael Bohl MD, Bianca Varda BS, Natasha Sioda BS, John Radosevich, Laura Snyder MD
Dignity Health, St. Joseph's Hospital and Medical Center

Invited Discussant: Deborah Stein, MD, MPH

Introduction: Neurosurgical guidelines recommend maintaining mean arterial pressure (MAP) between 85–90 mmHg following acute spinal cord injury (SCI). This is accomplished with intensive blood pressure monitoring and MAP augmentation with vasopressors as needed to maintain MAP at or above 85 mmHg. In our hospital, SCI patients receive orders for MAP maintenance for 72 hours following admission, but it is unclear how often the patient's MAP meets the target and whether or not this affects outcome. We hypothesized that the relative proportion of MAP measurements meeting the target of 85 mmHg (MAP85) would be associated with extent of neurologic recovery by hospital discharge.

Methods: SCI patients admitted between 2014 and 2019 were identified from the registry of a level 1 trauma center. Sequential MAP values for the first 72 hours from admission were obtained from electronic medical record review. The proportion of MAP85 was calculated for each patient. Cumulative vasopressor dose (norepinephrine equivalent) for first 72 hours within admission was recorded. Neurologic improvement, as measured by positive change in ASIA Impairment Scale by at least one level from time of admission to discharge, was evaluated with respect to proportion of MAP85.

Results: 136 SCI patients: 102 were male with median ISS 24 (17 – 27) and hospital LOS 10.4 days (6.6 – 15.5). Average number of MAP recordings for all patients was 157.0±70.4 and average proportion of MAP85 was 71.5%. 103 (81.4%) patients required vasopressors to elevate MAP (ASIA A 80.6%; B 95%; C 93%; D 59%). Median norepinephrine-equivalent dose was 25.9 mg (11.7 – 47.4). Admission ASIA scores were: A 31(22.8%), B 20(14.7%), C 27(19.9%), and D 58(42.6%). 41 patients (30.1%) were observed to have improvement in ASIA score by discharge (admission ASIA A 17%; B 32%, C 39%, D 12%). Proportion of MAP85 was higher for patients with ASIA improvement (79% ± 14 vs 68% ± 25, $p = 0.002$). Multivariate logistic regression modeling, adjusted for central cord syndrome, vasopressor dose, ISS, and admission ASIA score demonstrated a significant association between proportion of MAP85 and neurologic improvement of at least one ASIA level ($p = 0.020$).

Conclusion: The proportion of MAP measurements meeting the target of 85 mmHg was determined to be an independent predictor of neurologic improvement. Nonetheless, despite the intention of maintaining MAP above 85 mmHg for the first 72 hours of admission, the proportion of MAP measurements below the target during this period was nearly 30% on average. Increased vigilance regarding MAP maintenance above 85 mmHg is warranted to optimize neurologic recovery following SCI.

Session I: Plenary Papers 1-9
Paper 9: 12:10 PM - 12:30 PM

FIREARM STORAGE PRACTICES OF U.S. MEMBERS OF THE AMERICAN COLLEGE OF SURGEONS

Deborah A. Kuhls MD, Brendan T Campbell MD, Eileen M. Bulger MD, Ronald M. Stewart MD
UNLV School of Medicine

Invited Discussant: Tracey Dechert, MD

Introduction As a part of its firearm injury prevention action plan, the American College of Surgeons (ACS) surveyed the entire US ACS membership regarding individual member's knowledge, experience, attitudes, degree of support for ACS COT firearm programs, and degree of support for a range of firearm injury prevention policies. This survey included questions regarding members' prevalence of firearm ownership, type of firearm(s) in the home, personal reasons for firearm ownership and methods of firearm/ammunition storage.

Methods An email invitation to participate in an anonymous, 23-item survey on firearms was sent to all US ACS members (n= 54,761) by a contracted survey research firm. Cross tabulation of questionnaire items by demographic characteristics and chi-square analyses were performed with statistical significance $p < 0.05$.

Results The overall response rate was 20.4% (11,147/54,761). Forty-two percent of respondents keep firearm(s) in their home (82%long guns, 82% handguns; 32% high-capacity magazine fed, semi-automatic rifle); 75% own for self-defense/protection, 73% for target practice; 39% store firearms unlocked and 32%store them unlocked and loaded. Results vary by practice/training location, practice type, military experience, gender, age, presence of children in the home, level of training and race/ethnicity.

Conclusion Significant percentages of ACS members store firearms in their home and about 1/3 store firearms in an unlocked *and* loaded fashion. Safe storage is a tenet of responsible firearm ownership. These data present opportunities for engaging surgeons in efforts to improve safe firearm storage in homes.

Table 1: Storage Practices of ACS Members Groups (%)

Storage Status N	Gen Surg 5121	Other Surg 4241	Mil Exp 2406	No Mil Exp 8726	Female Gender 2347	Male Gender 8777	Child in Home 4046	No Child in Home 7014	Resident Member 1904	FACS Member 6896	Retired Member 1102
Store in Home	41	41	59*	38*	26*	47*	40*	42*	24*	47*	58*
Unlocked	39*	32*	46*	36*	34*	39.6*	26*	46*	42*	36*	53*
Unlocked & Loaded	33*	28*	39*	29*	26*	32.9*	21*	38*	33*	31*	40*

Abbreviations: Gen Surg: General Surgery, Mil Exp: Military Experience, FACS: ACS Fellow *p < 0.05

Table 2: Storage Practices of ACS Members By Race/Ethnicity (%)

Storage Status N	White Race 8579	African American 283	Hispanic /Latino 393	Female Gender 2347	Asian/Asian American 986	Mid Eastern/ North African 200	Multi-Racial 443
Store in Home	47*	23*	33*	26*	18*	13*	35*
Unlocked	40*	37*	30*	34*	30*	17*	31*
Unlocked & Loaded	32*	35*	41*	26*	23*	28*	31*

*p < 0.05

Session II: Papers 10-13

Wednesday , September 9, 2020

1:00 PM - 2:40 PM

Moderator: Rosemary Kozar, MD

Session II: Plenary Papers 10-13
Paper 10: 1:00 PM - 1:20 PM

ANTITHROMBIN III AMELIORATES POST-TBI CEREBRAL LEUKOCYTE-ENDOTHELIAL CELL INTERACTIONS AND BLOOD BRAIN BARRIER (BBB) PERMEABILITY IN VIVO

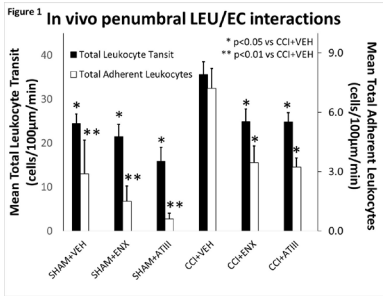
Mohamed Elsaadani MD, Syed Ahmed MD, Christina Jacovides MD, Alfonso Lopez MD, Victoria Johnson PhD, Lewis J. Kaplan MD, C. William Schwab MD, Douglas Smith MD, Jose L. Pascual MD, PhD
Hospital of the University of Pennsylvania

Invited Discussant: Hasan Alam, MD

Introduction: Acute traumatic coagulopathy often accompanies traumatic brain injury (TBI) and may impair cognitive recovery. Antithrombin III (ATIII) reduces the hypercoagulability of TBI. ATIII and heparinoids such as enoxaparin (ENX) demonstrate potent anti-inflammatory activity, reducing organ injury and modulating leukocyte (LEU) activation, independent of their anticoagulant effect. It is unknown what impact ATIII exerts on cerebral LEU activation and BBB permeability after TBI. We hypothesized that ATIII reduces live microcirculatory LEU-endothelial (EC) interactions and leakage at the BBB following TBI.

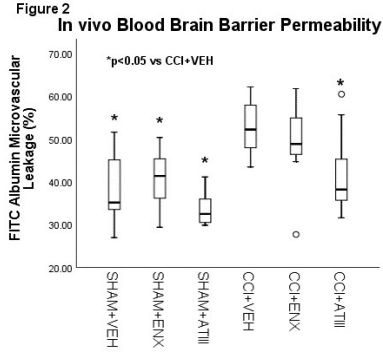
Methods: CD1 mice (n=71) underwent either severe TBI (controlled cortical impact; CCI: 6 m/sec velocity, 1 mm depth and 4 mm diameter) or sham craniotomy (SHAM) and then received either ATIII (250 IU/kg), ENX (1.5mg/kg) or VEH (saline) every 24h. 48 hours post-TBI, cerebral intravital microscopy visualized *in-vivo,* penumbral microvascular EC-L interactions and microvascular leakage to assess BBB inflammation/permeability. Body weight (bw) loss and the Garcia Neurological Test (GNT: motor, sensory, reflex, balance) served as surrogates of clinical recovery.

Figure 1



Results: Both ATIII and ENX similarly reduced *in vivo* penumbral LEU rolling and adhesion (Figure.1, $p < 0.05$). ATIII also reduced live BBB leakage (Figure.2, $p < 0.05$). ATIII animals demonstrated the least 48-hour bw loss (8.4 ± 1%) vs CCI+VEH (11.4 ± 0.5%, $p < 0.01$). GNT scores were similar among groups.

Figure 2



Conclusions: ATIII reduces post-TBI penumbral EC-LEU interactions in the BBB leading to reduced neuro-microvascular permeability. ATIII further reduced body weight loss compared to heparinoid or no therapy. Further study is needed to determine if these ATIII effects on neuroinflammation affect longer term neurocognitive recovery after TBI.

Session II: Plenary Papers 10-13
Paper 11: 1:20 PM - 1:40 PM

THE EXPRESSION OF REPULSIVE GUIDANCE MOLECULE A (RGMA) AFTER TRAUMATIC BRAIN INJURY: THE TIME-COURSE GENE EXPRESSION CHANGES IN THE MURINE CONTROLLED CORTICAL IMPACT MODEL

Eri Uemura MD, Goro Tajima MD, PhD, Naoya Matsumoto MD, PhD, Ayako Tokunaga PhD, Miyuki Miura, Takehiko Murase MD, PhD, Kazuya Ikematsu MD, PhD, Osamu Tasaki MD, PhD
Nagasaki University Hospital Acute & Critical Care Center

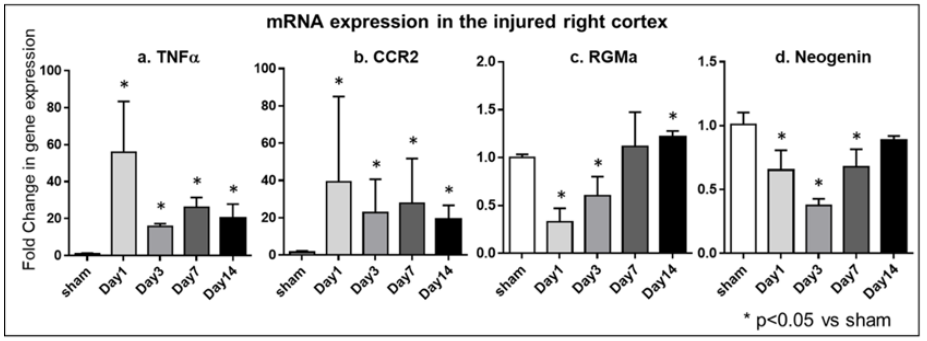
Invited Discussant: Eric Ley, MD

Introduction: Repulsive guidance molecule a (RGMa) is a key protein to regulate nerve regeneration negatively, as its inhibition enhances axonal growth and promotes functional recovery in spinal cord injury animal models. However, the role of RGMa in traumatic brain injury (TBI) remains elusive. The purpose of this study is to clarify TBI-responsive RGMa expression in a murine model.

Methods: Adult male C57Bl/6J mice were subjected to controlled cortical impact (CCI). Brains were extracted 1, 3, 7, and 14 days after the injury (n=6 in each group). Changes in the mRNA expression of RGMa and its receptor, Neogenin were evaluated by quantitative polymerase chain reaction (qPCR) in the damaged area of cortex, along with expression measurement of inflammation-related molecules. Neurological deficit was also assessed by the cylinder test in each time point.

Results: Neurological score was consistently lower in the CCI group compared to the sham group through the experimental period. mRNA expressions of representative inflammatory cytokine (TNF-a) and chemokine (CCR2) were remarkably increased at day 1 and gradually decreased over time, although kept higher values at least until day 14 (Figure a,b). mRNA expressions of RGMa and Neogenin were significantly suppressed in the damaged cortex until day 3. Interestingly, RGMa expression was suppressed most at day 1 and up-regulated over time, and significantly higher than the sham group at day 14 (Figure c,d)

Conclusion: In acute phase of TBI, significant inflammation was induced in the damaged cortex, and the expressions of RGMa and Neogenin were significantly decreased under inflammatory milieu of the damaged area. Contrary to the subsequent inflammatory remission, RGMa expression exceeded more than normal level two weeks after TBI. Intrinsic regenerative response to acute brain injury might be hampered by following up-regulation of RGMa, hinting the possibility of functional RGMa inhibition as a new effective maneuver against TBI.



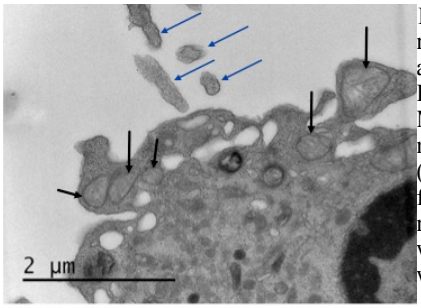
Session II: Plenary Papers 10-13
Paper 12: 1:40 PM - 2:00 PM

ACTIVE MONOCYTE EXOCYTOSIS OF MITOCHONDRIAL DAMPS SUPPRESSES NEUTROPHIL FUNCTION

Barbora Konecna PhD, Woon-Yong Kwon MD,PhD, Barbora Vlkova PhD, Quanzhi Zhang MSc, Jinbong Park PhD, Wei Huang PhD, Hyo In Kim MSc, Kiyoshi Itagaki PhD, **Carl J. Hauser MD**
BIDMC Medical Center

Invited Discussant: Raul Coimbra, MD, PhD

INTRODUCTION: Both trauma and primary infections increase risk of secondary infections. Injury mobilizes danger-associated molecular patterns (DAMPs) in the form of mitochondria (mt) released by cellular necrosis. It is unknown whether infection or other forms of inflammation might act similarly and how the release of mtDAMPs in such cases might predispose to secondary infection.



METHODS: Mitochondrial DNA (mtDNA) release from human monocytes (Mo) was studied after LPS stimulation using PCR (for Cytochrome B), fluorescent video-microscopy of live adherent Mo (using Mito-Tracker dye), electron microscopy and size exclusion chromatography (SEC). Human neutrophil (PMN) chemotaxis to fMLF (CTX, assayed in transwells) and respiratory burst (RB, assayed by luminometry) were studied after PMN incubation with or without mtDNA.

RESULTS: LPS exposure causes Mo to actively release mtDAMPS by the cells budding mt (Figure, black arrows). This occured mostly in the form of microvesicles (Figure, blue arrows) and to a lesser extent as exosomes (shown by PCR of the SEC exosome band). In the PMN studies, pre-incubation with mtDNA suppressed CTX to fMLF in a dose dependent manner ($P < 0.01$). CTX suppression by mtDNA was reversed by chloroquine (CQ) indicating an endosomal, TLR-9 dependent mechanism. In contrast, PMN RB was completely unaffected by mtDNA

CONCLUSIONS: In addition to the now well-known direct release of mtDAMPs by traumatic cellular disruption, inflammatory and or infectious stimuli appear able to cause active mtDAMP release in microvesicles. The mtDAMPs thus released appear to have unique effects on PMN functions that can contribute to the suppression of antimicrobial function. This DAMP-mediated "feed-forward" mechanism of amplifying innate immune responses might be generalizable to many forms of inflammation. And where it causes immune dysfunction that effect can be mitigated if the cellular pathways by which the DAMPs act can be defined. In this case, the endosomal inhibitor CQ is benign and well tolerated. So it might warrant study as a prophylactic anti-infective after mtDNA mobilization by injury or prior infection.

Session II: Plenary Papers 10-13
Paper 13: 2:00 PM - 2:20 PM

FREEZE DRIED PLATELETS REPAIR AND STABILIZE THE VASCULAR ENDOTHELIUM IN HEMORRHAGIC SHOCK

Shibani Pati MD, PhD, Daniel Potter PhD, Alpa Mahuvakar PhD, Byron Miyazawa BS, Martin Schreiber MD
University of California San Francisco

Invited Discussant: Ernest Moore, MD

Introduction: Currently in blood-banking practice in the US, platelets are stored in incubators at 22°C, with gentle agitation for up to 5 days. This short storage time has led to a global shortage of platelets for bleeding patients. A freeze-dried platelet-derived product (FDPlts) can circumvent these challenges by providing hemostasis, prolonging the shelf life of platelet products, improving safety from infectious risks, and significantly enhancing utilization (i.e. in remote and austere regions). In this study we aimed to test a human freeze dried platelet product in a murine model of hemorrhagic shock (HS) and trauma. FDPlts have been demonstrated to have potent hemostatic properties, but the vascular and organo-protective effects of the FDPlts remain to be elucidated. We hypothesized that FDPlts would have the capacity to regulate vascular stability and also function to mitigate organ failure induced by HS and trauma.

Methods: FDPlts were obtained from Cellphire Inc (Rockville, MD). *In vitro*, endothelial impedance (ECIS) assays were conducted with pulmonary endothelial cell (PECs) monolayers treated with FDPlts to determine if FDPlts could attenuate PEC permeability induced by thrombin. *In vivo*, a Miles assay of permeability was conducted to determine if intravenous (IV) FDPlts could attenuate vascular leak induced by VEGF-A. In a clinically relevant model of HS and trauma, IV FDPlts were tested to determine if FDPlts could attenuate pulmonary vascular leak and lung injury induced by HS. Scanning electron microscopy was utilized to evaluate FDPlt morphology and intravital microscopy determined if FDPlts could contribute to clot formation in injured vessels.

Results: Endothelial impedance assays demonstrate that FDPlts attenuate PEC permeability *in vitro* in a dose dependent fashion. In the Miles assay in mice, IV FDPlts inhibit vascular permeability induced by VEGF-A. In an established model of mouse HS and trauma, IV FDPlts administered after the shock period significantly attenuated pulmonary vascular permeability and lung injury comparable to whole blood resuscitation (Figure 1). Scanning electron microscopy reveals that FDPlts are comparable in morphology to 22°C activated platelets. Intravital microscopy of FITC-tagged FDPlts demonstrates that FDPlts adhere *in vivo* to injured vascular endothelium and contributes to clot formation.

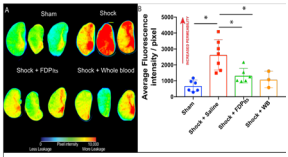


Figure 1. FDPlts attenuate pulmonary vascular permeability. **A)** Representative scans of lungs from mice infused with 10kD Dextran dyes. **B)** Quantitation of the average fluorescence intensity of the lungs which shows that FDPlts and whole blood transfusion block leak * = $p < 0.05$ via one way ANOVA tukey test. No significant difference was found between whole blood and FDPlts.

Conclusion: Our findings demonstrate that FDPlts have the capacity to attenuate vascular permeability and can contribute to clot formation suggesting that they may be a logistically superior option for use in bleeding patients. This is the first study to demonstrate that a platelet product can improve trauma associated organ failure and suggests that platelets could be beneficial in treating diseases characterized by vascular leak such as ARDS.

Scholarship Presentations

Wednesday, September 9, 2020
2:40 PM - 3:00 PM

Galinos Barmparas, MD
Cedars-Sinai Medical Center
"The Impact Of Anticoagulant Solution, Processing Method And Storage Time On The Biochemical And Coagulation Profile Of Stored Whole Blood"

Ian Brown, MD, PhD
University of California Davis Medical Center
"P-Selectin-Dependent Pulmonary Arterial Thrombosis in Blunt Thoracic Trauma"

Jennifer Leonard, MD, PhD
Washington University
"The Role of Neutrophil Mediated NETosis in Pulmonary Endothelial Damage Following Traumatic Injury"

Session III: Papers 14-18

Wednesday, September 9, 2020

3:00 PM - 4:40 PM

Moderator: Christopher Michetti, MD

Session III: Plenary Papers 14-18
Paper 14: 3:00 PM - 3:20 PM

ASSOCIATION OF TIMING OF INITIATION OF PHARMACOLOGIC VENOUS THROMBOEMBOLISM PROPHYLAXIS WITH OUTCOMES IN TRAUMA PATIENTS

Jason Hecht, Emily Han Other, Mark R. Hemmila MD, Anne Cain-Nielsen, Wendy L. Wahl MD
St. Joseph Mercy Ann Arbor

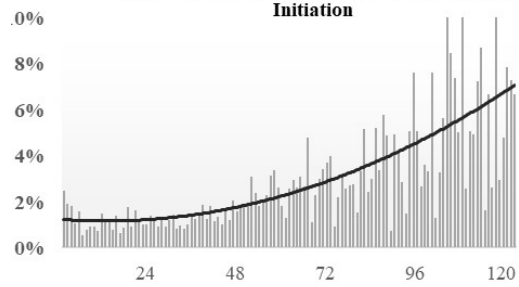
Invited Discussant: Elliott Haut, MD, PhD

Introduction: Venous thromboembolism (VTE) is a serious complication for trauma patients associated with significant morbidity and mortality. Current guidelines emphasize the importance of VTE chemoprophylaxis, however, the timing of initiation must balance the risks of thrombosis versus bleeding. Our study aims to address this literature gap by looking at the timing of chemoprophylaxis in all trauma patients.

Methods: Trauma quality collaborative data (2008-2019) was analyzed. Patients were excluded if hospitalization < 48 hours or no prophylaxis given. Comparison groups were based on timing of initiation of prophylaxis (< 24 hours, 24 to 48 hours, ≥ 48 hours). Risk-adjusted rates of mortality and VTE were calculated using patient factors including type of pharmacologic agent in addition to standard trauma patient confounders.

Results: Of the 89,165 patients analyzed, 1,752 (1.9%) died and 1.8% experienced a VTE complication. (**Figure 1**) After adjusting for type of prophylaxis and patient factors, delay in initiation of chemoprophylaxis to 24 – 48 or ≥ 48 hours after hospital presentation was associated with increased risk of VTE events (**Table 1**). These findings remained significant after exclusion of perceived higher-risk patients in sensitivity analysis. Delay in initiation of chemoprophylaxis in the ≥ 48 hour group also resulted in increased mortality as compared to earlier initiation.

Figure 1. VTE Rate by Hour of Prophylaxis Initiation



Conclusion: Early initiation of pharmacologic VTE prophylaxis in stable trauma patients reduces mortality and thrombotic complication.

Table 1. Risk of Mortality and VTE Stratified by Chemoprophylaxis Timing

	Timing of VTE Prophylaxis Initiation					
Outcome	0 to <24 hrs from Admission		24 to < 48 hrs from Admission		≥ 48 hrs from Admission	
Patients, n	42,780		27,323		19,062	
Mortality, % (n)	1.43 (610)		1.48 (404)		3.87 (738)	
Venous Thromboembolism, % (n)	1.06 (453)		1.33 (364)		4.20 (801)	
Risk Adjusted Outcome	OR (95% CI)	*p*-value	OR (95% CI)	*p*-value	OR (95% CI)	*p*-value
Mortality	Ref	--	0.87 (0.76-1.00)	0.053	1.16 (1.02-1.33)	0.026
Venous Thromboembolism	Ref	--	1.22 (1.06-1.41)	0.006	2.27 (1.98-2.60)	<0.001

Session III: Plenary Papers 14-18
Paper 15: 3:20 PM - 3:40 PM

RISK OF THROMBOEMBOLIC EVENTS AFTER THE USE OF TXA IN TRAUMA PATIENTS

Marianna Fischmann MD, Matthew Hernandez MD, Michael Traynor MD, Martin D. Zielinski MD, Brian D. Kim MD
Mayo Clinic

Invited Discussant: Michelle McNutt, MD

Introduction: Administration of tranexamic acid (TXA) has been shown to reduce mortality after injury. Despite this benefit, TXA has been associated with arterial and venous thromboembolism in traumatically injured patients. The aim of this study was to describe thrombotic events in a rural community served by a Level I trauma center in patients administered TXA. We hypothesized that patients who received TXA would demonstrate higher rates of thrombotic events compared to those that did not.

Methods: This is a retrospective cohort study of trauma patients who received TXA (bolus or bolus and infusion) from January 2012 to January 2019. Demographics, mechanism of injury, hospital length of stay, and Injury Severity Score (ISS) were abstracted. The primary outcome was the frequency of thromboembolic events (up to 28 days after injury). Secondary outcome included in-hospital mortality. Univariate comparisons between those who received TXA versus those who did not after matching for mechanism of injury, age, sex, and ISS were performed. A subgroup analysis was performed looking at the outcomes for patients who received initial TXA bolus alone vs. bolus followed by maintenance infusion. A multivariable logistic regression analysis controlled for possible confounders, chosen based on the univariate analysis (massive blood transfusion activations, solid organ injuries, and blunt carotid injuries).

Results: A total of 848 patients were included, of whom 212 received TXA and 636 were in the matched control group. Overall, the median age was 48 years (IQR 28, 66) and 70.8% were male. There were no statistically significant differences between groups for age, sex and mechanism of injury. The median ISS was 26 (IQR 16, 34) in patients who were administered TXA and 22 (IQR 14, 29) in those who didn't (p=0.001). The rate of any thromboembolic event within 28 days was 12.7% (n=28) in the TXA group vs. 5.9% (n=38) in the control group (p=0.0007). The rate of DVT was 8.5% (n=18) vs. 3.5% (n=22) (p=0.0028). Pulmonary embolism was diagnosed in 3.8% (n=8) vs. 1.9% (n=12) (p=0.11). The rate of myocardial infarction was 1.9% (n=4) vs. 0.4% (n=3) (p=0.07). Stroke occurred in 2.4% (n=5) vs. 1.1% (n=7) in the control group (p = 0.18). The in-hospital mortality was higher in the TXA group (n=44, 20.8%) than in controls (n=64, 10%) (p < 0.0001). In multivariable analysis, patients who received TXA had increased odds of developing any thromboembolic event (OR 2.29 [95% CI 1.31-4.02], p=0.0037). The difference in mortality did not remain significant after adjustment (OR 1.19 [95% CI 0.73-1.93], p= 0.48). In a subgroup analysis, patients who received the initial bolus dose of TXA and a maintenance infusion had higher rates of thromboembolic events (24/106, 22.6%) than patients who received only the initial bolus (11/106, 10.4%), p < 0.0001.

Conclusion: In this observational study at a Level I Trauma Center, patients who received TXA had higher rates of thromboembolic events than matched controls. The administration of TXA for traumatically injured patients in the community setting should not be routine considering our results.

Session III: Plenary Papers 14-18
Paper 16: 3:40 PM - 4:00 PM

HEAD IN THE SAND? THE VALUE OF ROUTINE DUPLEX ULTRASOUND SCREENING FOR VENOUS THROMBOEMBOLISM IN THE TRAUMA PATIENT: A RANDOMIZED VANGUARD TRIAL

Sarah Majercik MD, **Annika Kay**, David Morris MD, Thomas White MD, Don VanBoerum MD, David Collingridge MSc, Joseph Bledsoe MD, Scott Stevens MD, Scott Woller MD
Intermountain Medical Center

Invited Discussant: M. Margaret Knudson, MD

Introduction: Venous thromboembolism (VTE) is a source of significant morbidity and mortality in injured patients. Current ACCP guidelines recommendation against routine duplex ultrasound (DUS) screening for deep vein thrombosis (DVT) but do not differentiatehigh-risk trauma patients from lower risk patients. Theevidence supporting this guideline is poor and mostly retrospective in nature. We hypothesized that moderate and high-risk trauma patients who undergo scheduled ultrasound surveillance for lower DVT will have a lower rate of symptomatic DVT, DVT propagation, and symptomatic or fatal pulmonary embolism (PE) than those who do not undergo screening.

Methods: Prospective, randomized vanguard trial between March 2017 and September 2019 of patients admitted to the Trauma service at a single, Level 1 trauma center, with a RAP score of 5 or greater. Patients were randomized to receive bilateral lower extremity DUS surveillance at days 1,3,7, and weekly thereafter during hospitalization versus no routine surveillance (testing for DVT could occur if clinically suspected). The two groups were compared with regard to DVT (distal and proximal lower extremity) and PE rates (both during the index hospitalization and at 90 days post-discharge),DVT propagation to popliteal vein or higher, major bleeding episodes, composite VTE/bleeding outcome, and all cause 90 day mortality. All patients received VTE chemoprophylaxis and treatment (if necessary) as per institutional protocols.

Results: 3236 trauma service admissions were screened. 1989 moderately high-risk (RAP>=5) patients were randomized (995 DUS group, 994 non-DUS). Patients had a mean age of 62 years, ISS of 14, RAP of 7.7, and 97% sustained blunt trauma. There was no difference between the groups with regard to age, gender, BMI, injury mechanism, RAP score, ISS, hospital or ICU LOS. DUS patients had a higher overall rate of DVT (15.1% vs. 1.7%, $p<0.001$), as expected. Most (87%) of the DVT in the DUS group were below the knee. Rate of proximal DVT was also higher in the DUS group (1.9% vs. 0.4% $p=0.003$). At 90 days, there were a total of 13 PE in the no DUS group vs. 7 in the DUS group, $P=0.26$. Overall mortality was not different between groups.

Conclusion: Routine surveillance DUS in high risk trauma patients diagnoses more DVT, most of which are below the knee. Routine surveillance does identify more proximal DVT than clinical suspicion alone, but does not result in less PE or death. Further studies are needed to delineate which sub-populations may benefit most from routine DUS surveillance.

Session III: Plenary Papers 14-18
Paper 17: 4:00 PM - 4:20 PM

HYBRID EMERGENCY ROOM SHOWS THE MAXIMUM EFFECT ON TRAUMA RESUSCITATION WHEN USED IN PATIENTS WITH HIGHER SEVERITY

Yutaka Umemura MD, PhD, **Natsuhiro Morita MD,** Kazuma Yamakawa MD, PhD, Hiroshi Ogura MD, Atsushi Watanabe MD, Satoshi Fujimi MD, PhD, Takahiro Kinoshita MD
Osaka General Medical Center

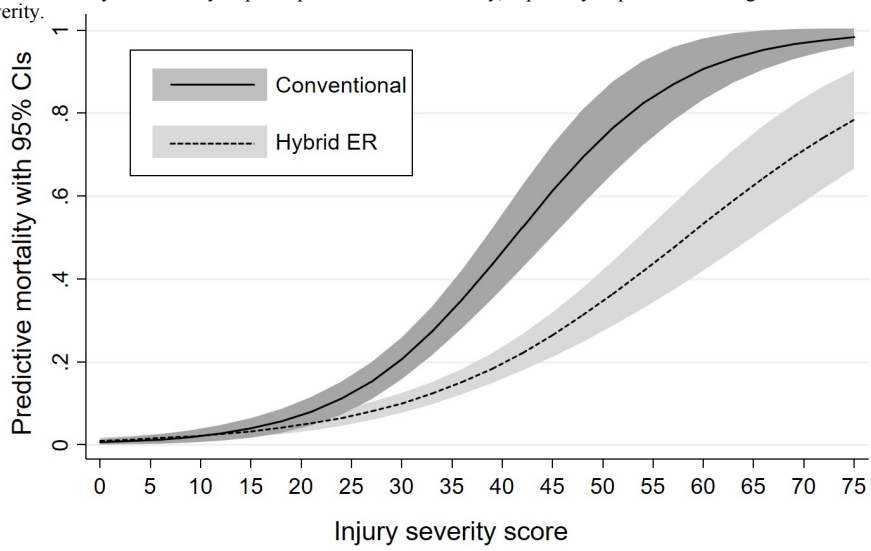
Invited Discussant: Laura Moore, MD

Background: Hybrid emergency room (ER) system is a novel trauma workflow which uses angio-computed tomography (CT) equipment in a trauma resuscitation room. In August 2011, we installed the world's first Hybrid ER in our hospital, and started to perform all examinations and treatments for trauma resuscitation in one room. However, effects of Hybrid ER has not been extensively investigated.

Material and Methods: This investigation was a retrospective cohort study conducted in a tertiary hospital in Japan from August 2007 to January 2020. We aimed to investigate survival benefit of the Hybrid ER and identify an optimal subset of trauma patients likely to receive higher benefits from the Hybrid ER. We consecutively included severe blunt adult trauma patients [Injury Severity Score (ISS) ≥16]. We divided study population into two groups: 1) the Conventional group (from August 2007 to July 2011) and 2) the Hybrid ER (from August 2011 to January 2020) group. We evaluated the association between 28-day mortality and the installation of Hybrid ER using multivariable logistic regression analysis. A restricted cubic spline analysis was conducted to evaluate the trend of 28-day mortality during the study period. To evaluate difference in effects on survival benefit based on patient severity, we also evaluated whether the effect of the Hybrid ER on survival was modified by patients' ISS.

Results: Among 1,050 trauma patients, 348 were in the Conventional group and 702 were in the Hybrid ER group. There was no significant difference in ISS and probability of survival (Ps) between two groups. We observed a significantly lower 28-day mortality in the Hybrid ER group (Ps adjusted odds ratio, 0.48; 95% confidence interval, 0.32–0.71; $P < 0.001$). Restricted cubic spline analysis revealed that thePs adjusted 28-day mortality sharply decreased approximately 200 days after the installation of the Hybrid ER. Increase of survival probabilities according to the increase of ISS was significantly curbed in Hybrid ER group (p for interaction = 0.014, Figure). As ISS increased over the level of 25, survival probabilities in Hybrid ER group was much lower compared to those in conventional group.

Conclusion: Hybrid ER may improve post-traumatic mortality, especially in patients with higher baseline severity.



Session III: Plenary Papers 14-18
Paper 18: 4:20 PM - 4:40 PM

REAL-TIME BEDSIDE MANAGEMENT AND TITRATION OF PARTIAL REBOA WITHOUT AN ARTERIAL LINE: GOOD FOR PRESSURE, NOT FOR FLOW!

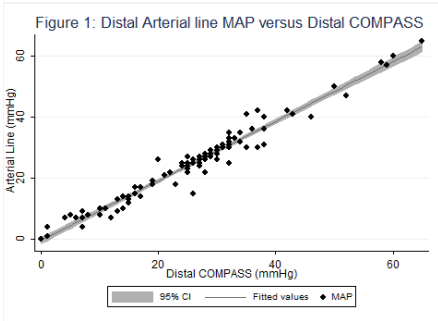
Matthew Carr MD, Derek Benham MD, Richard Calvo PhD, Lyndsey Wessels MD, Joseph Lee BS, Andrew Schrader, Michael Krzyzaniak MD, Matthew Martin MD
Naval Medical Center San Diego

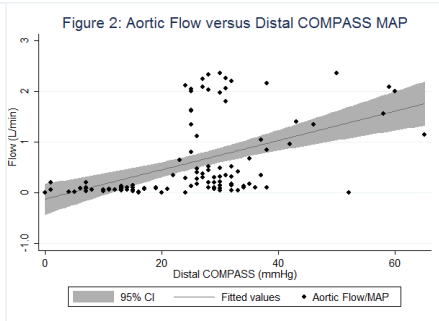
Invited Discussant: Megan Brenner, MD, MSc

Introduction: Partial resuscitative endovascular balloon occlusion of the aorta (pREBOA) attempts to minimize ischemia/reperfusion injury while still controlling hemorrhage. There is little data on optimal methods to evaluate and titrate partial flow, typically requiring invasive arterial line (AL) monitoring. We sought to examine the use of a miniaturized handheld digital pressure device (COMPASS) for pREBOA placement and titration of flow.

Methods: Ten swine underwent standardized hemorrhagic shock. Carotid and iliac pressures were monitored with both AL and COMPASS devices, and flow by aortic and SMA flow probes. pREBOA was inflated to control hemorrhage for 15 minutes before being deflated to try targeting aortic flow of 0.7L/min (using only the COMPASS device) by an operator blinded to the AL pressures and aortic flow. Correlations between COMPASS and proximal/distal AL were evaluated, as well as actual aortic flow.

Results: There was strong correlation between the distal MAP and the distal COMPASS MAP as seen in Figure 1 ($r=.979$, $p < 0.01$), as well as between the proximal AL and the proximal COMPASS on the pREBOA ($r=.989$, $p < 0.01$). There was a significant but weaker correlation between the distal compass MAP reading and aortic flow ($r=0.47$, $p < 0.0001$) though it was not clinically significant (Fig 2) and predicted flow was not achieved in a majority of the procedures. Of 10 pigs, survival times ranged from 10-120 minutes, with a mean survival of 50 minutes, and one pig surviving to 120 minutes.





Conclusion: Highly reliable pressure monitoring is achieved proximally and distally without arterial lines using the COMPASS device on the pREBOA. Despite accurate readings, distal MAPs were a poor indicator of aortic flow and titration based upon distal MAPs did not provide reliable results. Further investigation will be required to find a suitable proxy for targeting specific aortic flow levels using pREBOA.

Session IV: Papers 19-22

Thursday, September 10, 2020
9:00 AM - 10:20 AM
Moderator:
Kimberly Davis, MD, MBA

Session IV: Plenary Papers 19-22
Paper 19: 9:00 AM - 9:20 AM

GALL STONES RELATED COMPLICATIONS AFTER UNTREATED BILIARY COLIC: A SIX-MONTH READMISSIONS STUDY

Faisal Jehan MD, Jorge Con MD, Kartik Prabhakaran MD, Muhammad Khan MD, Muhammad Zeeshan MD, Peter Rhee MD, MPH, Rifat Latifi MD
New York Medical College -Westchester Medical Center

Invited Discussant: James Davis, MD

Introduction: Cholelithiasis and its subsequent complications are the leading causes of hospital admissions related to gastrointestinal problems. Cholecystectomy is considered the standard of care for the management of symptomatic cholelithiasis and biliary colic. The incidence of recurrence of symptoms and complications after an untreated biliary colic has never been studied. The aim of our study was to evaluate the incidence of complications after an untreated biliary colic.

Methods: We performed five years (2010-2014) analysis of the national readmission database and included all adult patients diagnosed with biliary colic or symptomatic cholelithiasis without cholecystitis, choledocholithiasis, cholangitis and pancreatitis who did not underwent cholecystectomy. Primary outcome measures were readmissions for biliary colic, acute cholecystitis, choledocolithiasis, cholangitis and pancreatitis within 3 months and 6 months.

Results: We included a total of 22,345 patients with the diagnosis of biliary colic. Mean age was 42±4 years and 64% were female. The incidence of a gallstone-related complication by 3-months and 6-months are 23% and 35% respectively. The incidence of recurrent biliary colic was 9%and 12%; acute cholecystitis 7% and 10%; choledocolithiasis 4% and 5%; cholangitis 1%and 2%; and pancreatitis 2% and 6% within 3 months and 6 months respectively.

Conclusion: Untreated biliary colic is associated with a very high rate of 3 months and 6 months gall-stones related complications. Cholecystitis should be performed as soon as possible after biliary colic to prevent these complications. Further studies exploring the reasons of delaying cholecystectomy in these patients are warranted.

Session IV: Plenary Papers 19-22
Paper 20: 9:20 AM - 9:40 AM

BILE DUCT CLEARANCE AND CHOLECYSTECTOMY FOR CHOLEDOCOLITHIASIS: ONE - STAGE LAPAROSCOPIC CHOLECYSTECTOMY WITH INTRA-OPERATIVE ENDOCOPIC RETROGRADE CHOLANGIOPANCREATOGRAPHY (ERCP) PROCEDURE VERSUS TWO - STAGE PROCEDURE

Gary Bass MD, MBA, Arvid Pourlotfi MD, Mark Donelly MD, Caroline McIntyre MD, Rebecka Ahl MD, PhD, Yang Cao PhD, Babak Sarani MD, Amy Gillis MD, Shahin Mohseni MD, PhD
Orebro University Hospital

Invited Discussant: Caroline Reinke, MD

Introduction: Significant clinical equipoise exists regarding optimal sequencing in the definitive management of choledocholithiasis. Central to this is the migration in treatment algorithm from sequential biliary ductal clearance and gallstone reservoir management (either at index admission or at an interval) to simultaneous laparoendoscopic management. Our current study compares these two different approaches.

Methods: Patients were recruited from a Swedish and an Irish university hospital with different practice patterns for definitive management of choledocholithiasis. In the former, patients with choledocholithiasis undergo one-stage procedure with laparoscopic cholecystectomy with intra-operative rendezvous ERCP at index admission, while in the latter, patients undergo endoscopic biliary duct clearance on index admission and return following recovery for interval day-case laparoscopic cholecystectomy (two-stage procedure). Demographics, clinical characteristics, and outcomes were compared between these approaches over the period January 2015-December 2018. Outcomes of interest were post-procedural complications and total hospital days.

Results: Three hundred fifty seven consecutive patients were treated for choledocholithiasis during the study period, of these, 222(62.2%) patients underwent one-stage procedure, while 135(37.8%) underwent two-stage procedure. Patients in both cohorts were closely matched in terms of age, sex and serum peak total bilirubin. Patients in the one-stage procedure group exhibited a greater inflammatory reaction as measured by their C-reactive protein (136±137 vs. 95±102mg/L, p=0.024), and had higher rate of co-morbidities (Charlson Comorbidity Index ≥3: 37.8% vs 20.0%, p=0.003), and were less fit for surgery (ASA ≥3: 11.7% vs. 3.7%,p < 0.001). A significantly shorter mean time to definitive treatment, i.e. cholecystectomy (3.1±2.5 vs 40.3±127 days, p=0.017), without any excess morbidity, was detected in the one-stage compared to two-stage cohort. Patients in the one-stage cohort experienced shorter mean post-procedure length of stay (3.0±4.7 vs 5.0±4.6 days, p < 0.001) and total length of hospital stay (6.5±4.6 vs 9.0±7.3 days, p=0.002).

Conclusion: Within the context of developing European and US models of Acute Care Surgery, consideration should be given to index-admission laparoscopic cholecystectomy with intra-operative ERCP for treatment of choledocholithiasis. Our data suggest this strategy significantly shortens time to definitive treatment, decreases total hospital stay without any excess in adverse outcomes, reduces the financial burden on the healthcare system, and could potentially increase patient satisfaction.

Session IV: Plenary Papers 19-22
Paper 21: 9:40 AM - 10:00 AM

EVALUATING THE ASSOCIATION BETWEEN AAST EMERGENCY GENERAL SURGERY SEVERITY GRADES AND OUTCOMES USING NATIONAL CLAIMS DATA

John W. Scott MD, MPH, Kristan L. Staudenmayer MD, MSc, Garth H. Utter MD, MSc
Department of Surgery, University of Michigan

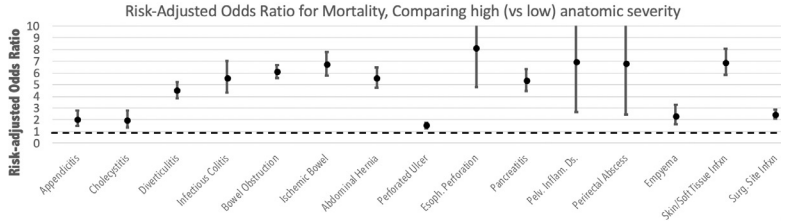
Invited Discussant: Heena Santry, MD

Background: Emergency General Surgery (EGS) encompasses a heterogenous population of acutely ill patients, and standardized methods for determining disease severity are essential for comparative effectiveness research and quality improvement initiatives for EGS. The AAST Patient Assessment Committee has developed a 5-level grading system for the anatomic severity of 16 EGS conditions; however, little is known regarding how well these AAST EGS grades can be approximated by diagnosis codes used in administrative databases.

Methods: We identified all adult hospitalizations in the 2012-2017 Nationwide Inpatient Sample that had a principal diagnosis of one of the 16 EGS conditions using ICD-9-CM (2012-2015q3) and ICD-10-CM (2015q4-2017) diagnosis codes. We assigned AAST clinically-derived anatomic severity grades using the principal diagnosis, as well as secondary diagnoses that assist in assigning disease severity. We evaluated whether assigned EGS grades (2-4 categories, or dichotomized into less vs. more severe) were associated with clinical outcomes, including in-hospital mortality, complications, length of stay (LOS), and adjusted hospital costs. We hypothesized that ICD codes could distinguish EGS condition severity, as determined by association with worse outcomes. Analyses were adjusted for age, sex, Charlson comorbidity index, US Census division, and year.

Results: The weighted sample of EGS patients included 11,644,457 adults from 2012 to 2017. ICD-9-CM and ICD-10-CM mapping were similar in how many distinct clinical strata could be assigned. The number of strata per condition for ICD-9-CM was 2 (6 conditions), 3 (6 conditions), and 4 strata (4 conditions). ICD-10-CM mapped to 2 (8 conditions) 3 (6 conditions), and 4 strata (2 conditions). Higher severity strata (vs. the lowest) were associated with higher risk-adjusted odds of mortality in all conditions except breast abscess (no deaths) and PID. Higher strata were associated with complications in all conditions except PID. LOS and costs were significantly greater in higher strata for all conditions. Across each of the 16 conditions, there was a significant association between higher dichotomized severity and each of the four outcomes (mortality shown in Figure).

Conclusion: The AAST EGS anatomic disease severity grades approximated from ICD-9/-10-CM diagnosis codes demonstrate good construct validity and offer a viable alternative to determining EGS grades by medical record review. Future work is needed to validate against prospectively collected clinical data. EGS grades approximated from claims data may be useful in EGS benchmarking and quality improvement efforts.



Session IV: Plenary Papers 19-22
Paper 22: 10:00 AM - 10:20 AM

READMISSION FOR VENOUS THROMBOEMBOLISM AFTER EMERGENCY GENERAL SURGERY IS UNDERREPORTED AND INFLUENCED BY INSURANCE STATUS

Rishi Rattan MD, Alessia Cioci MD, Eva Urrechaga MD, Matthew Chatoor MD, Joseph Krocker MD, Deanna Johnson, Gary Curcio MD, Nicholas Namias MD, MBA, Daniel D. Yeh MD, Enrique Ginzburg MD, Joshua Parreco MD
University of Miami

Invited Discussant: Myung Park, MD

Introduction: Prior studies of venous thromboembolism (VTE) after emergency general surgery (EGS) have been limited to single institutions or are not nationally representative. However, up to 1 in 3 postoperative readmissions occur at another hospital and are not captured by current metrics. We hypothesized that different-hospital readmission accounted for a significant number of readmissions with VTE after EGS and that predictive factors would be different for same- and different-hospital readmissions.

Methods: The 2010-2014 Nationwide Readmissions Database (NRD) was queried for all non-elective, short-stay (< 4 days) EGS hospitalizations. EGS was determined using the American Association for the Surgery of Trauma Committee on Severity Assessment and Patient Outcomes definition, comprised of diagnosis and procedures codes from the 9th edition of the International Classification of Diseases. The primary outcome was readmission within 180 days with VTE. The secondary outcome was readmission to a different hospital within 180 days with VTE. Univariate analysis of the NRD's 47 demographic, clinical, and hospital variables with exploratory $p < 0.1$ identified variables to include in multivariate logistic regressions. These analyses identified risk factors, reported as odds ratios with their 95%confidence intervals, for readmission to index and different hospitals with VTE, with significance set at $p < 0.05$. Patients were excluded if during the index admission they: expired, developed a VTE, had a vena cava filter placed, or did not have at least 180 days of follow up. Results were weighted for national averages according to Healthcare Utilization Project guidelines.

Results: Of 1,160,694 patients meeting inclusion criteria, 5,404 (0.5%) patients were readmitted within 180 days with a VTE. Of these, 1,568 (29%) were readmitted to a different hospital. The strongest predictors overall for readmission with VTE were tracheopulmonary surgery and metastatic cancer. However, the strongest predictors for readmission to a *different* hospital were small index hospital and Medicaid as the payor (Table).

Risk factors for readmission within 180 days with VTE, OR (95% CI)

Age ≥ 65 years	CCI ≥ 2	Obesity	Metastatic cancer	Medicare	Type of surgery	
					Soft tissue	Tracheo-pulmonary
2.09 (1.87-2.34)	2.03 (1.88-2.20)	1.39 (1.29-1.50)	2.58 (2.31-2.87)	1.26 (1.15-1.37)	1.96 (1.72-2.23)	3.50 (3.08-3.96)

Risk factors for different hospital readmission within 180 days with VTE, OR (95% CI)

Diabetes	Medicare	Medicaid	For-profit hospital	Hospital size		Non-appendix GI surgery
				Small	Medium	
1.22 (1.04-1.43)	1.25 (1.07-1.45)	1.48 (1.19-1.84)	1.25 (1.06-1.48)	1.64 (1.36-1.98)	1.24 (1.06-1.44)	1.37 (1.07-1.77)

VTE, venous thromboembolism. CCI, Charlson Comorbidity Index. GI, gastrointestinal.

Conclusions: 1 in 3 readmissions with VTE after EGS occur at a different hospital and may be missed by current quality metrics that only capture same-hospital readmission. Such metrics may underestimate for-profit hospital postoperative VTE rates relative to public and non-profit hospitals, potentially affecting benchmarking and reimbursement. Fragmentation of care appears to be affected by insurance status in addition to clinical factors. These findings have implications for policy and prevention programming design. Further study is needed to better understand this significant and unique patient population.

Session V: Papers 23-29

Thursday, September 10, 2020
10:35 AM - 12:55 PM
Moderator:
Clay Cothren Burlew, MD

Session V: Plenary Papers 23-29
Paper 23: 10:35 AM - 10:55 AM

UNIVERSAL SCREENING FOR BLUNT CEREBROVASCULAR INJURY

Jonathan A. Black MD, Russell Griffin PhD, Peter Abraham MD, Elizabeth Le MD, Bart Thaci MD, Mark Harrigan MD, Jeffrey D. Kerby MD, PhD, Jan O. Jansen MBBS
University of Alabama at Birmingham

Invited Discussant: Walter Biffl, MD

Introduction: Blunt cerebrovascular injury (BCVI) can cause thromboembolic stroke. Most trauma centers selectively screen patients with neck computed tomographic angiography (CTA) based on clinical criteria. The incidence of BCVI among blunt trauma admissions using selective screening protocols has been reported to be approximately 2-3%. However, approximately 20% of patients with BCVI lack specific screening criteria and are usually diagnosed only after developing neurological symptoms; as a result, the 20% is likely an underestimate of the true number of undiagnosed BCVIs. In 2016, our institution adopted universal BCVI screening in blunt trauma patients using a 64-slice neck CTA protocol that involved no additional IV contrast and only minimal additional radiation exposure. The aim of this study was to accurately determine the incidence of BCVI and evaluate the diagnostic performance of the Denver (DC), expanded Denver (eDC), and modified Memphis (mMC) criteria in selecting patients for screening.

Methods: Retrospective review of all neck CTAs obtained in blunt trauma patients over a two year period, from August 2017 to August 2019. Each neck CTA was individually reviewed to evaluate for the presence of BCVI. Patient records were also evaluated for objective injury criteria that would have triggered screening for BCVI based on the DC, eDC, and mMC.

Results: A total of 6800 patients who had suffered blunt trauma were evaluated, of whom 5634 (82.8%) had a neck CTA. The majority of patients who were not screened for BCVI had no head or neck injury (69%), were transfers from another facility (21%), or were not admitted to a trauma unit from the emergency department (5%). A total of 471 patients (8.4%) had CTA evidence of BCVI on admission. Table 1 shows the diagnostic performance of commonly used selective screening criteria compared to universal screening. The eDC identified the most BCVI cases (sensitivity=75%) but had the lowest accuracy (PPV=15.2%). The DC and mMC were slightly more accurate (PPV~20%) and had the highest diagnostic ability (LR+ 2.8 and 3.0, respectively), but had low sensitivity (57.7% and 47.6%, respectively). Consequently, if relying on traditional screening criteria, the DC, eDC, and mMC would have respectively resulted in 42.2%, 24.8%, and 52.4% of patients with BCVI identified by universal screening not receiving a neck CTA to screen for BCVI.

Conclusions: The true incidence of BCVI is greater than previously recognized. Commonly used screening criteria fail to detect a considerable number of BCVI cases. Consideration should be given to universal screening for BCVI using neck CTA in blunt trauma.

Table 1. Screening diagnostic measures of three commonly used criteria for blunt cerebrovascular injury

Diagnostic	Denver	Expanded Denver	Modified Memphis
% Total patients screening positive	23.9%	41.4%	18.7%
False negative rate	42.2%	24.8%	52.4%
False positive rate	20.9%	38.3%	16.1%
Sensitivity	57.7%	75.2%	47.6%
Specificity	79.1%	61.7%	83.9%
Positive Predictive Value	20.2%	15.2%	21.2%
Negative Predictive Value	95.4%	96.5%	94.6%
Likelihood Ratio Positive	2.8	2.0	3.0

Session V: Plenary Papers 23-29
Paper 24: 10:55 AM - 11:15 AM

THE IMPACT OF DELAYED HIP FRACTURE MANAGEMENT ON HEALTH OUTCOMES FOR AFRICAN AMERICAN OLDER ADULTS

Molly Jarman PhD, MPH, Claire Sokas MD, Michael K. Dalton MD, MPH, Tarsicio Uribe-Leitz MD, MPH, Manuel Castillo-Angeles MD, MPH, Marilyn Heng MD, Arvind von Keudell MD, Zara Cooper MD, MSc, Ali Salim MD
Brigham and Women's Hospital

Invited Discussant: Anne Mosenthal, MD

Introduction: Delays in surgical management of hip fractures are associated with worsened health outcomes for older adults. There is evidence that systematic delays in emergency medical care disadvantage African American patients seeking treatment for acute medical conditions (e.g. myocardial infarction), but similar patterns have not been examined in geriatric injury care. Our objectives were to 1) determine if delays in hip fracture management are more common for African American patients than White patients and 2) determine if delays in hip fracture management contribute to racial differences in health outcomes following hip fracture.

Methods: We identified adults age ≥65 with race categorized as White/Non-Hispanic or African American/Non-Hispanic and diagnoses consistent with isolated hip fracture in the 2007-2016 Trauma Quality Program Public Use File. We categorized hip fracture management as non-surgical, timely surgery (< 24 hours from arrival), and delayed surgery (> 24 hours from arrival), and used multivariable logistic regression models to estimate the associations between African American race, timeliness of surgical intervention, hospital length of stay, and health outcomes associated with prolonged immobility (catheter-associated urinary tract infection and decubitus ulcer), adjusting for age and sex. We then used binary mediation models to determine the proportion of excess complications for African American patients attributable to delayed hip fracture management.

Results: Of 126,314 eligible patients, 5% were African American, 67% were female, the median age was 80 (SD = 7), and average length of stay was 6.2 days (SD = 4.6). Compared to otherwise similar White patients, African Americans were 15% less likely to undergo surgical hip fracture repair (OR = 0.85, $p < 0.001$), 45% more likely to experience delayed surgery (OR = 1.45, $p < 0.001$), and experienced wait time to surgery that was 6.4 hours longer on average ($p < 0.001$). African Americans were more likely to experience catheter-associated urinary tract infection (OR = 1.27, $p < 0.001$) and decubitus ulcer (OR = 1.59, $p < 0.001$), and had an average length of stay that was 1.05 days longer ($p < 0.001$). In mediation models, 7.7% of excess urinary tract infections and 10.3% of excess decubitus ulcers experienced by African American patients were attributed to variation in timing of surgical hip fracture repair.

Conclusion: Delays in surgical hip fracture repair disproportionately impact African American older adults, contributing to increased risk of complications and longer hospital length of stay. Efforts to prepare the US trauma care system for the aging population must ensure equitable access to high quality trauma care and orthopaedic surgery for all communities.

Session V: Plenary Papers 23-29
Paper 25: 11:15 AM - 11:35 AM

A NATIONWIDE PROSPECTIVE MULTICENTER STUDY ON DEFINITIVE SURGERY FOR ISOLATED HIP FRACTURE WITHIN 24 HOURS

Darwin Ang, Mark G. McKenney MD, Patrick J. Offner MD, MPH, Stephen F. Flaherty MD, Matthew M. Carrick MD, David S. Plurad MD, Ernest A. Gonzalez MD, John H. Armstrong MD, Jeffrey Anglen MD, Roger Nagy MD, MIchele Ziglar, Huazhi Liu MSc, Greg McCormack BS, Julie Nash, Mary Danish BS
Ocala Regional Medical Center

Invited Discussant: Alicia Mangram, MD

Introduction: Isolated hip fractures (IHFs) are high frequency/high morbidity injuries. Definitive surgery < 24 hours from admission has been associated with improved mortality. An IHF practice management guideline (IHF-PMG) was developed for a large multi-hospital network to help achieve a goal of ≥ 70% definitive surgery < 24 hours. We report on its feasibility and results.

Methods: This is a prospective multicenter cohort study; involving 85 U.S. Trauma Centers. From 2017 to 2019, patients ≥ 65 years with IHF were included. Four cohorts were examined; 1) hospitals that used the network's IHF-PMG, 2) hospitals that used their own PMG, 3) hospitals that partially used the network IHF-PMG, and 4) hospitals that did not implement any PMG. The primary outcome was inpatient mortality. Multivariable regression with reliability adjustment was used to calculate the expected value for the mortality observed to expected ratio (O/E).

Results: Data on 29,920 IHFs were prospectively collected. After implementation of the IHF-PMG, IHF mortality decreased within the hospital network from 2017, 2018, and 2019 (2.6% vs. 1.6% vs. 1.5%, p - value = 0.04). This was observed even after risk adjustment, mortality (O / E) 1.08, 0.84, and 0.81, respectively. Hospitals that developed their own IHF-PMG or used the system's IHF-PMG had the lowest mortality at 1.2% and 1.4% vs. 1.7% and 2.0%, p-value = 0.02). Complication rates and hospital LOS were also lowest for both groups.

Conclusion: The goal directed IHF-PMG for definitive surgery within 24 hours was possible to implement across a large nationwide hospital network. The IHF-PMG was associated with lower inpatient mortality and hospital LOS.

Session V: Plenary Papers 23-29
Paper 26: 11:35 AM - 11:55 AM

A MULTICENTER TRIAL OF THE EVOLVING DIAGNOSIS AND MANAGEMENT OF HIGH-GRADE PANCREATIC INJURIES

Walter L. Biffl MD, Bryan C. Morse MD, Michelle K. McNutt MD, Jason S. Lees MD, Rishi Rattan MD, Miklosh Bala MD, Chance Spalding PhD, DO, S. Rob Todd MD, Rachael A. Callcut MD, Paul J. Chestovich MD, James W. Davis MD, Linda Dultz MD, Gregory J. Jurkovich MD, Michaela A. West MD, PhD, Ernest E. Moore MD
Scripps Memorial Hospital- La Jolla

Invited Discussant: Babak Sarani, MD

Introduction: Outcomes following pancreatic trauma have not improved significantly over the past two decades, in large part due to their infrequency and a dearth of data guiding management. In 2013 the Western Trauma Association published an algorithm for pancreatic trauma, highlighting emerging data that might change the approach to the diagnosis and management of high-grade pancreatic injuries (Grade III-V; HGPI). We hypothesized that the use of magnetic resonance cholangiopancreatography (MRCP), pancreatic duct stenting, operative drainage vs resection, and nonoperative management of HGPI have increased since the publication of the algorithm.

Methods: Multicenter retrospective review of diagnosis, management, and outcomes of adult pancreatic injuries from 2010-2018. Data were analyzed by grade and time period relative to algorithm publication (PRE, 2010-2013; POST, 2014-2018) using Chi-Square, Fisher's Exact, and Z-tests where appropriate.

Results: 32 centers reported complete data on 1081 patients. Of the 454 (42%) with HGPI, 233 (51%) had penetrating trauma and 61% went directly to the operating room (OR) without imaging. 67 (15%) died within 24 hrs (7% PRE vs 7% POST). Management and outcomes of 24-hr survivors are summarized in the Table. Proportions of resection: drainage changed among grade IV and V injuries ($p<.05$). Among patients who had the diagnosis of grade IV/V injury made by CT, there was an increasing trend to manage nonoperatively (10% PRE vs 21% POST, $p=.22$). Among all HGPI patients, MRCP (9% to 13%, $p=.20$) and ERCP (11% to 17%, $p=.12$) trended upward. Pancreatic duct stenting increased from 7% to 15% ($p=.016$) and indications for stents changed from primary/prophylactic (54% PRE) to managing complications (71% POST). CT scanning was diagnostic of main duct integrity in only 26%. Moreover, 41% of grade II injuries had complications, suggesting possible under-grading by imaging. Overall pancreas-related complications trended upward (30% PRE to 41% POST, $p=.07$).

	III PRE	III POST	IV PRE	IV POST	V PRE	V POST
24 hour survivors	113	185	15	42	11	21
Operative Resection	86 (76%)	149 (81%)	9 (60%)	20 (48%)	8 (73%)	12 (57%)
Operative Drainage	11 (10%)	24 (13%)	3 (20%)	15 (36%)	3 (27%)	7 (33%)
Operative Other/Neither	5 (4%)	4 (2%)	1 (7%)	2 (5%)	0	1 (5%)
Nonoperative	11 (10%)	8 (4%)	2 (13%)	5 (12%)	0	1 (5%)
MRCP	11 (10%)	21 (11%)	0	5 (12%)	1 (9%)	6 (29%)
ERCP	14 (12%)	25 (14%)	1 (7%)	11 (26%)	0	5 (24%)
Stent	9 (8%)	22 (12%)	1 (7%)	10 (24%)	0	4 (19%)
Mortality after 24 hr	9 (8%)	13 (7%)	1 (7%)	2 (5%)	1 (9%)	1 (5%)
Pancreatic Complication	36 (32%)	70 (38%)	6 (40%)	20 (48%)	4 (36%)	11 (52%)

Conclusion: The number of patients with HGPI at most trauma centers is low. Nearly half result from penetrating trauma and most are diagnosed and managed in the operating room. Resectional management of grade III injuries is the norm, but drainage of grade IV/V injuries is increasingly favored over resection. There are trends toward increasing use of MRCP, ERCP and nonoperative management in recent years but the numbers are small and there is no statistical difference. Early mortality is decreasing but complications remain problematic. Prospective studies should focus on accurate assessment of ductal integrity as well as prevention and treatment of pancreatic abscess and fistula.

Session V: Plenary Papers 23-29
Paper 27: 11:55 AM - 12:15 AM

HARD SIGNS GONE SOFT

Anna Romagnoli MD, Joseph J. DuBose MD, Anahita Dua MD, Richard Betzold, Tiffany K. Bee MD, Timothy C. Fabian MD, Jonathan Morrison MD, PhD, David V. Feliciano MD, David J. Skarupa MD, Jeanette Podbielski, Richard Catalano MD, Xian Luo-Owen PhD, Kenji Inaba MD, David S. Kauvar MD, MPH
Massachusetts General Hospital

Invited Discussant: Enrique Ginzburg, MD

Introduction: Clinical "hard signs" (HS) of vascular injury were described over 30 years ago and continue to be espoused as foundational tools in determining the need to proceed immediately to operation. We hypothesize that, in contemporary practice, HS no longer obviate the utilization of additional imaging prior to intervention.

Methods: The American Association for the Surgery of Trauma (AAST) PROspective Observational Vascular Injury Treatment (PROOVIT) registry was utilized to correlate the presence of HS in extremity vascular injury with subsequent diagnosis and management.

Results: Of 1910 cases, 1108 (58%) had one or more HS of vascular injury--82.6% of whom presented with active hemorrhage or expanding hematoma, 15.3% with only ischemia. Computed tomographic angiography (CTA) was performed in (26.6%) of cases (24% of hemorrhagic HS patients, 40% ischemic HS patients). Diagnosis of vascular injury was made by operative exploration without additional imaging in 65% of cases--70% of hemorrhagic HS patients, 45.3% ischemic HS patients, ($p<0.0001$).

In cases of exploration without imaging, open repair (OR) was performed in 68% of cases while endovascular or hybrid repair (EHR) was utilized in 1.4%. In all-comers with HS who underwent CTA, OR was performed in 63.9% of cases while EHR was utilized in 9.8% of cases ($p<0.0001$).

Hemorrhagic HS patients who underwent operative exploration without additional imaging had a 68.3% rate of OR and a 1.6% rate of EHR, compared with hemorrhagic HS patients who underwent CTA, who had a 61.8% rate of OR and a 10.5% EHR, $p<0.0001$. Ischemic HS patients who underwent operative exploration without additional imaging had a 76.6% rate of OR, and 0 reported EHR, compared with ischemic HS patients who underwent CTA had a 72.01% rate of OR and 5.9% rate of EHR ($p=0.0471$).

There was no difference in units of pRBCs transfused, in-hospital mortality, amputation or reintervention rate between the OR and EHR groups.

Conclusion: Classic teaching is that hard signs of vascular injury warrant open surgery with no further imaging. The inclusion of CTA in the workup of patients with HS of vascular injury resulted in a significant increase in endovascular or hybrid repair in patients with both hemorrhagic and ischemic hard signs, with no difference in outcomes. In contrast to traditional practices, patients with hard signs of vascular injury who are stable may benefit from the acquisition of additional information afforded by CTA which may facilitate alternate management strategies; further prospective study is required

Session V: Plenary Papers 23-29
Paper 28: 12:15 AM - 12:35 AM

PROSPECTIVE STUDY OF SHORT-TERM QUALITY OF LIFE AFTER TRAUMATIC RIB FRACTURES

Jeff Choi MD, Suleman Khan, Nicholas Hakes, Garrison Carlos MD, Joshua Jaramillo MD, Ryan Seltzer BS, David A. Spain MD
Stanford University

Invited Discussant: Suresh Agarwal, Jr., MD

Introduction: Comprehensive post-discharge quality of life (QoL) of patients who suffer traumatic rib fractures in the current era of multi-modality pain management remains unclear. We hypothesized that even isolated rib fractures confer considerable QoL burden, and that opportunities for intervention post-discharge may exist.

Methods: We prospectively enrolled adult patients at our Level I trauma center with rib fractures starting July 1, 2019. We excluded patients with baseline dementia or Glasgow Coma Scale < 15 at discharge. QoL was assessed at 1 and 3-months after discharge using the Trauma Quality-of-Life questionnaire (T-QoL; a comprehensive and sensitive QoL assessment tool for trauma patients) and 6 additional questions. Paired t-test compared differences in 1 vs 3-month responses. We performed a subgroup analysis on patients with isolated rib fractures.

Results: 120 patients (mean age 66.2 years, 38.5% female) have been enrolled to date, with 78.3% (94/120) and 74.7% (59/79) follow-up at 1 and 3 months, respectively. At 3 months after discharge, 31.0% of patients who were working prior to injury were not back at work, and 8.5% were still dependent on narcotic pain medications. Despite mild improvements compared to 1-month post-discharge, QoL remained suboptimal at 3 months post-discharge. Patients especially reported poor overall recovery (T-QoL mean±SD: 2.87±0.66) and physical well-being (T-QoL mean±SD: 2.91±0.79). The subgroup with isolated rib fractures reported similarly suboptimal QoL in the domains of recovery (T-QoL mean±SD: 3.06±0.61) and physical well-being (T-QoL mean±SD: 3.23±0.63) at 3 months post-discharge.

Conclusion: Traumatic rib fractures are associated with suboptimal QoL at 1 and 3 months after injury, placing patients at risk for post-traumatic stress disorder. Even after isolated rib fractures, patients reported poor physical well being and poor overall recovery. Longer-term follow-up and delayed interventions such as improved pain management or operative fixation may be warranted to improve QoL.

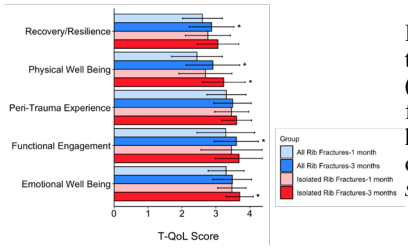


Figure: Trauma Quality of Life (T-QOL) scores for the five QoL domains for patients with rib fractures (all patients and subgroup with isolated rib fractures) at 1 and 3 months after discharge. A higher T-QOL score is associated with a lower risk of post-traumatic stress disorder. **1 vs 3-month scores statistically significant differences at α=0.05*

Session V: Plenary Papers 23-29
Paper 29: 12:35 AM - 12:55 AM

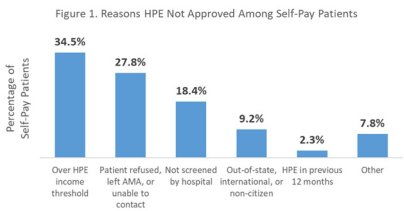
ACQUISITION OF MEDICAID AT THE TIME OF INJURY: AN OPPORTUNITY FOR SECURING INSURANCE COVERAGE

Joshua Jaramillo MD, Katherine Arnow BS, Amber W. Trickey PhD, MSc, Diem Tran PhD, Todd Wagner PhD, Sylvia Bereknyei PhD, Alex HS Harris PhD, MSc, Arden M. Morris MD, MPH, David A. Spain MD, Lisa M. Knowlton MD, MPH
Stanford University Medical Center

Invited Discussant: Kevin Schuster, MD, MPH

Introduction: Uninsured trauma patients have a higher risk of mortality, inadequate post-discharge resources and catastrophic health expenditure than insured counterparts. Hospital Presumptive Eligibility (HPE), enacted with the 2014 Affordable Care Act, enables hospitals to screen uninsured patients upon hospitalization and initiate Medicaid enrollment. Payer status is recorded at discharge in trauma registries, therefore HPE-approved patients are classified as Medicaid. We aimed to accurately characterize admission insurance status and identify factors associated with acquisition of HPE.

Methods: We identified Medicaid and self-pay patients aged 18-64 with a primary trauma diagnosis (ICD-10) in a large level I trauma center from 2015-2018. We combined trauma registry clinical data with review of electronic medical record case management and social worker notes, to determine our primary outcome of HPE acquisition. Univariate and multivariate analyses were performed.



Results: Among 1,410 patients, 864 (61.3%) had Medicaid and 546 (38.7%) were uninsured at hospitalization. Compared to those with Medicaid on arrival, the uninsured were younger (34 vs. 38 years, $p < .001$), more often male (80.4% vs. 64.9%, $p < .001$) and Hispanic (55.5% vs. 43.5%, $p < .001$). Among those uninsured at arrival, 242 (44.3%) received HPE approval before discharge, and 304 (55.7%) remained self-pay. Demographics were similar between HPE patients and remaining uninsured; however, HPE patients had higher injury severity score (ISS > 15: 14.9% vs. 5.6%, $p < .001$), longer median length of stay (LOS) (1 [IQR: 0,5] vs. 0 [0,1] days, $p < .001$), were more frequently admitted as inpatients (61.5% vs. 34.5%, $p < .001$) and discharged to post-acute services (13.2% vs. 0.7%, $p < .001$). Patient, hospital and policy factors contributed to HPE non-approval (Figure 1). In adjusted analyses, discharge to post-acute services (vs. home: aOR 11.5, $p < .001$) and increasing hospital LOS ($p \leq .003$) were associated with increased likelihood of HPE.

Conclusion: Time-of-injury hospitalization is an underutilized opportunity for intervention, whereby uninsured patients can obtain coverage and improve healthcare access. We identified individual, hospital and policy-level opportunities to increase HPE acquisition, which merit further study nationally across trauma centers. As administrative and trauma registry data do not distinguish between HPE and traditional Medicaid patients, prospective insurance data collection could identify targets for intervention.

Session VI: Papers 30-37

Friday, September 11, 2020
9:00 AM - 11:40 AM
Moderator:
David Livingston, MD

Session VI: Plenary Papers 30-37
Paper 30: 9:00 AM - 9:20 AM

TIME IS OF THE ESSENCE: THE RELATIONSHIP BETWEEN TIMING OF AMPUTATION AND COMPLICATIONS AMONG PATIENTS WITH A MANGLED LOWER EXTREMITY

Bourke Tillmann MD, Matthew Guttman MD, Avery B. Nathens MD, PhD, MPH, Charles de Mestral MD, PhD, Ahmed Kayssi MD, MSc, MPH, Barbara Haas MD, PhD
Sunnybrook Health Sciences Centre

Invited Discussant: Kenji Inaba, MD

Introduction: Although extremities are the most commonly injured body region, management of the severely injured, or "mangled", lower limb poses a substantial challenge. While new surgical techniques have led to an increased ability to perform limb salvage, multiple studies suggest limb salvage does not improve functional outcomes or quality of life as compared to amputation. Moreover, efforts to salvage a mangled extremity may, in some patients, simply delay an eventual amputation. This delay potentially contributes to increased complications and mortality. However, the relationship between the timing of amputation and outcomes is unknown. The objective of this study was to evaluate the relationship between amputation timing and mortality among patients with a mangled lower extremity.

Methods: We performed a retrospective cohort study using data derived from the American College of Surgeons Trauma Quality Improvement Program (2012–2017). We included adult patients who sustained a mangled lower extremity and were treated at a Level I trauma center. A patient was identified as having a mangled extremity if they sustained either 1) a severe crush injury (Abbreviated Injury Scale score ≥ 3) or 2) a severe fracture with associated injuries of two or more of soft tissues, arteries, or nerves. Early amputations were defined as those that occurred within 24 hours of presentation. We compared mortality between patients who underwent early amputation and those treated with the intention of limb salvage. Secondary outcomes included hospital length of stay (LOS), severe sepsis, acute kidney injury, and decubitus ulcers. Given that the decision between timing of amputation and outcomes is likely confounded by patient and injury characteristics, instrumental variable analysis was used to adjust for this confounding.

Results: We identified 4,987 patients with a mangled lower extremity across 209 centers, of which 848 (17.0%) underwent an early amputation. In unadjusted analyses, mortality rates were significantly higher among patients who underwent an early amputation as compared to those treated with the intention of limb salvage (10.6% vs 5.2%; RR 2.10, 95% CI 1.65 – 2.67). After controlling for confounding, there was no association between early amputation and mortality (OR 1.39; 95% CI 0.66 – 2.93). However, early amputation was associated with shorter LOS (RR 0.73; 95% CI 0.51 – 0.95), and lower odds of severe sepsis (OR 0.42; 95% CI 0.20 – 0.88) and developing a decubitus ulcer (OR 0.50; 95% CI 0.27 – 0.96).

Conclusion: Among patients who sustained a mangled lower extremity, early amputations were associated with shorter hospital LOS and fewer complications with no difference in mortality. Given the elevated risk of short-term complications and lack of evidence of improved long-term functional and psychological outcomes, attempts at limb salvage should focus on those with highest probability of good functional outcomes, with careful consideration of elevated short-term risks.

Session VI: Plenary Papers 30-37
Paper 31: 9:20 AM - 9:40 AM

EXTRATHORACIC POLYTRAUMA DYSREGULATES NEUTROPHIL FUNCTION AND EXACERBATES PNEUMONIA-INDUCED LUNG INJURY

Christina X. Zhang MD, Anja Fuchs PhD, Sarbani Ghosh MSc, Shin-Wen Chang BS, Liang Lu MD, PhD, Celeste Cummings, Regina Clemens MD, PhD, Mark Hoofnagle MD, PhD, Grant V. Bochicchio MD, MPH, Isaiah Turnbull MD, PhD, Jennifer Leonard MD, PhD
SUNY Downstate

Invited Discussant: Addison May, MD, MBA

Introduction: 40% of trauma patients admitted to the ICU will develop an infectious complication, and pneumonia is the most common cause of death of trauma patients surviving the initial insult. We previously demonstrated that extrathoracic polytrauma (EP) induces emergency hematopoiesis, characterized by accelerated myelopoiesis in the bone marrow (BM) and increased myeloid cell frequency in the peripheral tissues. We hypothesized that EP causes polymorphonuclear neutrophil (PMN) priming which would exacerbate the immunopathology induced by pneumonia in injured animals.

Methods: C57BL/6 mice were subjected to polytrauma consisting of a lower extremity pseudofracture, liver crush injury, and 15% blood-volume hemorrhage. Pneumonia was induced by intratracheal injection of $5x10^6$ CFU *P. aeruginosa* (PA) or secondary acute lung injury was induced by injection of $1x10^7$ of heat-killed PA (HKPA). To measure lung permeability, 20ul of 10mg/kg FITC-conjugated dextran (FD) was injected intratracheally 24hr after trauma, and FD was measured in the plasma 1hr after injection. PMNs were isolated by immunomagnetic bead-mediated negative selection with biotin-labeled antibody cocktail, and ROS production was measured by Luminol fluorescence. Survival was compared by Log-Rank test; bivariate comparisons were by Mann-Whitney U-Test.

Results: Pneumonia after EP resulted in significantly lower survival than those in sham-manipulated mice (95% vs. 40%, $p < 0.05$). EP also caused increased lung permeability when compared to naïve mice (1091 vs. 236 ng/ml FD in the plasma, p=0.02). Neutrophils in BM and blood from EP mice had significantly higher resting (unstimulated) ROS production than those isolated from naïve animals demonstrating priming of the neutrophils following EP (Figure 1A). After intra-tracheal HKPA injection to both naïve and EP mice, BAL PMNs from trauma mice had significantly higher resting ROS production (Figure 1B).

Conclusions: EP primes neutrophils and causes immunopathologic PMN ROS production, breakdown of the lung epithelial barrier, increased pulmonary epithelial damage and susceptibility to secondary bacterial pneumonia. These results suggest that trauma induced immune dysfunction can exacerbate the immunopathology caused by infection and propose neutrophil mediated pulmonary damage as a therapeutic target for post-trauma pneumonia.

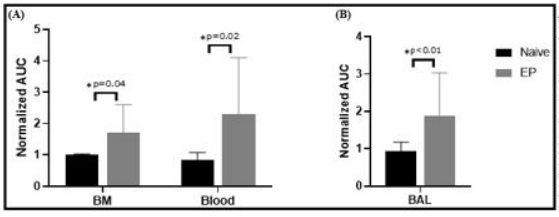


Figure 1. ROS production by neutrophils from BM, blood, and BAL. AUC were calculated after measuring ROS production over 60 minutes of neutrophils from mice with EP alone (A), or with EP and HKPA injection (B). AUC value were normalized to those from naïve mice. BAL = Bronchoalveolar Lavage; BM = Bone Marrow; EP = Extrathoracic Polytrauma; AUC = Area under the Curve; HKPA = Heat-killed *P. aeruginosa.*

Session VI: Plenary Papers 30-37
Paper 32: 9:40 AM - 10:00 AM

TRAUMA PATIENT VS. CAREGIVER SATISFACTION WITH DELIVERY OF PALLIATIVE CARE: WHO FACES THE BURDEN?

Rebecca Vogel MD, Constance McGraw MPH, Pamela Bourg, Diane Redmond, Jennifer Pekarek, Chester Dreiman MD, Allen Tanner, Neal Lynch, David Bar-Or MD
Swedish Medical Center

Invited Discussant: Leah Tatebe, MD

Background: Although the reciprocal nature of the patient-caregiver relationship is evident in palliative care (PC), very few studies actually report on the transactional influence of the patient to the caregiver. Particularly for older patients following traumatic injury, families often become surrogate decision makers and have to facilitate challenging conversations about end-of-life care. The purpose of this study was to compare trauma patient satisfaction to caregiver satisfaction during delivery of PC.

Methods: This was a prospective cross-sectional study over two years (11/2016-11/2018) and included trauma patients $\geq$ 55 years and their primary caregivers. Two ACS-verified Level I trauma centers in Colorado contributed data. Consented patients and their primary caregivers were administered satisfaction surveys prior to discharge; patients took the Family Satisfaction with Advanced Cancer Care Scale (FAMCARE-P-13) survey, while caregivers took the FAMCARE survey; higher scores indicate higher satisfaction. Both surveys can be analyzed by four domains: Information Giving, Availability of Care, Physical Care, and Psychosocial Care. Usual care at both facilities closely followed the ACS-TQIP Palliative Care Guidelines. The primary outcome was overall mean patient and caregiver satisfaction by survey domain. Comparisons between patient and caregiver satisfaction were analyzed using paired samples t-tests. Satisfaction was also examined with paired t-tests across four PC assessments: consultation, prognostication screenings, formal family meetings, and advanced goals of care discussion.

Results: There were 451 patient and caregiver pairs enrolled. There were no significant differences between patient and caregiver satisfaction across the four survey domains: information giving, availability of care, physical care, and psychosocial care. There were significant differences when satisfaction between patients and caregivers was examined by PC assessment component, Table1. Caregivers had lower satisfaction compared to patients with physical care and psychosocial care when there was a consultation, lower satisfaction with information giving, physical care, and psychosocial care when they had a prognostication screening, and lower satisfaction in every domain when they had a formal family meeting. Conversely, caregivers had significantly higher satisfaction with availability of care when there was an advanced goals of care discussion, compared to patients.

Conclusions: Caregivers often reported significantly lower satisfaction with PC than patients; this was particularly true for caregiver satisfaction with both prognostication screenings and formal family meetings. Our data suggest that caregivers may be receiving some of the patient burden; thus, there is room for improvement in delivery of prognostic information to family members during family meetings and throughout hospitalization.

Table 1. Mean (SD) Satisfaction Between Matched Patients and Caregivers, by Palliative Care Assessment

Survey domain	Consultation	Prognostication	FFM	AGOC
Information Giving	86.3% (14.1) vs. 83.3% (14.4)	83.9% (15.5) vs. 79.7% (16.7)*	86.1% (13.8) vs. 81.6% (14.2)**	82.4% (14.4) vs. 84.0% (13.8)
Availability of Care	88.0% (13.4) vs. 85.6% (14.3)	85.7% (15.5) vs. 83.0% (16.5)	87.8% (13.4) vs. 84.9% (14.0)*	84.4% (14.0) vs. 86.8% (14.1)*
Physical Care	86.7% (13.5) vs. 83.3% (14.1)*	85.3% (15.4) vs. 81.3% (15.3)*	86.7% (13.5) vs. 82.3% (13.3)**	82.8% (14.0) vs. 84.2% (13.5)
Psychosocial Care	89.5% (14.0) vs. 85.7% (14.5)*	89.5% (14.0) vs. 85.7% (14.5)**	89.6% (14.7) vs. 85.3% (14.2)**	85.9% (14.9) vs. 87.0% (14.1)

FFM, formal family meeting; AGOC, advanced goals of care discussion; SD, standard deviation. *indicates significance 0.01-0.04; **indicates significance <0.01. Reported as patient vs. caregiver satisfaction.

Session VI: Plenary Papers 30-37
Paper 33: 10:00 AM - 10:20 AM

ARE LEGALLY PURCHASED GUNS TO BLAME FOR OVERALL FIREARM MORTALITY? A STATE-LEVEL ANALYSIS OF THE ASSOCIATION BETWEEN FIREARM RETAIL AVAILABILITY AND FIREARM MORTALITY

August C. Houghton BS, Sharven Taghavi MD, Eman Toraih MD, Caroline Granruth BS, McGrew Patrick MD, Chrissy Guidry MSc, DO, Rebecca Schroll MD, Maureen Lichtveld MD, MPH, Juan C. Duchesne M.D.
Tulane University School of Medicine

Invited Discussant: Nina Glass, MD

Introduction: In efforts to decrease overall gun-violence mortality, firearm legislation frequently seeks to exert influence on the retail segment. However, the relationship between the retail availability of firearms and firearm mortality has not been clearly demonstrated. We hypothesized that increased firearm retail availability would correlate with higher rates of both firearm homicide and firearm suicide mortality.

Methods: This cross-sectional analysis utilized Federal Firearms and Explosives License (FFL) data obtained from the Bureau of Alcohol, Tobacco, Firearms and Explosives (ATF). Licensed firearm retail locations (LFRs) were defined as FFL Types 01, 02, and 07 with listed business names and addresses. For each state, the number of LFRs was normalized per 100,000 residents. State-level firearm homicide and suicide rates from 2015-2017 were obtained from the Centers for Disease Control. Additionally, several categories of state-level demographic data were gathered for further analysis. Spearman's Rho was performed. Individual linear regression models were then constructed for firearm homicide and firearm suicide mortality.

Results: In total, 50,339 U.S. LFRs were identified (Fig. 1). On the state-level, multiple significant correlations were identified between variables. The strongest correlation observed was between the number of LFRs and suicide rate (0.79, $p < 0.001$) (Fig. 2). No significant relationship was observed between number of LFRs and firearm homicide rates (-0.119, p=0.41). In linear regression analysis, number of LFRs was an independent predictor of suicide mortality (0.173, $p < 0.001$) but not of firearm homicide mortality (Table 1).

Conclusion: Our analysis demonstrated a significant correlation between firearm retail availability and firearm suicide but not firearm homicide mortality. Completed suicides account for nearly two-thirds of U.S. gun deaths, and strong evidence suggests many of these tragedies are shockingly impulsive in nature. Moderate legislative approaches such as mandatory point-of-sale waiting periods may be beneficial in reducing firearm deaths by suicide.

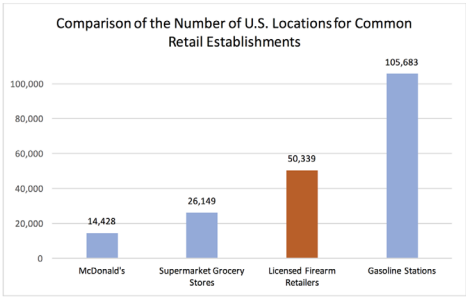


Fig. 1. There are more Licensed Firearm Retailers in the U.S. than McDonald's locations and Supermarket Grocery Stores. (McDonald's, 2019) (FoodIndustry.com, 2019) (U.S. Bureau of Labor Statistics, 2019).

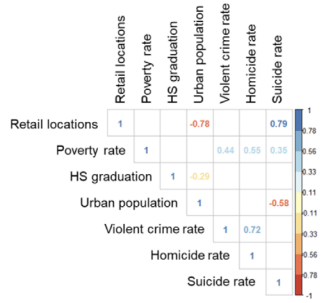


Fig. 2. Spearman's rho correlation matrix was used. Only correlation coefficients of significant correlations are shown. HS: high school

Table 1. Independent predictors for mortality.

Outcome	Independent factors	Beta	95% confidence interval		P value
			Lower limit	Upper limit	
Homicide Mortality	Violent Crime Rate	0.010	0.006	0.014	<0.001
	Poverty Rate	0.393	0.217	0.570	<0.001
	HS Graduation Rate	0.119	0.0003	0.237	0.049
Suicide Mortality	Licensed Firearm Retailers	0.173	0.142	0.203	<0.001
	Poverty rate	0.344	0.167	0.522	0.001

Linear regression analysis was applied using stepwise method. HS: high school.
Adjusted R^2 of the models were 58.4% and 74.4% for homicide and suicide rates, respectively.

Session VI: Plenary Papers 30-37
Paper 34: 10:20 AM - 10:40 AM

DEVELOPING COMMUNITY-BASED SOLUTIONS TO INTERPERSONAL FIREARM VIOLENCE: THE DIFFERING PERSPECTIVES OF SURVIVORS AND TRAUMA SURGEONS

Bachar N. Halimeh, Dorothy Hughes PhD, Blake Evans, Figueroa Julia, Tanya L. Zakrison MD, MPH, Robert D. Winfield MD
Kansas University Medical Center

Invited Discussant: Srephanie Bonne, MD

Introduction: Interpersonal firearm violence remains epidemic in the United States. Treating survivors without understanding and addressing root causes will ultimately prove ineffective. We hypothesized that interviewing survivors of interpersonal firearm violence and the trauma surgeons who treated them would reveal similarities and differences in perspectives on firearm violence, helping to improve patient care and revealing new ideas to reduce firearm violence.

Methods: Between July 2017 and January 2020, this mixed methods study employed criterion-based sampling to collect quantitative and qualitative data from adult survivors of interpersonal firearm violence presenting and the surgeons who treated them at our ACS Verified Level I trauma center. Quantitative data were collected using closed-ended surveys. Semi-structured interviews were conducted using guides inquiring about perceptions of firearm violence causes and solutions. Quantitative data were analyzed by calculating descriptive statistics by survey question. Qualitative data were coded using the interview guide as an a priori codebook, analyzed for themes within codes, then themes were compared for similarities and differences across participant groups. Qualitative and quantitative data were triangulated to better understand differences and similarities in perspectives among survivors and surgeons.

Results: A total of 10 trauma surgeons and 51 patients participated between July 2017 and January 2020. Patients were younger than surgeons (29 vs. 42 years, p=0.005) and more frequently African American (62 vs. 10%, p=0.007); both groups were predominantly male (84 vs. 90%, p=1). Triangulated data showed consensus among survivors and surgeons that endemic community violence and easy access to firearms were leading causes of firearm violence. Survivors also reported a lack of conflict mediation skills as causal, whereas surgeons cited poverty and unhealthy family dynamics. Survivors and surgeons agreed improved employment and education opportunities and community outreach could be effective in addressing firearm violence. Survivors recommended conflict resolution education; in contrast, surgeons recommended increased police presence. Survivors and surgeons strongly agreed trauma centers could help by providing education and community outreach. A few survivors noted the utility of interview data in accomplishing these ends, stating survivor stories could be effective in deterring firearm violence.

Conclusion: While there was more agreement than not between surgeons and patients in regarding causative and mitigating factors, key differences in perspectives existed. These data supported the importance of community- and trauma-informed care initiatives to bridge gaps between afflicted populations and surgeon-driven hospital-based violence intervention programs.

Session VI: Plenary Papers 30-37
Paper 35: 10:40 AM - 11:00 AM

CAUGHT IN THE CROSSFIRE: 37 YEARS OF FIREARM VIOLENCE AFFLICTING AMERICA'S YOUTH

Nathan Manley MD, Richard Lewis MD, Dih-Dih Huang MD, Tiffany K. Bee MD, Peter Fischer MD, MSc, Martin A. Croce MD, Louis J. Magnotti MD, MSc
University of Tennessee Health Science Center

Invited Discussant: Dennis Vane, MD, MBA

Introduction: Publicly available firearm data is difficult to access. Trauma registry data is excellent at documenting patterns of firearm-related injury. Law enforcement data excels at capturing national violence trends to include both circumstances and firearm involvement. The goal of this study was to utilize publicly available, law enforcement data from all 50 states to better define patterns of firearm-related homicides in the young.

Methods: All homicides in individuals $\leq$ 25 years old in the United States over a 37-year period ending in 2016 were analyzed: infant $\leq$ 1 year old, child 2-9 years old, adolescent 10-19 years old, young adult 20-25 years old. Primary data files were obtained from the Federal Bureau of Investigation and comprised the database. Data analyzed included homicide type, situation, circumstance, month, firearm type and demographics. Rates of all homicides and firearm-related homicides per 1 million (M) population and the proportion of firearm-related homicides (out of all homicides) were stratified by year and compared over time using simple linear regression.

Results: 171,113 incidents of firearm-related homicide were analyzed (69% of 246,437 total homicides): 5313 infants, 2332 children, 59,777 adolescents and 103,691 young adults. Most were male (79%), black (50%) with a mean age of 18. Firearm-related homicides peaked during the summer months of June, July and August (median = 1156 per year; $p = 0.0032$). Rates of all homicides (89 to 53 per 1M population) and firearm-related homicides (56 to 41 per 1M population) decreased significantly from 1980 to 2016 ($\beta = -1.12$, $p < 0.0001$ and $\beta = -0.57$, $p = 0.0039$, respectively). However, linear regression analysis identified a significant increase in the proportion of firearm-related homicides (out of all homicides) from 63% in 1980 to 76% in 2016 ($\beta = 0.33$, $p < 0.0001$).

Conclusions: For those 25-years-old and younger, the proportion of firearm-related homicides has steadily and significantly increased over the past 37-years, with three out of four homicides firearm-related in the modern era. Despite focused efforts, reductions in the rate of firearm-related homicides still lag behind those for all other methods of homicide by nearly 50%. That is, while the young are less likely to die from homicide, for those unfortunate victims, it is more likely to be due to a firearm. This increasing role of firearms in youth homicides underscores the desperate need to better direct prevention efforts and firearm policy if we hope to further reduce firearm-related deaths in the young.

Session VI: Plenary Papers 30-37
Paper 36: 11:00 AM - 11:20 AM

A PSEUDO-DILEMMA: ARE WE OVER-DIAGNOSING AND OVER-TREATING TRAUMATIC SPLENIC INTRAPARENCHYMAL PSEUDOANEURYSMS?

Sydney Radding MD, Ara Ko MD, MPH, Rishi Kundi MD, Jonathan Morrison MD, PhD, Rosemary A. Kozar MD, PhD, John S. Maddox MD, Jason Radowsky MD, Joseph J. DuBose MD, David V. Feliciano MD, Thomas M. Scalea MD
University of Maryland, Shock Trauma Center

Invited Discussant: Ben Zarzaur, MD, MPH

Introduction: Splenic embolization for traumatic vascular abnormalities in stable patients is a common practice. We hypothesize that modern contrast-enhanced CT identifies unimportant post-traumatic splenic vascular lesions such as intraparenchymal pseudoaneurysms (PSA), perhaps altering the indication for splenic embolization.

Methods: After IRB approval, we reviewed our high-volume center experience with the endovascular management of splenic injuries from Sep 2014-Nov 2018. Multidisciplinary review was used to compared initial CT findings to subsequent angiography, analyzing management and outcomes of identified PSAs.

Results: Of 717 splenic injuries managed overall during the study period, 155 (21.6%) underwent embolization and 140 (19.5%) had adequate imaging available for review. All patients had blunt trauma, 65.7% were male, and 2.1% presented with systolic blood pressure < 90 mm Hg. Mean age was 43, and mean ISS was 22 ± 9. AAST splenic injury grades included Grades 2 (6.4%); 3 (31.4%), 4 (61.4%) and 5 (0.7%). Vascular injuries identified on initial CT were active extravasation in 17.1% and PSA in 52.1%. Angiography was performed a mean of 17 hours after admission, with 44.3% done within 6 hours. Subsequent embolization was performed for 87.9% using coils (74), plug devices (43) or both (6). Among the 73 patients with PSA on initial CT, 24 (32.9%) had no visible lesion on subsequent angiogram. Embolization for angiogram confirmed PSA was undertaken in 87.8% (43/49). On post-embolization CT at 48-72 hours, persistently perfused splenic PSAs were seen in 39.5% (17/43) of those with and 66.7% (4/6) without embolization. No patients with PSA on angiography who was observed without embolization required delayed splenectomy, whereas 4.7% (2/43, p = 1.00) in the embolized group had splenectomy at 74.7 and 288.0 hrs after admission.

Conclusion: Modern CT may identify clinically insignificant splenic PSAs in a third of patients. Even when identified at angiogram and embolized, 40% of traumatic PSAs will remain perfused during hospitalization.

Session VI: Plenary Papers 30-37
Paper 37: 11:20 AM - 11:40 AM

ENHANCING TRAUMA REGISTRIES BY INTEGRATING TRAFFIC RECORDS AND GEOSPATIAL ANALYSIS TO IMPROVE BICYCLIST SAFETY

Jay J. Doucet MD, MSc, Laura N. Godat MD, Leslie M. Kobayashi MD, Allison E. Berndtson MD, Amy Liepert MD, Eric Raschke DO, John Denny, Alan Smith PhD, Todd W. Costantini MD
UC San Diego Division of Trauma, Surgical Critical Care and Burns

Invited Discussant: Louis Magnotti, MD,MSc

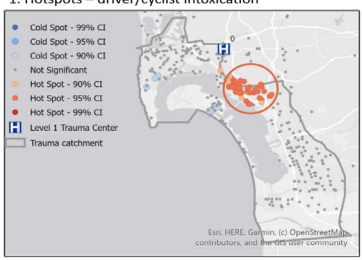
Background: Trauma registries are used to identify modifiable injury risk factors for trauma prevention but lack data useful for prevention of bicycle-automobile collisions such as vehicle speeds, driver intoxication, street conditions and neighborhood characteristics. We hypothesized that geographic information systems (GIS) analysis of trauma registry data matched with a traffic accident database could identify risk areas for bicycle-automobile injuries to better inform injury prevention efforts.

Methods: The trauma registry of a U.S. Level I trauma center was used retrospectively to identify bicycle-motor vehicle collision admissions from 2010 to 2018. Data collected included demographics, vitals, injury severity scores, toxicology, helmet use and mortality. Matching with the statewide integrated traffic records system (SWITRS) was done to provide collision, victim and GIS data. Mapping was done with census tract data including poverty levels. Hot spot analysis to identify statistically significant incident clusters was done using the Getis Ord Gi* statistic.

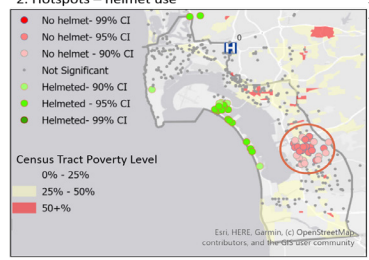
Results: Out of 25,535 admissions, 531(2.1%) were bicyclists struck by automobiles, 425 (80.0%) were matched to SWITRS. There were 5 bicyclist scene deaths and 11 (2.5%) deaths after admission. Alcohol intoxication was involved in 13.4% of bicyclists but 20% of drivers, and in 50% of fatalities (P=0.004). Bicyclists had higher tract poverty rates than the county mean (18.53% vs 14.3%, P < 0.001). Collisions in poorer census tracts had less helmet use (24.7% vs 36.7%, P=0.012) and more drivers at-fault (25.6% vs. 20.5%, P=0.022). GIS analysis identified hot spots for intoxicated drivers or bicyclists (Z score=3.3; P=0.002) and lack of helmet use (Z score=3.4; P=0.001, see figures 1, 2.)

Conclusions: Combining trauma registry data and traffic records with GIS analysis identifies additional risk factors for bicyclist injury. Trauma centers should lead efforts to prospectively link public traffic accident data to their registries to better target injury prevention.

1. Hotspots – driver/cyclist intoxication



2. Hotspots – helmet use



Session VII: Papers 38-44

Monday, September 14, 2020

9:00 AM - 11:20 AM

Moderator: Robert Winchell, MD

Session VII: Plenary Papers 38-44
Paper 38: 9:00 AM - 9:20 AM

REGIONALIZATION OF TRAUMA CARE BY OPERATIVE EXPERIENCE: DOES THE VOLUME OF EXPLORATORY LAPAROTOMY MATTER?

Andrew Tang MD, Mohamad Chehab MD, Kamil Hanna MD, Michael Ditillo DO, Lourdes Castanon MD, Letitia Bible MD, Molly Douglas MD, Samer Asmar MD, Bellal Joseph MD
University of Arizona

Invited Discussant: Brian Eastridge, MD

Introduction: The volume-outcome relationship led to the regionalization of trauma care. The relationship between the trauma center's laparotomy volume and outcomes is not well explored. The aim of our study is to evaluate the impact of laparotomy volume on outcomes in blunt and penetrating trauma patients.

Methods: We performed a (2017) analysis of the ACS-TQIP database. We included adult (≥18y) blunt and penetrating trauma patients who required exploratory laparotomies for hemorrhage control. Trauma centers were stratified based on each center's penetrating and blunt laparotomy volumes. (HV: high volume:>20 cases/year, MV: medium volume 10-20 cases/year, LV: low volume <10 cases/year). Primary outcomes were 24-hour mortality and in-hospital mortality. Secondary outcomes were major complications and time to hemorrhage control. Regression analysis was performed controlling for demographics, injury parameters, transfusions remaining center characteristics.

Results: A total of 9,381 patients were included of which 5,396 had blunt injuries and 3,985 had penetrating injuries. Overall, the mean age was 39±18y, abdomen AIS was 3[3-4], and ISS was 48[27-66]. For ACS Level I centers: 40% were HV, 45% MV, and 15% LV. For ACS Level II centers: 10% were HV, 30% MV, and 60% LV. For ACS Level III centers: 0% were HV, 61% MV, and 39% LV. On regression analysis, admission of penetrating trauma patients to HV penetrating trauma laparotomy centers was independently associated with improved 24-hour and in-hospital mortality. A similar trend was observed for blunt trauma patients. No association was found between major complications and center volume for neither mechanisms of injury. **Table 1**. HV penetrating trauma centers had a significantly lower time to hemorrhage control (35 [26-53] min) vs. MV (40 [29-63] min) and LV centers (45 [31-66] min) ($p<0.01$). The same trend was observed for HV blunt trauma centers (73 [41-145] min) vs. MV (82 [50-147] min) and LV centers (93 [56-158] min) ($p<0.01$).

Conclusion: Severely injured patients requiring laparotomy had higher survival when admitted to trauma centers with HV operative experience for their particular mechanisms of injury. The regionalization of trauma care should be based on a thorough evaluation of the center's operative experience with different mechanisms of injury.

Table 1: Multivariable Regression Analysis

	Penetrating Injuries (N=3985)			Blunt Injuries (N=5396)		
Outcome	**LV (N=1185)**	**MV (N=1588)**	**HV (N=1212)**	**LV (N=1239)**	**MV (N=2299)**	**HV (N=1858)**
24-Hour Mortality	Ref	0.99 [0.92-1.07]	**0.76 [0.71-0.83]***	Ref	0.96 [0.77-1.20]	**0.76 [0.60-0.96]***
In-Hospital Mortality	Ref	1.02 [0.92-1.12]	**0.86 [0.77-0.96]***	Ref	0.95 [0.79-1.14]	**0.83 [0.68-0.73]***
Major Complications	Ref	1.01 [0.74-1.34]	0.82 [0.69-1.34]	Ref	1.07 [0.91-1.26]	0.76 [0.71-1.44]

LV=Low Volume (<10 cases/year); MV=Medium Volume (10-20 cases/year); HV=High Volume (>20 cases/year); *=p<0.05

Session VII: Plenary Papers 38-44
Paper 39: 9:20 AM - 9:40 AM

USE OF RESUSCITATIVE ENDOVASCULAR BALLOON OCCLUSION OF THE AORTA IN TRAUMATIC BRAIN INJURY PATIENT: A NATIONWIDE ANALYSIS

Muhammad Khurrum MD, Michael Ditillo DO, Molly Douglas MD, Letitia Bible MD, Lourdes Castanon MD, Mohamad Chehab MD, Andrew Tang MD, Narong Kulvatunyou MD, Bellal Joseph MD
University of Arizona

Invited Discussant: A. Britton Christmas, MD

Introduction: Resuscitative endovascular balloon occlusion of the aorta (REBOA) has emerged as a non-invasive alternative to resuscitative thoracotomy for noncompressible torso hemorrhage. The use of REBOA in animal models revealed worsening traumatic brain injury (TBI) due to increase intracranial pressure. There is a paucity of clinical data regarding its effect in severe TBI patients. The aim of our study was to evaluate the effect of REBOA on outcomes in severe TBI patients.

Methods: We performed a retrospective analysis of the 2017 American College of Surgeons Trauma Quality Improvement Program. We include adult (age ≥18y) TBI (Head AIS ≥ 3) patients. Patients who were dead on arrival, transferred and had prehospital cardiac arrest were excluded. Patients were stratified into: those who underwent REBOA within 1 hour of presentation (REBOA group) and those who did not (no-REBOA group). Propensity score matching was performed (1:2 ratio) adjusting for demographics, vital signs, injury-parameters, and blood products transfused. Outcomes were the rates of complications, length of stay (LOS), and mortality.

Results: Of 501,155 adult TBI patients, a matched cohort of 486 patients (162 REBOA and 324 no-REBOA group) was obtained. Mean age was 41±18y, head-AIS was 3 [3-4], and ISS was 56 [41-72]. Patients in the REBOA group had a significantly longer LOS (16 [5-31] d vs. 10 [2-33] d; $p < 0.01$). Patients in the REBOA group also had higher rates of in-hospital mortality (43.2% vs. 29.9%; $P < 0.01$), 24-hour mortality (32.1% vs. 17.1%; $p < 0.01$), cardiac arrest (21% vs 8.6%; $p < 0.01$), pulmonary embolism (6.2% vs 2.5% ; $p = .04$), unplanned intubation (4.1% vs. 0.9%; $p < 0.01$), acute kidney injury (6.7% vs. 2.5%; $p = 0.03$) and lower-extremity amputation (4% vs. 0.8%; $p < 0.01$).

Conclusion: REBOA in severe TBI patients was associated with worse outcomes compared with a similar cohort of patients who did not undergo REBOA. The decision to use REBOA should be carefully considered in the presence of a TBI. Future studies are required to clearly demarcate the use of REBOA in this subgroup of trauma patients.

Session VII: Plenary Papers 38-44
Paper 40: 9:40 AM - 10:00 AM

MULTI-INSTITUTIONAL VALIDATION STUDY OF THE INJURED TRAUMA SURVIVOR SCREEN (ITSS)

Terri deRoon-Cassini PhD, Joshua C. Hunt PhD, Erick Herrera-Hernandez BS, Kelley Jazinski-Chambers BS, Amber Brandolino MSc, Katy Maher PhD, Brianna Jackson BS, Randi N. Smith MD, MPH, Diane Lane BS, Mackenzie Cook MD, Karen J. Brasel MD, MPH, Marc A. de Moya MD
Medical College of Wisconsin

Invited Discussant: Rachael Callcut, MD

Background: Development of posttraumatic stress disorder (PTSD) or a major depressive episode (MDE) are common following traumatic injury, occurring in up to 20% of US trauma survivors. This led to the American College of Surgeons-Committee on Trauma (ACS-COT) recommendation to screen for these disorders in trauma centers. The nine-item Injured Trauma Survivor Screen (ITSS) has previously been shown to predict PTSD and MDE risk at 1- and 6-months after traumatic injury. We hypothesized that the ITSS would retain high sensitivity when compared to more time-consuming, symptom-based measures in a AAST sponsored multi-institutional validation study.

Method: Patients were enrolled following admission to one of four Level I trauma centers. All participants (N = 375) were administered the ITSS. Symptom-based measures were included as a proxy for detailed evaluation of acute psychological distress, evaluated in a second post-screening step, to enhance specificity of the overall psychodiagnostic evaluation and reduce false positives. The PTSD Checklist for *DSM-5* (PCL-5), and the Center for Epidemiological Studies Depression Scale Revised (CESD-R) were administered during initial hospitalization, an average of 3.88 days after injury (SD = 3.26). The Clinician Administered PTSD Scale for *DSM-5* (CAPS-5) and the CESD-R were administered at follow-up, an average of 1.2 months after injury (SD = .473), to generate binary diagnostic (Yes-present / No-absent) categories.

Results: The rate of PTSD in the sample was 20.5% (n = 46) and the rate of MDE was 15.25% (n = 34). The ITSS PTSD Scale (n = 224, additional participant data is still being entered) had a sensitivity of 73.91% (n = 34/46), specificity 63.48 %, NPV 90.7%and PPV 33.6% (AUC = .687, 95% CI = 0.622, 0.747). The combined risk group increased the specificity to 80.34%.The ITSS Depression Scale had a sensitivity of 73.53% (n = 25/34), specificity 58.73 %, NPV 89.9% and PPV 30.8 % (AUC = .661, 95% CI = 0.595, 0.723). The combined risk group increased the specificity to 100%.

Conclusions: The short, easy to administer ITSS retained high sensitivity and specificity in a multi-institutional validation study. Symptom-based measures can reduce the false-positive rate for patients that screen positive on the ITSS. Therefore, the ITSS is a viable option for trauma centers with diverse patient populations.

Session VII: Plenary Papers 38-44
Paper 41: 10:00 AM - 10:20 AM

ROADWAY FEATURES ASSOCIATED WITH ELDERLY MOTOR VEHICLE COLLISIONS

Maxwell J. Presser, Adaobi Nwabuo MPH, Megan Wier MPH, Shamsi Soltani MPH, Devan Morris BS, Rebecca Plevin MD
University of California, San Francisco

Invited Discussant: Robert Barraco, MD, MPH

Introduction: As the number of older US drivers has increased over the past several decades, so has the number of injuries, hospitalizations, and deaths from motor vehicle crashes (MVCs) involving the elderly. Given the multiple age-related risk factors that contribute to road crashes among the elderly, we seek to identify environmental & road features associated with increased collisions involving elderly drivers.

Methods: This is a retrospective observational study using 2015-2019 Police Department traffic crash reports and a Department of Public Health database of built-environment variables from a single urban center. Demographics and environmental/road features were compared for vehicle-only MVCs involving elderly (≥ 65 years) or younger drivers; crashes involving pedestrians or bicyclists were excluded. Chi-squared and nonparametric tests were used to analyze 36,168 drivers involved in MVCs.

Results: There were 2,575 (7.1%) %) elderly drivers involved in MVCs. Left turns and all-way stop signs were associated with increased risk for these crashes. On the other hand, intersections with left turn restrictions, traffic lights, only one-way streets, and bike lanes were inversely associated. Crashes with elderly drivers were more likely to occur on weekdays. Elderly drivers were less often intoxicated at the time of the crash, but they were more frequently the party at fault when crashes involved multiple vehicles. Elderly drivers were less likely than younger adult drivers to be involved in fatal MVCs.

Conclusion: Updates to built road features have potential to decrease injury and death from MVCs involving elderly adults. Left turn restrictions or other innovative safety treatments at all-way stops or where left turns are permitted may mitigate road crashes involving older adults, who contend with decreased vision and slower response times. Supplemental education of older drivers may increase awareness of higher-risk driving tasks such as turning left as well as driving alternatives including public transportation and paratransit. Since transportation plays an important role in maintaining activities of daily living among elderly adults, safe transportation options and environments and appropriate counseling are necessary to promote safer travel.

Characteristic	Relative Risk for Age ≥65 (n=2,575, 7.1%) vs. <65 (n=33,593, 92.9%)	95% Confidence Interval
Alcohol use	0.45	0.34-0.60
Left turn prior to crash	1.15	1.02-1.23
Left turns prohibited	0.89	0.82-0.97
Traffic light	0.84	0.78-0.91
One-way streets only	0.67	0.57-0.78
Bike lane	0.92	0.85-0.99
All-way stop signs	1.25	1.12-1.41
During weekend	0.85	0.78-0.92

Session VII: Plenary Papers 38-44
Paper 42: 10:20 AM - 10:40 AM

RECENT RELEASE FROM PRISON – A NOVEL RISK FACTOR FOR INTIMATE PARTNER HOMICIDE

Justin Cirone MD, Robert Keskey MD, David Hampton MD MEng, Mark Slidell MD MPH, Marie Crandall MD MPH*, Rishi Rattan MD*, Catherine Velopulos MD MHS**, Debra Allen MSN RN TCRN CCRN-K, Kenneth Wilson MD, Tanya L. Zakrison MD MPH
University of Chicago, *University of Florida, **University of Colorado

Invited Discussant: D'Andrea Joseph, MD

Introduction: The United States has the highest per-capita incarceration rate and the largest prison population in the world. The incarceration of individuals has been not been demonstrated to be a successful deterrent to future violence but may in fact be a potent stimulator of this. Despite being among the most closely monitored group of citizens, 60.1% of recently incarcerated individuals will be arrested again within 2 years of release and may even commit crimes as serious as homicide soon after discharge. The pattern of homicidal violence currently remains unknown for these recently incarcerated homicide suspects (RIHS).

Methods: A retrospective analysis of the 36 states included in the 2003-2017 National Violent Death Reporting System Restricted Access Database was performed with focus on incidents where homicide suspects had recent institutionalization status documented. Individuals were identified as being recently incarcerated within the last 30 days, or not recently incarcerated. Pearson's chi-squared and Wilcoxon rank-sum tests were used to compare the RIHS population to the homicide suspect population who were not recently incarcerated.

Results: This database of 14,561 homicides suspects included 249 cases where the suspect had been recently incarcerated. RIHS more commonly had a known relationship with the victim (74.7% vs 50.9%, $p < 0.001$), and these homicides were more likely to be committed in the victim's own home (42.6% vs 34.2%, p=0.006). Intimate partner violence was a factor in 30.5% of the RIHS cases (vs 16.8%, $p < 0.001$). The homicide weapon was most likely to be a firearm (57.8%, $p < 0.001$) and the most common firearm type were semi-automatic handguns. Only 6.4% were due to suspect's mental health illness, but recent alcohol (12.9% vs 5.4%, $p < 0.001$) and other substance use (22.9% vs 4.5%, $p < 0.001$) was significantly higher in the RIHS group. While RIHS were more likely to commit homicide for gang-related reasons compared to non-incarcerated suspects, it was only a precipitating factor in 12.0% of the homicides (vs 7.4%, p=0.006).

	Not Recently Incarcerated	Recently Incarcerated	p-value
n = 14,561	n = 14,312	n = 249	
Age, years, median (IQR)	28.0 (21.0-39.0)	30.0 (24.0-37.0)	0.028
Male Sex	90.7% (10,608)	97.2% (239)	<0.001
Race			<0.001
White	28.6% (3,920)	41.25% (99)	
Black	36.8% (5,034)	42.1% (101)	
Other	34.6% (4,744)	16.7% (40)	
Suspect's Relationship to Victim			<0.001
Victim Knows Suspect	50.9% (7,289)	74.7% (186)	
Stranger	7.7% (1,108)	10.8% (27)	
Unknown	41.3% (5,915)	14.5% (36)	
Victim was a Bystander	1.4% (198)	4.8% (12)	<0.001
Injury Occurred at Victim's Home	34.2% (4,897)	42.6% (106)	0.006
Suspect Previously Abused Victim	3.4% (487)	15.3% (38)	<0.001
Gang Violence Related	7.4% (1,061)	12.0% (30)	0.006
Intimate Partner Violence Related	16.8% (2,401)	30.5% (76)	<0.001
Due to Suspect's Mental Health Illness	3.9% (551)	6.4% (16)	0.040
Suspect Recent Alcohol Use	5.4% (780)	12.9% (32)	<0.001
Suspect Recently Used Substances	4.5% (640)	22.9% (57)	<0.001
Weapon/Means - Top 3			<0.001
Firearm	72.2% (10,081)	57.8% (144)	
Sharp Instrument	12.8% (1,780)	17.7% (44)	
Hanging, Strangulation or Suffocation	3.1% (437)	10.4% (26)	
Firearm Type - Top 3			<0.001
Handgun: Semi-Automatic	19.1% (1,896)	38.7% (55)	
Handgun: Other	44.6% (4,431)	30.3% (43)	
Rifle/Long Gun	4.2% (421)	7.0% (10)	

Conclusions: Homicide suspects who were recently incarcerated were more likely to target a known person in the victim's own home and use a firearm in the crime. Alcohol and other substance abuse is a precipitating factor significantly more often than mental health illness, and these homicides are six times more likely to be due to intimate partner violence than for gang-related reasons. Additional future interventions are urgently needed to eliminate these preventable deaths.

Session VII: Plenary Papers 38-44
Paper 43: 10:40 AM - 11:00 AM

A CLINICAL PRACTICE GUIDELINE USING PERCENTAGE OF PREDICTED FVC IMPROVES RESOURCE ALLOCATION FOR RIB FRACTURE PATIENTS

Joshua Billings MD, Abid Khan MD, L. Paige Clement, Alyssa Douville, Eric Brown, Thomas J. Schroeppel MD,
University of Colorado Health

Invited Discussant: Fredric Pieracci, MD, MPH

Introduction: Although rib fractures are present in approximately 10% of blunt trauma patients, predicting which patients will require higher level care is a challenge during initial triage. Percentage of predicted (PP) forced vital capacity (FVC) better incorporates patient-specific factors to customize the measurements to each patient. A single institution transitioned from a clinical practice guideline (CPG) utilizing absolute FVC to one using PP FVC to improve initial triage of rib fracture patients. This study aims to compare the outcomes of patients before and after the CPG change.

Methods: A review of rib fracture patients was performed over a 34 month retrospective period (RETRO) and 12 month prospective period (PRO). The RETRO cohort was triaged by initial absolute FVC and initial PP FVC was used to triage the PRO cohort. Demographics, mechanism, injury severity (ISS), chest abbreviated injury scale (AIS), number of rib fractures, tube thoracostomy (TT), intubation, admission to ICU, transfer to ICU, hospital length of stay (LOS), ICU LOS, and mortality data were compared. A multivariable model was constructed to perform adjusted analysis for LOS.

Results: 588 patients were eligible for the study with 269 RETRO and 319 PRO patients. No significant differences in age, gender, or injury details were identified between the groups. Fewer TT were performed in the PRO cohort. The groups had similar rates of intubation, admission to ICU, and mortality, however, fewer transfers to the ICU occurred in the PRO cohort. Patients in the PRO cohort had a shorter LOS and ICU LOS. Adjusted analysis with multiple linear regression identified age, ISS, TT, and the PRO cohort as significant predictors of LOS with R^2=0.163.

	Total Study n=588	RETRO n=269	PRO n=319	*p*
Age	60 (47,75)	62 (50,76)	58 (43,74)	0.056
Female	39.1%	38.3%	39.8%	0.706
ISS	13 (9,17)	13 (9,17)	13 (9,17)	0.392
Chest AIS	3 (2,3)	3 (2,3)	3 (2,3)	0.715
Thoracostomy	17.6%	22.3%	13.5%	0.005
Intubation	3.6%	4.5%	2.8%	0.286
Admit to ICU	32.8%	36.1%	30.1%	0.125
Transfer to ICU	9.7%	16.0%	4.4%	<0.001
ICU LOS	0 (0,2)	0 (0,3)	0 (0,1)	<0.001
Hospital LOS	5 (3,7)	5 (4,8)	4 (2,7)	<0.001

Multivariable: LOS	*B*	*SE B*	Beta	*p*
Age	0.02	0.01	0.10	0.012
PRO	-1.28	0.37	-0.13	0.001
TT	2.10	0.49	0.17	<0.001
ISS	0.21	0.02	0.33	<0.001

Conclusion: PP FVC better stratified rib fracture patients leading to a decrease in transfers to the ICU, ICU LOS, and hospital LOS. By incorporating patient specific-factors into the triage decision, the new CPG optimized triage and decreased resource utilization over the study period.

Session VII: Plenary Papers 38-44
Paper 44: 11:00 AM - 11:20 AM

DISTINCT IMMUNOLOGIC ENDOTYPES ARE ASSOCIATED WITH CLINICAL TRAJECTORY AFTER SEVERE BLUNT TRAUMA AND HEMORRHAGIC SHOCK

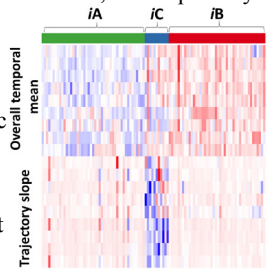
Scott C. Brakenridge MD, Zhongkai Wang MSc, Michael C. Cox MD, Babette Brumback PhD, Alicia M. Mohr MD, Frederick A. Moore MD, Joseph Cuschieri MD, Ronald V. Maier MD, Philip A. Efron MD, Lyle Moldawer PhD
University of Florida

Invited Discussant: Ronald Tompkins, MD

Introduction: The genomic/cytokine "storm" after severe trauma has been well documented. However, the differing composition, magnitude and resolution of this response, and its relationship to clinical outcomes remains unclear.

Methods: This is a secondary analysis of a prospective longitudinal cohort study among severely injured trauma patients with hemorrhagic shock. Peripheral blood sampling was performed at 0.5, 1, 4, 7, 14 and 28 days after injury. Plasma cytokines were measured by Luminex™. K-means unsupervised clustering utilizing overall mean and trajectory slope of selected immunologic biomarkers (IL6, IL8, IL10, IL17, G-CSF, GM-CSF, IP10 & sPD-L1) was used to distinguish temporal immunologic endotypes. Endotypes were compared to known clinical trajectories defined as early death (< 14 days), chronic critical illness (CCI) [≥ 14 days ICU LOS + persistent organ dysfunction] and rapid recovery (RAP) [ICU LOS < 14 days + organ recovery].

Results: The cohort included 102 severely injured patients (ISS=33, IQR 24-41) in hemorrhagic shock (Max. Lactate=4.6, IQR 3.2-6.2) enrolled across two Level 1 trauma centers. We identified 3 distinct immunologic endotypes (*i*A, *i*B, *i*C), each with unique associations to clinical trajectory (p=0.003). Endotype *i*A (n=47) exhibited a moderate initial proinflammatory response followed by a return to immunologic homeostasis, with a primary clinical trajectory of RAP (n=44, 93.6%). Endotype *i*B (n=44) exhibited an early hyperinflammatory response with persistent inflammation and immunosuppression, with the highest incidence of CCI (n=10, 22.7%). Endotype *i*C (n=11) exhibited a similar hyperinflammatory response, but with rapid return to immunologic homeostasis and a predominant trajectory of RAP (n=9, 81.8%). Patients with endotype *i*B had the highest severity/duration of organ dysfunction, highest incidence of nosocomial infections (50%, p=0.001) and was the predominant endotype of patients that developed CCI (10/13 CCI, 76.9%; p=0.002). Endotype *i*B (n=1) and *i*C (n=2) comprised all early deaths.



Conclusion: This study identified three distinct immunologic endotypes after severe blunt injury and hemorrhagic shock differing in the magnitude and duration of the early response. The clinical trajectory of chronic critical illness (CCI) is characterized by an endotype (iB) defined by persistent inflammation/immunosuppression, and is associated with poor clinical outcomes.

Session VIII: Papers 45-51

Tuesday, September 15, 2020

4:00 PM - 6:20 PM

Moderator: Mary Fallat, MD

Session VIII: Plenary Papers 45-51
Paper 45: 4:00 PM - 4:20 PM

PEDIATRIC ADJUSTED REVERSE SHOCK INDEX MULTIPLIED BY GLASGOW COMA SCALE OUTPERFORMS PEDIATRIC ADJUSTED SHOCK INDEX IN PEDIATRIC WAR ZONE TRAUMA

Daniel Lammers MD, Christopher Marenco MD, Woo Do MD, Conner Jeffrey MD, John Horton MD, Matthew Martin MD, Escobar Mauricio MD, Jason Bingham MD, Matthew Eckert MD
Madigan Army Medical Center

Invited Discussant: Randall Burd, MD, PhD

Introduction: Shock index (SI) and its pediatric adjusted derivative (SIPA) have demonstrated utility as prospective predictors of mortality in adult and pediatric trauma populations. Although basic vital signs provide promise as triage tools, factors such as neurologic status on arrival have profound implications for trauma-related outcomes. Recently, the reverse SI (rSI) multiplied by Glasgow Coma Scale (GCS) (rSIG) has been validated in adult trauma as a tool combining early markers of physiology and neurologic function to predict mortality. This study sought to compare the performance characteristics of rSIG against SIPA as a prospective predictor of mortality in pediatric war zone injuries.

Methods: Retrospective review of the Department of Defense Trauma Registry, 2008 –2016, was performed for all patients less than 18 years old with documented vital signs and GCS on initial arrival to the trauma bay. Optimal age specific cut off values were derived for rSIG via the Youden Index using receiver operating characteristic analyses. Multivariate logistic regression was performed to validate accuracy in predicting early mortality.

Results: A total of 2,007 pediatric patients with a median age range of 7-12, 79% male, average ISS 11.9, and 63% sustaining a penetrating injury were included in the analysis. The overall mortality was 7.1%. A total of 874 (43.5%) and 685 (34.1%) patients had elevated SIPA and pediatric adjusted rSIG (rSIG) scores, respectively. After adjusting for demographics, mechanism of injury, initial vital signs and presenting laboratory values, rSIG (OR=4.054; p=0.013) was found to be superior to SIPA (OR=2.742; p=0.005) as an independent predictor of early mortality.

Conclusion: Pediatric adjusted rSIG more accurately identifies pediatric patients at the highest risk of death following war zone injuries when compared to SIPA alone. These findings may help refine early risk assessments for patient management and resource allocation in constrained settings. Further validation is necessary to determine applicability to the civilian population.

Session VIII: Plenary Papers 45-51
Paper 46: 4:20 PM - 4:40 PM

COMPARISON OF MASSIVE AND EMERGENCY TRANSFUSION PREDICTION SCORING SYSTEMS AFTER TRAUMA WITH A NEW BLEEDING RISK INDEX SCORE APPLIED IN-FLIGHT

Shiming Yang PhD, Chien-Yu Lin MSc, Peter Rock MD, MBA, Douglas Floccare MD, MPH, Florian Stumpf BS, Colin Mackenzie MD, PhD, Catriona Miller PhD, Christopher Winans, Samuel Galvagno MD, PhD, Deborah M. Stein MD, MPH, Thomas M. Scalea MD,
Peter F. Hu PhD
University of Maryland Shock Trauma Center

Invited Discussant: Bryan Cotton, MD,MPH

Introduction: Scoring systems such as the Assessment of Blood Consumption (ABC)[1], Revised Trauma Score (RTS) and Shock Index (SI) have been used to estimate the need for emergency blood transfusion. We have developed a Bleeding Risk Index (BRI) based on the autonomous analysis of pulse oximetry photoplethysmographic (PPG), ECG and blood pressure (BP) signals. We hypothesized that in the prehospital environment BRI would have equivalent or better performance compared to ABC, RTS, and SI for predicting the need for emergent and massive transfusion

Methods: We analyzed data from 1,396 adult trauma patients transported directly to a level I trauma center from the scene via helicopter from January 2016 to December 2017. The BRI score was calculated based on the features derived from the PPG and ECG waveforms at 240Hz and oximetry SpO2 and BP trends at 0.5Hz. The ABC, RTS and SI were calculated using admission data. The area under the receiver operating characteristic curve (AUC) with 95% confidence interval (CI) was calculated for predictions of Critical Administration Threshold (CAT: ≥3 units of pRBC in the first hour) or Massive Transfusion (MT: ≥ 10 U of blood in the 1st 24 hour). We consider the difference in AUCs was statistically significant when the AUCs 95% CI range does not overlap.

Result: Among the 1,396 patients, the mean age was 46.5 ± 20.1 (SD) years, 67.1% were male, the MT rate was 3.4%, and CAT 7.7%. Proportion blunt to penetrating injury was 1:13. The mortality rate was 6.6%, Average air transport time was 31 ± 12.3 (SD) min. For prediction of MT, the AUC for BRI (solid red line) was 0.94 (CI: 0.91-0.96), significantly better than ABC (AUC=0.80, CI: 0.73-0.87), SI (AUC=0.83, CI:0.76-0.90) and RTS (AUC=0.78, CI: 0.71-0.85). For predicting CAT, BRI (AUC=0.95, CI: 0.93-0.96) was also significantly better than ABC (AUC=0.78, CI: 0.73-0.82), SI (AUC=0.85, CI:0.80-0.89) and RTS (AUC=0.79, CI: 0.74-0.83).

Conclusion: The continuous non-invasive patient vital signs-based BRI score performs better than ABC, RTS and SI predictions of emergency and massive transfusion. BRI does not require additional or expert interpretation of data. Automated prediction of transfusion using machine learning and artificial intelligence may better assist blood-bank planning and pre hospital triage decision-making, especially in situations of prolonged field care or where medical expertise may not be immediately available.

[1]: Cotton BA, et. al. Journal of Trauma and Acute Care Surgery. 2010 Jul 1;69(1):S33-9.

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Session VIII: Plenary Papers 45-51
Paper 47: 4:40 PM - 5:00 PM

TRANSFUSION OF A SINGLE "DISCRETIONARY" UNIT OF RED BLOOD CELLS IS ASSOCIATED WITH WORSE CLINICAL OUTCOMES IN TRAUMA PATIENTS: A TRAUMA QUALITY IMPROVEMENT PROGRAM (TQIP) STUDY

Khaled Abdul Jawad MD, Daniel D. Yeh MD, Roman Dudaryk MD, Charlie Nederpelt BS, Mohamad El Moheb MD, Haytham Kaafarani MD, MPH, Alessia Cioci MD, Eva Urrechaga MD, Saskya E Byerly MD, MSc, Rishi Rattan MD, Gerd D. Pust MD, Nicholas Namias MD, MBA, Richard Epstein MD
University of Miami Miller School of Medicine

Invited Discussant: Jeffrey Kerby, MD, PhD

Introduction: Studies in elective surgery report adverse outcomes associated with transfusion of a solitary ("discretionary") unit of red blood cells (RBC) compared to no transfusion. We explored if a similar association exists in trauma patients.

Methods: The 2017 Trauma Quality Improvement Program (TQIP) database was queried for adults (≥18 years) with blunt/penetrating trauma, Glasgow Coma Scale (GCS)>8, and Injury Severity Score (ISS) 9-25. Patients with severe brain injury, mild injury, or severe injury were excluded. Random matching without replacement was conducted between those who received 1 unit of RBCs in the first 4 hours with no subsequent blood product transfusions and those who received no blood products during the entire hospitalization. Matching was performed at a ratio of up to 1:10 based on: age (≤65/>65 years), injury mechanism (blunt/penetrating), ISS (moderate/severe), GCS (mild/moderate), arrival systolic blood pressure (120). Relative risks (RR) of infections (superficial, deep, or sepsis), deep vein thrombosis (DVT) or pulmonary embolus (PE), and inpatient mortality were compared. P-values were adjusted according to Holm-Bonferroni for multiple comparisons.

Results: A total of 1238 transfused patients were matched to 11966 controls (mean ratio 1:9.7). Among transfused, the median age was 45.5 years (IQR 30,64), and 67.8% were male. Hypotension, tachycardia, or both were present in 11.8%, 13.5%, and 1.5% patients respectively. Blunt trauma occurred in 70.2%, brain injury was mild in 93.8%, and ISS was moderate in 45.3%. Comparing transfused to control, there were statistically significant, clinically relevant increased RRs of infection (3.27), DVT/PE (2.18), and mortality (1.8)**(Table).**

Conclusion: Compared to no transfusion, transfusion of a single unit of RBCs in the first 4 hours in trauma patients who did not require any subsequent units during hospitalization was associated with clinically significant increased risks of infection, DVT or PE, and mortality. Additional research is required to compare the risk/benefit of transfusion of a discretionary unit vs modest crystalloid challenge and the potential confounding effect of trauma center on outcomes. Unfortunately, the TQIP database does not provide identifiers for trauma centers.

Adverse Outcome	Transfused 1 Unit (n=1238)	Not Transfused (n=11966)	Relative Risk (95% CI)	P-value
Tissue Infection	24 (1.9%)	71 (0.6%)	3.27 (2.06, 5.17)	<.001
Deep Vein Thrombosis or Pulmonary Embolus	30 (2.4%)	133 (1.1%)	2.18 (1.47, 3.23)	<.001
Mortality	40 (3.2%)	215 (1.8%)	1.8 (1.29, 2.51)	<.001

Table: Relative Risks of Adverse Outcomes in the Transfused Group Compared to the Control Group

Session VIII: Plenary Papers 45-51
Paper 48: 5:00 PM - 5:20 PM

CLAMSHELL THORACOTOMY BETTER FACILITATES THORACIC LIFE-SAVING PROCEDURES WITHOUT INCREASED COMPLICATIONS COMPARED TO ANTEROLATERAL APPROACH TO RESUSCITATIVE THORACOTOMY: RESULTS FROM THE AAST AORTA REGISTRY

Joseph J. DuBose MD, Jonathan Morrison MD, PhD, Laura J. Moore MD, Jeremy W. Cannon MD, Mark J. Seamon MD, Kenji Inaba MD, Charles J. Fox MD, Ernest E. Moore MD, David V. Feliciano MD, Thomas M. Scalea MD
Uniformed Services University of the Health Sciences

Invited Discussant: Elizabeth Benjamin, MD, PhD

Introduction: Resuscitative thoracotomy (RT) is life-saving in select patients and can be accomplished through a left anterolateral (AT) or clamshell thoracotomy (CT). CT may provide additional exposure facilitating certain operative procedures but the added blood and heat loss and time to perform it may increase complications. No prospective multicenter comparison of techniques has yet been reported.

Methods: The observational AAST Aortic occlusion for resuscitation in trauma and acute care surgery (AORTA) registry was used to compare AT and CT in RT.

Results: AORTA recorded 1,218 RTs at 46 trauma centers from Jun 2014 – Jan 2020. Overall survival following RT was 6.0% (AT 6.6%; [59/900]; CT 4.2% [13/296], p = 0.132). Among all RTs, 11.1% (142/1278) surviving at least 24 hours were utilized to compare AT (112) and CT (30). There was no difference between the two groups with regards to age, gender, ISS or mechanism of injury [Table]. CT was significantly more likely to be used in patients needing lung resection and cardiac repair. CT was not associated with increased local thoracic / systemic complications, higher transfusion requirement, or greater ventilator, ICU or hospital days compared to AT.

Conclusion: Clamshell thoracotomy facilitates thoracic life-saving procedures without increased systemic or thoracic complications compared to AT in patients undergoing RT.

	Total (N = 142)	Anterolateral (N = 112)	Clamshell (N = 30)	p - value
Mean age (+/- SD)	35.8 +/- 15.3	32.2 +/- 14.8	35.8 +/- 12.7	p = 0.191
Male, % (n/N)	78.2% (111/142)	76.8% (86/112)	83.3% (25/30)	p = 0.441
ISS ≥ 20, % (n/N)	76.2% (96/126)	74.5% (76/102)	83.3% (20/30)	p = 0.361
Penetrating, % (n/N)	64.1% (91/142)	60.7% (68/112)	76.7% (23/30)	p = 0.106
Chest AIS ≥ 3, % (n/N)	77.8% (84/108)	73.2% (63/86)	95.5% (21/22)	p = 0.024
Lung resection, % (n/N)	14.8% (21/142)	9.8% (11/112)	33.3% (10/30)	p = 0.003
Cardiac repair, % (n/N)	9.2% (13/142)	5.4% (6/112)	23.3% (7/30)	p = 0.007
OUTCOMES				
ALI/ARDS, % (n/N)	16.9% (24/142)	17.9% (20/112)	13.3% (4/30)	p = 0.557
Pneumonia, % (n/N)	20.4% (29/142)	21.4% (24/112)	16.7% (5/30)	p = 0.566
Retained hemothorax, % (n/N)	6.3% (9/142)	6.3% (7/112)	6.7% (2/30)	p = 1.000
Empyema, % (n/N)	4.2% (6/142)	3.6% (4/112)	6.7% (2/30)	p = 0.607
Mean PRBCs 24hours (+/- SD)	21.4 +/- 18.3	20.6 +/- 17.1	24.4 +/- 22.4	p = 0.321
Mean ventilator days (+/- SD)	9.8 +/- 10.1	13.9 +/- 19.6	9.2 +/- 10.3	p = 0.237
Mean ICU LOS (+/- SD)	11.7 +/- 11.7	9.2 +/- 10.3	13.5 +/- 15.3	p = 0.546
Hospital LOS (+/- SD)	18.1 +/- 18.5	19.6 +/- 22.1	17.5 +/- 19.4	p = 0.627
Survival to discharge, % (n/N)	47.9% (68/142)	50.0% (56/112)	40.0% (12/30	p = 0.330

Session VIII: Plenary Papers 45-51
Paper 49: 5:20 PM - 5:40 PM

LONG-TERM OUTCOMES OF ILLICIT DRUG USE IN TRAUMA PATIENTS: A MULTICENTER PATIENT-REPORTED OUTCOMES STUDY

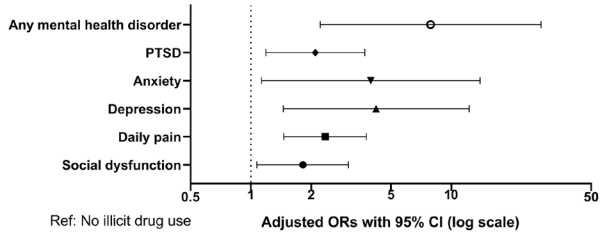
Mohamad El Moheb MD, Juan Herrera-Escobar MD, MPH, Kerry Breen BS, Claudia Orlas MD, Ashley Haynes BS, Nomi Levy-Carrick MD, Deepika Nehra MD, Sabrina Sanchez MD, Ali Salim MD, George Velmahos MD, PhD, Haytham Kaafarani MD, MPH
Massachusetts General Hospital

Invited Discussant: Michael Lekawa, MD

Introduction: Illicit drug use (IDU) is reported in up to 40% of trauma patients and is associated with a higher rate of in-hospital complications. However, little is known about its long-term impact on trauma patients. We aimed to assess the long-term mental and psychosocial outcomes of IDU in trauma patients 6-12 months after injury.

Methods: Trauma patients with moderate to severe injuries (ISS $\geq$ 9) who had a toxicology screen upon admission to one of three level 1 trauma centers were contacted by phone 6-12 months post-injury. IDU was defined as the presence of an illicit, non-prescribed substance on toxicology screen. The interviews systematically evaluated mental health (PTSD, depression, anxiety), chronic pain, and social functioning (SF-12 sub-domain). Patients with a score of 47 or lower on the SF-12 social functioning sub-domain were considered to have social dysfunction. Demographics, socioeconomic parameters, injury characteristics and hospital course data were also collected. Multivariable logistic regression models were built to determine the independent association between a positive screening for IDU at admission and long-term mental and psychosocial outcomes.

Results: A total of 571 patients were included in the analysis, of whom 173 (30.3%) screened positive for IDU on admission. IDU patients were younger (median age: 43 [28,55] vs 66 [46, 78], P < 0.001), had more penetrating injuries (8.7% vs 4.3%, P = 0.036), and were less likely to have received a college education (41.3% vs 54.5%, P = 0.004). After adjusting for patients' characteristics including the presence of a baseline psychiatric comorbidity, IDU patients were 8 times more likely to screen positive for a mental health disorder after injury. They were also more likely to screen positive for each of the individual mental health disorders: PTSD, depression, and anxiety. Additionally, they were twice as likely to suffer from daily chronic pain and social dysfunction 6-12 months after injury (**Figure**).



Conclusion: On the long term, IDU in trauma patients is strongly and independently associated with worse mental health, more chronic pain and severe impairment in social functioning. A trauma hospitalization presents an opportunity to screen and identify patients at risk and to mitigate the long-term impact of IDU.

Session VIII: Plenary Papers 45-51
Paper 50: 5:40 PM - 6:00 PM

MODIFIABLE FACTORS TO IMPROVE WORK-LIFE BALANCE FOR TRAUMA SURGEONS

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Dell Medical School, University of Texas at Austin

Invited Discussant: Jamie Coleman, MD

Introduction: A balance between work, and life outside of work, can be difficult for trauma surgeons to achieve. The specific aim of this study was to investigate factors associated with WLB for trauma surgeons. We hypothesized that trauma surgeons are dissatisfied with their WLB and there are modifiable factors that can be adjusted to improve and maintain WLB.

Methods: This was a survey study of AAST members involving detailed questions regarding demographics, clinical practice, family, lifestyle, and emotional support. The primary outcome was WLB while the secondary outcome was surgeon burnout.

Results: A total of 1,383 AAST members received an email with the survey, and 291 (21%) completed the survey. There was a total of 125 members (43%) satisfied with their WLB, while 166 (57%) were not. When comparing those who were satisfied with WLB to those who were not, there was no difference in age (51 vs. 49, p=.14), male gender (74% vs. 69%, p=0.36), or type of practice (p=0.19). Trauma surgeons satisfied WLB were more likely to be early (< 10 years) or late (> 20 years) career (p=0.02), spend fewer hours at work (p=0.004), more hours awake at home (p=0.001), enjoy their current job (p < 0.0001) and partners (0.0003), be better at saying no to (p=0.0004) and delegating (p=0.006) work-related tasks, and feel fairly compensated (p < 0.0001). Trauma surgeons satisfied with WLB more often participate in hobbies (86% vs. 68%, p=0.004), exercise (49% vs. 20%, p < 0.0001), have a healthy diet (74% vs. 48%, p < 0.0001), and get more hours of sleep at night (7 vs. 6, p=0.0004). In addition, despite receiving the same allotment of vacation weeks (4 vs. 4, p=0.47), the satisfied WLB group actually took more vacation weeks (4 vs. 3, p=0.005). Emotional support was better at work (73% vs. 47%, p < 0.0001) and home (95% vs. 83%, p=0.002) for those satisfied with WLB. After logistic regression, several factors were independently associated with WLB (see table). Those NOT satisfied with WLB self-reported suffering burnout (77% vs. 39%, p < 0.0001. Burnout shared several factors with those NOT satisfied with WLB including being mid-career [2.1(1.1-4.2, p=0.03], more hours at work [2.4 (1.2-4.9, p=0.02], fewer awake hours at home [3.3 (1.3-8.3, p=0.009], and feeling there is a better job for yourself [2.4 (1.2-4.8, p=0.02].

Satisfied WLB	OR (95% CI)	p-value	**NOT Satisfied WLB**	OR (95% CI)	p-value
Hobbies	2.3 (1.1-4.7)	0.03	Mid-Career (11-20 years)	0.3 (0.2-0.7)	0.002
Diet	2.6 (1.2-4.4)	0.02	More work hours	0.4 (0.2-0.7)	0.006
Exercise	2.6 (1.3-5.1)	0.006	Fewer home hours	0.2 (0.1-0.6)	0.002
Vacation weeks	1.3 (1.0-1.6)	0.02	Feel there is better job	0.4 (0.2-0.9)	0.02
Fair compensation	2.6 (1.3-5.3)	0.008			

Conclusions: Almost 60% of trauma surgeons surveyed were not satisfied with their WLB. Modifiable factors independently associated with a satisfying WLB were related to lifestyle and fair compensation. Factors independently associated with poor WLB and suffering burnout were being mid-career, increased hours at work, decreased awake hours at home, and feeling there was a better job for yourself. Factors associated with trauma surgeon WLB are modifiable. Trauma surgeons, as well as trauma leaders, should focus on these modifiable factors to optimize WLB and minimize burnout.

Session VIII: Plenary Papers 45-51
Paper 51: 6:00 PM - 6:20 PM

RECTAL DELIVERY OF OXYGEN MICROBUBBLES AUGMENTS SYSTEMIC OXYGENATION IN PORCINE MODEL OF SMOKE INHALATION-INDUCED ACUTE RESPIRATORY DISTRESS SYNDROME

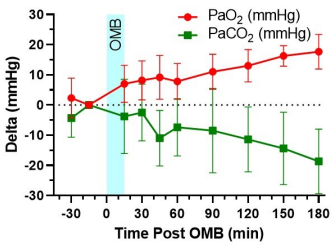
Paul Mountford PhD, Premila Leiphrakpam PhD, Hannah Weber, Andrea McCain,
Roser Romaguera Matas PhD, Nathaniel Zollinger BS, Benjamin Terry PhD, Mark Borden PhD,
Robert Scribner MBA, **Keely Buesing MD**
University of Nebraska Medical Center

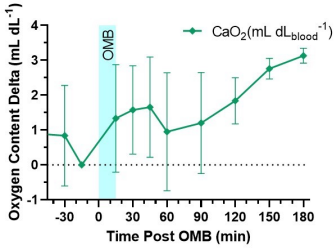
Invited Discussant: George Kasotakis, MD, MPH

Introduction: Acute respiratory distress syndrome (ARDS) is multifactorial and can result from sepsis, trauma, or pneumonia, as well as other primary pathology. It is one of the major causes of death in critically ill patients with a reported mortality rate of up to 60%. Oxygen microbubbles (OMB) are a novel therapy under investigation by our multi-campus, interdisciplinary research teams. In previous studies, we have shown that OMB treatment augments systemic oxygenation via diffusion across cavitary membranes. The present study focuses on the effect of OMB infusion via the colon in a porcine model of smoke inhalation-induced ARDS.

Methods: Animals (n = 6, ranging from 39-51 kg in weight) were exposed to smoke under general anesthesia for 2 hours (median smoke exposure = 1000 L oak wood smoke) after the ultrasound-guided placement of carotid, pulmonary, and femoral artery catheters. Peripheral oxygen saturation (SpO_2), vital signs, and ventilator parameters were monitored throughout the procedure. Chest x-ray, arterial, femoral and pulmonary artery blood samples were collected throughout the study. After the development of ARDS (48 hours post smoke inhalation), animals were maintained on minimal ventilator settings with FiO_2 = 21%. After three consecutive hypoxic blood gas measurements ($PaO_2 \leq 45$ +/- 5 mmHg) at 5 minute intervals, animals were given a one-time bolus treatment of OMB via the colon (dose volume of 3.6-4.3 L) and monitored for treatment effect. Animals were euthanized and lung tissue collected for analysis at the end of the study.

Results: Animals developed ARDS 48 hours after smoke inhalation as reflected by a SpO_2 of 60-85%, a PaO_2 of 31-46 mmHg and a CaO_2 of 4.6-8 mL dL_{blood}^{-1}, and bilateral, diffuse infiltrates demonstrated on CXR. OMB treatment resulted in significant improvements in systemic oxygenation as demonstrated by an increase in PaO_2 of 11-21 mmHg and CaO_2 of 1.3-3.3 mL dL_{blood}^{-1} and a decrease in $PaCO_2$ of 6.3-24.9 mmHg, along with improvements in other ABG parameters over a 3 hour post-treatment monitoring period.





	Before	After	Significance
PaO_2 (mmHg)	40.2 ± 5.2	56.2 ± 6.7	**
$PaCO_2$ (mmHg)	73.2 ± 8.0	54.1 ± 5.3	*
CaO_2 (mL/dL)	5.9 ± 1.2	8.9 ± 1.4	***

Conclusions: This study reports, for the first time, the successful augmentation of systemic oxygenation following colonic OMB treatment in a large animal model of smoke inhalation-induced ARDS. We propose OMB therapy as a novel treatment modality with great translational potential for oxygenation support in patients with ARDS.

Session IX: Papers 52-59

Wednesday, September 16, 2020
12:00 PM - 2:40 PM
Moderator: Sharon Henry, MD

Session IX: Plenary Papers 52-59
Paper 52: 12:00 PM - 12:20 PM

ALIVE AND AT HOME: 5-YEAR OUTCOMES IN OLDER ADULTS FOLLOWING EMERGENCY GENERAL SURGERY

Matthew Guttman MD, Bourke Tillmann MD, Avery B. Nathens MD, PhD, MPH, Refik Saskin MSc, Susan Bronskill PhD, Anjie Huang MSc, Barbara Haas MD, PhD
University of Toronto

Invited Discussant: Zara Cooper, MD, MSc

Background: Older adults (age > 65) represent 40% of hospitalizations for emergency general surgery (EGS) conditions, and this proportion will rise significantly over the next decade. While the short-term risks of EGS admission among older adults are well studied, little is known about long-term outcomes in this patient population. Moreover, data regarding long-term function and maintenance of autonomy following EGS admission among older adults are lacking. Accurate estimates of these risks are critical to patient counselling, selection of patients who might benefit from surgery, and the development of quality improvement initiatives. The objective of this study was to evaluate the relationship between EGS admission and the probability of an older adult being alive and living in their own home 5 years later. In addition, we evaluated the extent to which specific EGS diagnoses, need for operative intervention, and frailty modified this relationship.

Methods: We performed a population-based, retrospective cohort study of community dwelling older adults (age ≥ 65) admitted to hospital for 1 of 8 EGS diagnoses (appendicitis, cholecystitis, strangulated hernia, bowel obstruction, diverticulitis, peptic ulcer disease, intestinal ischemia, or perforated viscus) between 2006-2018 in a large regional health system. The primary outcome of interest was time spent alive and at home following an EGS-related admission (measured as time to nursing home admission or death). To ascertain the effect of EGS admission on being alive and at home independent of baseline characteristics, patients were matched to controls from the general population based on demographics and indicators of baseline health. Kaplan-Meier analysis was used to evaluate differences in mean time spent alive and at home across groups. Cox proportional hazard models were used to evaluate the risk of nursing home admission or death across time among cases compared to controls. All analyses were stratified by diagnosis, operative status and frailty.

Results: A total of 90,245 older adults admitted with an EGS diagnosis were identified and matched with controls. Mean patient age was 77.2 (±7.2) years, 54.3% were female and 10.4% were frail. Forty-one percent of patients underwent surgery during their admission. In the 5 years following their EGS admission, cases experienced significantly fewer months alive and at home compared to controls (mean time 43 vs. 50 months, $p < 0.001$). This association held in patients with frailty, whose mean time alive and at home was 28 months (controls 35 months, $p < 0.001$). In subgroup analyses, patients operated on for appendicitis or cholecystitis had long-term outcomes equivalent to controls. However, all other patient subgroups, regardless of diagnosis, operative status or frailty, experienced reduced time alive and at home compared to controls ($p < 0.001$). Cases had a 5-fold increased risk of nursing home admission or death in the first 3 months post-admission (HR 5.11, 95% CI 4.89-5.35). While the risk of nursing home admission or death decreased over time, patients who had experienced an EGS admission remained at elevated risk compared to controls for the entirety of the 5 year follow up (years 2-5, HR 1.17, 95% CI 1.15-1.19).

Conclusion: Older adults who require hospitalization for an EGS diagnosis are at increased risk for death or admission to a nursing home for at least 5 years following admission. However, most patients remain alive and living in their own home for several years following admission. Future work should focus on designing structures and processes of care to decrease the long-term risks experienced by patients discharged home following an EGS admission.

Session IX: Plenary Papers 52-59
Paper 53: 12:20 PM - 12:40 PM

FAST TRACK PATHWAY PROVIDES SAFE, VALUE BASED CARE ON BUSY ACUTE CARE SURGERY SERVICE

Kali M. Kuhlenschmidt MD, Erika K. Bisgaard MD, Natasha Housmand BS, Paul Comish MD, MPH, Stephen S. Luk MD, Joseph P. Minei MD, MBA, Michael W. Cripps MD
UT Southwestern

Invited Discussant: Lillian Kao, MD, MS

Background: Fast track (FT) pathways have been adopted across a multitude of elective services, while being slow to be adopted into the acute care surgery (ACS) realm. We hypothesized that a FT pathway implemented in an ACS service would safely decrease patient length of stay and resource utilization. To minimize variation we selected a singular, common operation, cholecystectomy, compared across two hospitals with well-established ACS services, differing only in the presence of a FT pathway.

Methods: Patients that underwent an urgent or emergent laparoscopic cholecystectomy for acute cholecystitis between May 1 and October 31, 2019 were queried using CPT codes. Patients that required a conversion to open or partial cholecystectomy were excluded as they no longer qualified for the fast track pathway. Retrospective chart review was used to gather information relating to the patients demographics, presentation, hospital course, and outcomes. Hospital length of stay and resource utilization were the primary outcomes.

Results: There was a total of 479 urgent or emergent laparoscopic cholecystectomies performed during the 6 months for acute cholecystitis. Four hundred and thirty (89.8%) were performed under the FT pathway. The median time to the OR following surgical consultation was not different between the two pathways (p=0.316), however, the median length of stay (hours [IQR]) was shorter by 15.9 hours in the FT cohort (22.6 [14.2-40.4] vs 38.5 [28.3-56.3], $p < 0.0001$). Under the FT pathway, only 33% of patients were admitted to the hospital and 75.6% were discharged from the PACU, as compared to 91.8% and 12.2% on the traditional pathway, respectively (both $p < 0.0001$). 59.6% of FT patients received a phone call follow up, as opposed to the traditional pathway where all patients had clinic follow up ($p < 0.0001$). ED bounce back rates, readmission rates, and complication rates were similar between the FT and traditional pathways ($p > 0.2$ for all). On multivariate analysis, fast track pathway patients were 7.65 times more likely to be discharged within 24 hours of surgical consultation (table)**.**

Conclusion: Use of a fast track program for patients with acute cholecystitis results in shorter times in the hospital, less inpatient bed usage and fewer clinic appointments benefiting the hospital, surgeon and patient, without compromise of clinical outcomes. Incorporation of a FT pathway into all areas of ACS should be investigated.

Multivariate logistic regression predicting discharge from hospital within 24 hours of consult

Variable	OR	95% CI	*p*-value
Age (per year)	1.00	0.98 - 1.01	0.481
Female gender	1.01	0.63 - 1.63	0.961
Race and ethnicity	0.83	0.54 - 1.29	0.411
Presence of comorbidities	0.51	0.32 – 0.83	0.006
Operative Time (per minutes)	0.99	0.98 - 0.99	<0.0001
Fast Track	7.65	2.90 - 20.15	<0.0001

Session IX: Plenary Papers 52-59
Paper 54: 12:40 PM - 1:00 PM

WHAT HAPPENS WHEN THEY'RE GONE? THE IMPACT ON HOSPITAL REVENUE AND OPERATIVE CASELOADS WHEN EMERGENCY GENERAL SURGERY OPERATIONS ARE REGIONALIZED

Robert D. Becher MD, Nitin Sukumar, Thomas Gill MD, Kevin M. Schuster MD, MPH, Adrian A. Maung M.D., Michael DeWane MD, Kimberly A. Davis MD, MBA
Yale School of Medicine

Invited Discussant: Jennifer Knight, MD

Introduction: The American College of Surgeons has advocated for the integration of surgical care delivery across geographic areas. Within the field of emergency general surgery (EGS), such a structured system of care has been shown to potentially reduce mortality. However, the possible benefit to patients may be a detriment to hospitals and surgeons. The aim of this study was to determine the financial and operative impact to institutions that would stop performing EGS operations due to regionalization.

Methods: Adult patients who underwent one of ten common EGS operations (see Table) were identified in the California State Inpatient Database (2010-2011). Building on our prior regionalization-simulation work, we identified all acute care hospitals which would be "closed" (meaning stop performing ≥1 EGS operation type) due to the hospital's higher EGS mortality. At these institutions, we calculated operative volumes as well as hospitalization costs across multiple cohorts: EGS-specific; all general surgery; all major surgery (across surgical disciplines); and all hospital discharges. Given the difference between what a hospital charges and the actual costs to the hospital, an institution-specific standardized conversion ratio was applied to calculate costs, which were used as a surrogate for revenue. Operative and financial data were then compared pre- and post-regionalization.

Operation Type (mean mortality rate)	Hospitals "closed"	Mean EGS volume lost, per hospital	Mean EGS revenue lost, per patient	Mean EGS revenue lost, per hospital
Appendectomy (0.9%)	68	34	$13,117	$440,606
Cholecystectomy (1.5%)	73	36	$19,083	$687,743
Colectomy (12.4%)*	181	22	$55,403	$1,237,155
Inguinal & Femoral Hernia (6.8%)	81	5	$13,858	$73,446
Lysis of Adhesions (7.1%)	108	10	$31,301	$312,692
NSTI Excision (13.2%)*	109	6	$43,351	$261,838
Repair of Perforated PUD (17.8%)*	169	7	$44,169	$287,542
Small Bowel Resection (12.1%)*	188	16	$47,283	$749,437
Umbilical Hernia (9.7%)	103	4	$14,456	$63,174
Ventral Hernia (7.1%)	110	6	$18,688	$111,196

Results: A mean of 119 hospitals were "closed," and an average of 14 patients were regionalized, for each EGS operation at each hospital over 2 years (see Table). The weighted-average in lost hospital revenues were $34,823 per patient and $487,881 per hospital (see Table). After EGS regionalization, a significant proportion (>95%; p< 0.001) of a given hospital's mean general surgery operative volume remained intact, as did >98% (p< 0.001) of overall major surgery caseloads. In financial terms, a significant proportion of general surgery hospital revenue (>94%; p< 0.001), of major surgery hospital revenues (>97%; p< 0.001), and of overall hospital discharge revenues (>99%; p< 0.001) also remained intact. When regionalizing only a group of the four highest-mortality operations (mortality >10%; see *Table), operative volumes and hospital revenues at the 60 impacted institutions were not significantly affected.

Conclusions: This study suggests that EGS regionalization may be financially and operatively viable with fewer negative repercussions to "closed" hospitals than generally assumed. The loss of EGS operative volume would have little impact on surgery caseloads. Financially, hospital revenue would not decrease significantly from pre-regionalization levels. Losses to case volume may be offset by increasing elective operative volumes.

Session IX: Plenary Papers 52-59
Paper 55: 1:00 PM - 1:20 PM

MULTICENTER VALIDATION OF THE AAST GRADING SCALE FOR ACUTE CHOLECYSTITIS

Kevin M. Schuster MD, MPH, Michael W. Cripps MD, Kali M. Kuhlenschmidt MD, Luis Taveras MD, Haytham Kaafarani MD, MPH, Majed El Hechi MD, Daniel Cullinane MD, Toby M. Enniss MD, Thomas J. Schroeppel MD, Jennifer Rodriquez, Ruchir Puri MD, Jennifer Mull, Rachel Sensenig MD, Brian Zilberman MD, Marie L. Crandall MD, MPH
Yale School of Medicine

Invited Discussant: Eric Toschlog, MD

Introduction: The AAST patient assessment committee has created grading systems for emergency general surgery diseases to assist with clinical decision making and risk adjustment during research. Single institution studies have validated the cholecystitis grading system as associated with patient outcomes. Our aim was to validate the grading system in a multi-institutional fashion and compare it to the Parkland grade for acute cholecystitis.

Methods: Patients presenting with acute cholecystitis to one of 8 institutions were enrolled. Discrete data to assign the AAST grade were collected. The Parkland grade was collected prospectively from the operative surgeon from four institutions. Parkland grade, AAST grade, and the imaging and operative subscales of the AAST grade were compared using linear and logistic regression to the need for surgical "bail-out" (sub-total or fenestrated cholecystectomy, conversion to open or cholecystostomy), surgical complications (bile leak, surgical site infection, bile duct injury) discharge disposition, all complications and OR time.

Results: Of 861 patients 781 underwent cholecystectomy. Mean age was 51.1 (18.6) and 62.7% were female. There were 6 deaths. Median AAST grade was 2 (IQR 1-2) and median Parkland grade was 3 (IQR 2-4). Median AAST clinical and imaging grades were 2 (IQR 2-2) and 1 (IQR 0-1) respectively. Higher grades were associated with longer operative times and worse outcomes though few were significant (Table). The Parkland grade outperformed the AAST grade based on area under the receiver operating characteristic curve (AROC)

	Any surgical "bail-out" OR (95% CI)	Surgical complication OR (95% CI)	Discharge other than home. OR (95% CI)	Any complication OR (95% CI)	OR time mins (sd)
AAST grade (AROC)	0.608	0.579	0.573	0.599	p< 0.001
Grade I	Reference	Reference	Reference	Reference	98.1 (53.9)
Grade II	1.55 (0.77 – 3.10)	1.26 (0.51 – 3.13)	0.95 (0.50 – 1.77)	1.53 (0.89 – 2.65)	108.9 (6.21)
Grade III	6.46 (2.37 – 17.61)	4.33 (1.27 – 14.57)	3.89 (1.55 – 9.78)	5.39 (2.37 – 12.29)	147.3 (68.9)
Grade IV	3.37 (0.99 – 11.44)	1.34 (0.21 – 8.64)	2.59 (0.91 – 7.44)	3.67 (1.47 – 9.11)	129.1 (56.6)
Grade V	19.36 (1.13 – 330.52)	4.02 (0.09 – 179.80)	2.12 (0.07 – 67.62)	1.75 (0.06 – 55.60)	121.1 (1.4)
AAST imaging grade (AROC)	0.535	0.559	0.547	0.550	p=0.078
Grade I	Reference	Reference	Reference	Reference	111.5 (57.6)
Grade II	1.51 (0.33 – 6.817)	0.51 (0.03 – 9.44)	1.63 (0.40 – 6.61)	0.68 (0.12 – 3.83)	132.3 (52.6)
Grade III	3.25 (1.02 – 10.42)	4.03 (1.14 – 14.24)	3.20 (1.16 – 8.86)	2.93 (1.13 – 7.64)	145.3 (78.8)
Grade IV	1.18 (0.15 – 9.50)	0.80 (0.04 – 15.99)	2.60 (0.75 – 8.96)	0.23 (0.01 – 4.12)	101.0 (25.2)
Grade V	No patients	No patients	No patients	No patients	No patients
AAST Operative grade (AROC)	0.646	0.587	0.641	0.564	p<0.001
Grade I	Reference	Reference	Reference	Reference	103.2 (61.9)
Grade II	2.74 (1.52 – 4.93)	1.72 (0.84 – 3.53)	3.24 (1.28 – 8.16)	1.50 (0.85 – 2.64)	124.4 (53.6)
Grade III	6.18 (2.14 – 17.82)	5.70 (1.83 – 17.76)	7.33 (1.66 – 32.35)	4.80 (1.78 – 12.95)	142.5 (53.2)
Grade IV	24.38 (3.97 – 149.54)	6.96 (0.89 – 54.71)	4.93 (0.20 – 124.61)	3.57 (0.46 – 27.62)	169.6 (47.7)
Grade V	52.16 (0.56 - >999)	6.93 (0.07 – 654.68)	17.99 (0.19 - >999)	3.55 (0.04 – 333.5)	120.0
Parkland grade (AROC)	0.816	0.726	0.684	0.711	p<0.001
Grade I	Reference	Reference	Reference	Reference	68.5 (20.5)
Grade II	.039 (0.01 – 20.59)	1.97 (0.09 – 43.73)	1.17 (0.05 – 30.54)	0.91 (0.13 – 6.52)	78.7 (32.4)
Grade III	2.18 (0.11 – 43.04)	1.69 (0.08 – 34.65)	0.71 (0.03 – 18.52)	0.87 (0.14 – 5.62)	102.2 (73.5)
Grade IV	14.02 (0.78 – 251.03)	8.62 (0.47 – 158.03)	1.24 (0.05 – 32.28)	5.31 (0.93 – 30.32)	123.6 (57.7)
Grade V	23.63 (1.34 – 416.53)	9.41 (0.52 – 171.35)	2.89 (0.14 – 59.52)	3.72 (0.64 – 21.67)	136.1 (77.9)

Table 1: Odds ratios and 95% confidence intervals (OR 95% CI) for outcomes based on AAST grade, imaging grade, operative grade and Parkland grade. Operating room times for each grading scale as mean (sd-standard deviation) AROC – Area under Receiver Operating Characteristic Curve

Conclusions: The AAST cholecystitis grading schema has modest discriminatory power and should be modified before widespread use.

Session IX: Plenary Papers 52-59
Paper 56: 1:20 PM - 1:40 PM

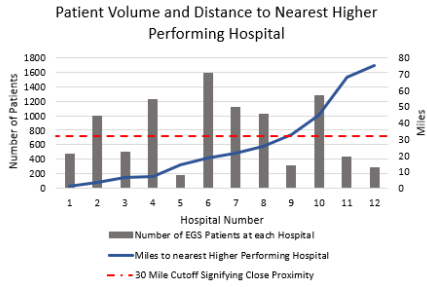
WILL TRAUMA SYSTEMS WORK FOR EGS? QUANTIFYING GEOGRAPHIC PROXIMITY BETWEEN LOWER AND HIGHER PERFORMING EMERGENCY GENERAL SURGERY HOSPITALS

Michael DeWane MD, Nitin Sukumar, Kevin M. Schuster MD, MPH, Adrian A. Maung MD, Kimberly A. Davis MD, MBA, Robert D. Becher MD
Yale Department of Surgery

Invited Discussant: Avery Nathens, MD, PhD, MPH

Introduction: Given the high morbidity and mortality associated with emergency general surgery (EGS), developing integrated local networks of EGS care may be beneficial. However, it is unknown whether geographic relationships between hospitals performing EGS operations affect outcomes. To better understand this issue, our study aimed to quantify: 1) the distance between the lowest-performing EGS hospitals and their nearest higher-performing EGS hospital; and 2) the distance from the lowest-performing EGS hospitals to their nearest Level I or II Trauma Center.

Methods: Adults undergoing 1 of 8 common EGS operations were identified in the California State Inpatient Database (2010-2011), which was paired with the American Hospital Association survey. Hospital-based risk-adjusted standardized mortality ratios based on a prior study were used to stratify hospitals by 3-tiers: poor-performing outliers, average performers, and high-performing outliers. Geographic modeling was used to calculate geodesic straight-line distance from the poor-performing outliers to nearest average or high-performing outlier hospital and nearest Level I or II trauma center.



Results: 217 acute care hospitals were analyzed. 12 hospitals were identified as poor-outliers (see Figure); total EGS cases performed per hospital (bar height) and distance to the nearest higher performing hospital (continuous line) are shown. Median distance to a higher performing hospital was only 20.1 miles (range 1.1-75.3 miles). For 8/12 poor-outlier hospitals performing 7,095 EGS operations over 2 years, a higher-performing center was located within 30 miles (dashed line). Median distance from the poor-outliers to the nearest level I or II trauma center was 48.3 miles; only 4 were located within 30 miles.

Conclusion: The lowest-performing EGS hospitals in California are, on average, located in close proximity to higher-performing EGS institutions. Thousands of EGS patients are operated on at poor-outlier hospitals within just 30 miles of a significantly higher-quality EGS institution. Only 33% of poor-outliers are located near a certified trauma center. As such, existing transfer networks for trauma may not be sufficient for EGS, especially for critically ill patients. Coordination of EGS care across novel networks of hospitals, starting within small geographic areas, may improve outcomes at a systems level.

Session IX: Plenary Papers 52-59
Paper 57: 1:40 PM - 2:00 PM

TRAUMA HEALTH LITERACY: STEPS TOWARD REMEDIATION

Catherine P. Seger MD, Emily Lenart DO, Dina Filiberto MD, Staci Martinez, Richard Lewis MD, Martin A. Croce MD, Louis J. Magnotti MD, MSc
UTHSC Memphis

Invited Discussant: Cherisse Berry, MD

Introduction: Health literacy in trauma patients remains sorely lacking. In a previous study at our institution, less than half of the patients correctly recalled either their injuries or operations post-discharge. Consequently, a simple vernacular discharge information form was developed as part of a quality improvement (QI) project. The purpose of the current study was to evaluate the impact of this form on the injury specific health literacy of these patients. Specifically, we hypothesized that the addition of this simple form would improve patients' knowledge of both their injuries and operative procedures.

Methods: Consecutive patients at a Level 1 trauma center were evaluated prospectively prior to and post-introduction of a discharge information form. All patients discharged following implementation of the QI project received the form. Patients were then surveyed at their first follow-up visit post-discharge (within a 4-month period) for knowledge of their injuries, operations, and satisfaction with their care. Patients discharged prior to implementation of the form (PRE) were then compared to those that received the form upon discharge (POST).

Results: 153 surveys were distributed and 146 were returned and comprised the database. 46 patients (32%) were discharged prior to introduction of the form and comprised the PRE group and 100 (68%) received the form upon discharge and comprised the POST group. 71% of patients were male, with a median age of 32. 59% reported annual household incomes of < $25,000 and 67% had an education level of high school diploma or less. Both the PRE and POST groups were comparable in terms of age, gender, health insurance status, income and education. There was a significant increase in the percentage of patients in the POST group able to correctly recall any provider (31% vs 11%, p=0.009), their injuries and operations compared to the PRE group (Tables). This translated into increased patient understanding (55% vs 35%, p=0.035) and overall patient satisfaction (74% vs 53%, p=0.016) in the POST group.

Recall	PRE	POST	p
Injury			0.0001
None	48%	15%	
Some	22%	29%	
All	30%	56%	

Recall	PRE	POST	p
Operation			0.0012
None	57%	23%	
Some	14%	20%	
All	29%	57%	

Conclusions: Introduction of a simple discharge information form coupled with directed patient education dramatically improved the injury specific health literacy of our patients. Specifically, they were able to confer to the outpatient healthcare provider post-discharge medically relevant features of their care. This study represents an important first step in the ongoing efforts to improve injury comprehension, health literacy and ultimately health outcomes in the trauma patient population.

Session IX: Plenary Papers 52-59
Paper 58: 2:00 PM - 2:20 PM

DEPRESSION PREDICTS LONG-TERM COGNITIVE IMPAIRMENT IN SURVIVORS OF CRITICAL ILLNESS

Mina F. Nordness MD, Jo Ellen Wilson MD, MPH, Caroline Erickson BS, Amy Kiehl, James Jackson, Pratik Pandharipande MD, E. Wes Ely MD, MPH, Mayur B. Patel MD, MPH
Vanderbilt University Medical Center

Invited Discussant: Matthew Lissauer, MD

Introduction: Our group has shown Intensive Care Unit (ICU) survivorship is associated with long-term cognitive impairment (LTCI). We have found an incidence of depression in up to 30%, and Post-Traumatic Stress Disorder (PTSD) in up to 10% of ICU survivors. The goal of this study is to identify the impact of post-ICU mental health disorders on cognition after critical illness. We hypothesized that depression and PTSD are independently associated with LTCI in ICU survivors.

Methods: This is a five-center (2 civilian, 3 Veteran Affairs) nested prospective cohort of critically ill patients admitted to medical and surgical ICUs in shock and/or respiratory failure, who underwent neuropsychological assessments at 3 and 12 months post hospital discharge. Our primary outcome was global cognition using the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS) at 12 month follow-up. Our independent variables were depression (Beck Depression Inventory-II, BDI-II) and PTSD (PTSD Checklist, PCL-S) measured at 3 and 12 months. We performed multivariable linear regression models controlling for covariates such as age, years of education, pre-existing cognitive impairment, Charlson comorbidity index, duration of mechanical ventilation, episodes of hypoxemia, and days of delirium or coma.

Results: There were 590 patients included with a median age of 61 (IQR: 52-70), enrollment Sequential Organ Failure Assessment (SOFA) score of 6 (IQR: 4 - 8), 520 (88%) mechanically ventilated, and 420 (71%) with delirium. Of ICU survivors, 113 (19%) had PTSD and 187 (32%) had depression at 3 months. At 12 months, median RBANS was 80 (IQR 71-87). Depression at 3-months was associated with lower 12-month RBANS (coefficient=-0.409 95% CI -0.813, -0.005 p=0.048). PCL score at 3-months had no association with global cognition at 12 months (coefficient=-0.244, 95% CI -0.732, 0.244, p=0.326). In sensitivity analysis, accounting for PCL increased the effect of depression on cognition at 12 months (coefficient=-0.646 95% CI -1.159,-0.134 p=0.014) and was found to primarily affect the subdomains of immediate (coeff. -0.742 95% CI -1.394, -0.090 p=0.026) and visuospatial memory (coeff -0.720 95% CI -1.325, -0.115 p=0.020).

Conclusions: Early post-ICU depression, but not PTSD, is independently associated with LTCI. When PTSD is controlled for, the effect of depression on cognition is increased. Treatment for early depression represents a novel intervention area for LTCI prevention in ICU survivors.

Session IX: Plenary Papers 52-59
Paper 59: 2:20 PM - 2:40 PM

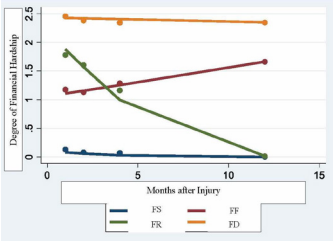
PATIENTS FOLLOW DIFFERENT FINANCIAL HARDSHIP TRAJECTORIES IN THE YEAR AFTER INJURY

Madhuri Nishtala MD, Lava Timsina PhD, Sarah Severance MD, Stephanie A. Savage MD, MSc, Ben L. Zarzaur MD, MPH, University of Wisconsin School of Medicine and Public Health

Invited Discussant: Joseph Minei, MD, MBA

Introduction: After serious illnesses or injury, lost wages, forced unemployment, and other financial burdens contribute to financial worry and poor coping mechanisms that may impair recovery. Collectively, this phenomenon is known as financial hardship or toxicity. While well-studied in cancer, financial hardship is less understood after injury. Previously, we found that experiencing a single episode of financial hardship during recovery after injury is associated with lower quality of life and more psychological distress compared to those without financial hardship. However, recovery is dynamic and patients may move in and out of financial hardship over time. We hypothesized that patients would follow distinct financial hardship trajectories and that these trajectories would be associated with Health Related Quality of Life (HRQoL) outcomes.

Methods: Adults (age $\geq$ 18) with injury severity score (ISS) > 9 but without brain or spinal cord injury were prospectively enrolled and followed for one year. Financial hardship was measured at 1, 2, 4 and 12 months after injury using four questions that covered changes in material conditions and the psychological response. Financial hardship was graded on a scale of 0 – 4 based on the number of positive responses to questions in each domain. The Short-Form 36 (SF-36) was used to asses HRQoL outcomes. Group-based trajectory modeling was employed to identify underlying financial hardship trajectories in the year after injury. Univariate and multivariable analysis identified factors associated with each trajectory and HRQoL outcomes.



Results: 500 patients were enrolled and group-based trajectory modeling revealed that patients followed one of four financial hardship trajectories in the year after injury (FIGURE). Financial Security (FS) was associated with no change in trajectory over time (8.4%). Financially Devastated (FD) patients showed a significant degree of hardship in the first month after injury and never recovered (51.6%). Financially Frail (FF) patients suffered a slow increase in the degree of financial hardship over time (33.6%). Financially Resilient (FR) patients started off with a high degree of hardship but were able to recover by the end of the year (6.2%). Only 15% of patients experience a favorable trajectory (FS and FR). Factors associated with the groups based on post-injury financial hardship trajectory, as well as HRQoL outcomes by trajectory, are shown in the TABLE.

Table. Factors and outcomes associated with various financial hardship trajectories in the year after injury.

	Financially Secure (n=43,8.4%)	Financially Frail (n=168,33.6%)	Financially Resilient (n=31,6.2%)	Financially Devastated (n=258,51.6%)	p-value
Age	45.8±18.2	37.7±14.1	35.6±15.3	36.5±13.5	0.0011
Male (%)	60.5	60.1	51.6	70.1	0.0560
Race/Ethnicity (%)					
Non-White	58.1	55.4	48.4	46.5	0.2320
Socioeconomic Status (Gini Index)	0.41±0.07	0.42±0.28	0.42±0.06	0.43±0.06	0.3624
Insurance Status (%)					
Self-Pay	14.0	41.7	38.7	48.1	0.0010
Injury Severity Score	20.0±10.5	20.6±10.4	18.5±7.7	21.0±9.7	0.5798
Mechanism of Injury (%)					
Blunt	79.1	79.8	83.9	72.5	0.111
Length of Stay	11.9±8.9	12.6±7.7	12.8±11.7	12.7±9.1	0.9557
Readmission (%)	9.3	6.0	6.5	10.5	0.415
SF-36					
Mental Component Score	56.3±11.3	41.8±13.1	54.0±7.9	41.8±13.1	<0.001
Physical Component Score	42.1±14.7	34.8±10.4	46.3±11.1	33.2±10.5	<0.001

Conclusion: Experiencing an unfavorable financial hardship trajectory was associated with not only worse psychological outcomes but also worse physical outcomes. Physical recovery may be impaired by coping strategies associated with financial hardship, such as avoidance of needed rehabilitation. Interventions to improve HRQoL outcomes should consider alleviating financial hardship as a component of the intervention.

Session X: Papers 60-65

Thursday, September 17, 2020

2:00 PM - 4:00 PM

Moderator: Ajai Malhotra, MD

Session X: Plenary Papers 60-65
Paper 60: 2:00 PM - 2:20 PM

ENDOVASCULAR VS OPEN MANAGEMENT OF TRAUMATIC ILIAC ARTERY INJURIES: A REVIEW OF THE AMERICAN ASSOCIATION FOR THE SURGERY OF TRAUMA PROSPECTIVE OBSERVATIONAL VASCULAR INJURY TRIAL (PROOVIT) REGISTRY

Jason A. Miner MD, Claire Hardman, John K. Bini MD, A. Peter Ekeh MD, Timothy C. Fabian MD, David V. Feliciano MD, Richard Catalano MD, Kenji Inaba MD, Joseph J. DuBose MD
Wright State University

Invited Discussant: Nicole Stassen, MD

Introduction: The American Association for the Surgery of Trauma PROspective Observational Vascular Injury Trial (PROOVIT) database has been collecting prospective data on vascular trauma since 2013. The aim of this review is to provide a contemporary analysis of the management and outcomes of iliac artery injuries using the PROOVIT database.

Methods: Registry data from March 2013 to November 2019 were reviewed. All trauma patients who had an injury to the iliac artery were included. Patients with missing data points were excluded from relevant analyses. The primary outcome was in-hospital mortality. Secondary outcomes were mean 24-hour pRBC transfusion requirements, need for reintervention, amputation rate, ventilator free days, and ICU free days.

Results: Two hundred iliac artery injuries were identified, and sufficient data for full analysis was available for 148. Penetrating mechanisms were responsible for 31.9% (61/191) and blunt mechanisms for 68.1% (130/191) of the injuries for which mechanism was known. An open approach was performed in 68 patients while 78 patients were managed with endovascular techniques. Of the 68 open repairs, 43 (63.2%) were for penetrating injury while 25 (36.8%) were for blunt. Of the 78 endovascular repairs, 11 (14.1%) were for penetrating injury while 67 (85.9%) were for blunt. The mortality rate for those managed endovascularly was 22.4% (17/76) vs. 44.6% (29/65) in those who underwent open approach (p=.005). Iliac artery injuries managed with endovascular rather than open techniques had a statistically lower mean 24-hour pRBC transfusion requirement (6 vs 11 units; p=.002) despite the endovascular group having a higher ISS than the open group (26 vs 19; p=.048). Although not statistically significant, the reintervention rate following open approach was 14.7% (10/68) vs. 6.6% (5/76) for endovascular intervention (p=.111). No difference in amputation rates was noted between groups (4.4% open vs. 3.9% endovascular; p=.111). Patients who survived to discharge did not have statistically significant differences in ICU free days (p= .469) or vent free days (p =.483) when calculated out of 28 days.

Conclusions: Our review of PROOVIT registry data demonstrates that endovascular intervention has become increasingly prominent in the management of both blunt and penetrating iliac artery injuries, and is now more common overall than open approaches. In addition, mortality and blood transfusion rates were noted to be significantly lower in the endovascular than open group despite the endovascular group having a significantly higher ISS. Among survivors, no difference in vent free days or ICU free days was noted between the endovascular or open management groups.

Session X: Plenary Papers 60-65
Paper 61: 2:20 PM - 2:40 PM

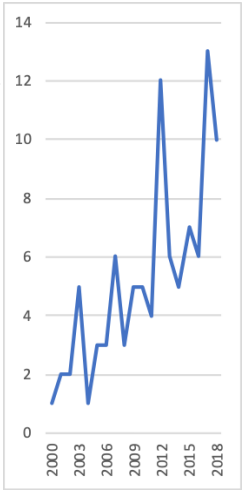
BEYOND THE HEADLINES: A DETAILED ANALYSIS OF 19 YEARS OF MASS SHOOTINGS ACROSS THE UNITED STATES

Richard Lewis MD, Jennings Dooley BS, Nathan Manley MD, Martin A. Croce MD, Louis J. Magnotti MD, MSc
Department of Surgery, University of Tennessee Health Science Center

Invited Discussant: Deborah Kuhls, MD

Introduction: Mass shootings, defined by the US Congress as the murder of three or more people in a public space, have captured the nation's attention over the past several years. Due to increased media focus, the public now perceives this as an increasing threat. Whether this translates to an ominous and increasing trend, or whether early clues to shootings can thwart these killings remains to be established. The goal of this study was to better characterize the phenomenon and identify potentially preventable factors of mass shootings.

Methods: Mass shootings in the United States from 2000-2018 were obtained from the FBI's active shooter registry. Catastrophic mass shootings, defined as the murder of more than nine people in a public space, were also evaluated. Data analyzed included number of deaths, firearm type, caliber, social media postings, psychiatric history, and demographics. Rates of mass shootings per 100M population were stratified by year and compared over time using simple linear regression.



Results: 99 incidents of mass shootings were identified over the study period. Of these, 15 (15%) were catastrophic mass shootings. The median number of deaths per shooting was 5 (range 3-58) and the majority (95%) involved a single shooter. Most shooters were young (mean age of 36), white (55%), and male (95%). 53 had a known psychiatric history and 46 had documented aberrant social media activity prior to their shootings. Handguns (alone or in combination) were the most common type of firearm used (81%). High velocity weapons accounted for 26% of all mass shooting incidents, but 53% of catastrophic mass shootings involved high velocity weapons (p=0.022). Aberrant social media postings occurred in 41% of mass shootings with 9 or fewer deaths, and in 80% of catastrophic mass shootings (p=0.005). The number of mass shootings per year increased over the study period (Figure). Linear regression analysis identified a significant increase in the incidence of mass shootings per 100M population from 0.36 in 2000 to 3.1 in 2018 ($\beta = 0.15$, $p < 0.0001$).

Conclusions: Consistent with popular perception, mass shootings have increased over the past 19 years. While recent efforts at gun reform have focused on high velocity semi-automatic weapons, the dominant role that handguns play in these murders should not be ignored. Given the recent rise in popularity of 'red-flag' laws, identification of worrisome social media posts should play a future role in preventing these tragic attacks.

Session X: Plenary Papers 60-65
Paper 62: 2:40 PM - 3:00 PM

THE PREHOSPITAL USE OF YOUNGER AGE WHOLE BLOOD IS ASSOCIATED WITH AN IMPROVED ARRIVAL COAGULATION PROFILE

Thomas Clements MD, Cameron McCoy MD, Scott Assen MD, Jessica Cardenas PhD, Charles Wade, David Meyer, Bryan A. Cotton MD, MPH
University of Calgary - Cumming School of Medicine

Invited Discussant: Jason Sperry, MD

Introduction: Recent *in vitro* data has shown that the hemostatic profile of WB degrades significantly after 14-days, yet the optimal storage remains debated. We hypothesized that arrival coagulation studies would be improved in patients receiving younger WB in the prehospital setting.

Methods: This study was approved by our institutional IRB. We evaluated all trauma patients who received prehospital blood products by our helicopter service between 07/17-07/19. "Young" WB was defined as 14-days or less. Patients who received at least one unit of "young" WB in the prehospital setting were classified as YOUNG, while the remainder were classified as OLD. Continuous data are presented as medians (25th-75th IQR) with comparisons performed using Wilcoxon Rank sum. Assessments of clinical hemostatic potential included arrival platelet cell count and rapid thrombelastography (r-TEG). Univariate analysis, including one-way ANOVA with repeated measures, was performed (STATA 12.1).

Results: 220 patients received prehospital WB during the study period. Of these, 153 patients received YOUNG WB, while 67 were transfused only OLD WB units. There were no differences in demographics, prehospital or arrival physiology, or injury severity score among the two groups. The measures of clot initiation (ACT) and kinetics (K-time) were improved, as were the measures of clot acceleration/fibrinogen function (angle), and platelet function (MA). As well, arrival platelet count was higher in the YOUNG cohort (TABLE). Though a trend towards less post-arrival transfusion were noted, this was not statistically significant (p=0.220).

Conclusion: Previous *in vitro* data has suggested deterioration of platelet function in cold-stored WB after 14-days. The current study demonstrated decreased global hemostasis by clinically available labs, especially related to fibrinogen and platelet interactions. In this small single center study, this did not translate into increased transfusion requirements. Further studies are needed to determine the optimal storage duration for cold-stored WB for transfusion in the bleeding trauma patient.

TABLE: Hemostatic profile between YOUNG vs OLD whole blood

	YOUNG (n=153)	OLD (n=67)	p-value
r-TEG ACT	113 (105, 121)	113 (105, 128)	0.080
r-TEG K-time	1.5 (1.1, 1.8)	1.8 (1.2, 2.1)	0.024
r-TEG angle	73 (70, 76)	71 (66, 75)	0.014
r-TEG MA	63 (58, 68)	60 (55, 65)	0.063
r-TEG LY-30	0.6 (0.0, 2.7)	0.6 (0.0, 1.8)	0.612
Platelet count x1000	198 (137, 255)	170 (131, 229)	0.050

Session X: Plenary Papers 60-65
Paper 63: 3:00 PM - 3:20 PM

VALIDATION OF A NOMOGRAM PREDICTING BLEEDING CONTROL INTERVENTIONS AFTER HIGH-GRADE RENAL TRAUMA

Sorena Keihani MD, MSc, Joel Gross MD, Ryan Joyce MD, Sherry Wang MD, Douglas Rogers MD, Judith Hagedorn MD, J. Patrick Selph MD, Rachel Sensenig MD, Rachel Moses MD, MPH, Shubham Gupta MD, Nima Baradaran MD, Joshua Broghammer MD, Angela Presson PhD, Raminder Nirula MD, MPH, Jeremy Myers MD
Department of Surgery, University of Utah

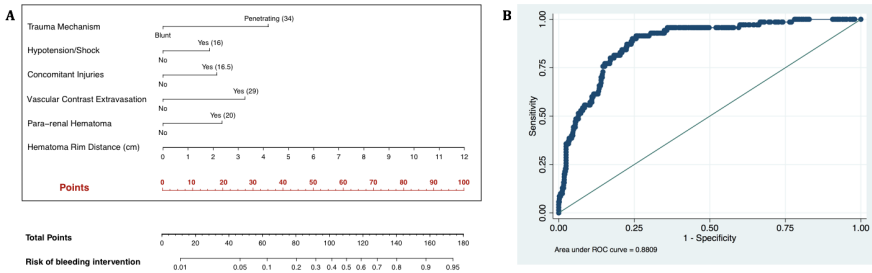
Invited Discussant: Andre Campbell, MD

Introduction: Renal trauma grading has a limited ability to distinguish patients who will need interventions after renal trauma. A nomogram incorporating both clinical and radiologic factors has been previously developed to predict bleeding control interventions after high-grade renal trauma (HGRT). We aimed to externally validate this nomogram using multi-center data from level-1 trauma centers.

Methods: We gathered HGRT (AAST grades III-V) data from 7 Level-1 trauma centers. Two radiologists, blinded to the intervention data, reviewed the initial CT scans, when available. Nomogram variables included: 1. trauma mechanism (penetrating vs. blunt); 2. hypotension/shock; 3. concomitant injury (i.e. any solid organ, gastrointestinal, spinal cord, or major vascular injury, or pelvic fracture); 4. vascular contrast extravasation (VCE); 5. pararenal hematoma extension (beyond aorta on left or IVC on right or into the pelvis); and 6. hematoma rim distance (HRD, i.e. largest measure from the edge of the kidney to the hematoma). Bleeding interventions included nephrectomy, partial nephrectomy, renorrhaphy, renal packing, and renal angioembolization. Mixed-effect logistic regression, with clustering by facility, was used to assess the associations. The prediction accuracy of the nomogram was assessed using the area under the receiver operating characteristic curve (AUC) and its 95% confidence interval (CI).

Results: A total of 560 HGRT patients with a median (interquartile range) age of 32 (23-47) years were included. Median injury severity score was 27 (17-38). Trauma mechanism was blunt in 89%. Injuries were grade III, IV, and V in 58%, 35%, and 7%. Overall, 71% had concomitant injuries and 21% presented in shock. Using initial CT scans, 14% had VCE and 37% had pararenal extension of hematoma. Median HRD was 1.7 (0.9-2.6) cm and 14% had an HRD≥3.5 cm. Overall, 88% underwent expectant management and 12% underwent bleeding control interventions including 34 angioembolizations and 26 nephrectomies. Presence of VCE was associated with 7.5-fold increase in odds of bleeding interventions (95% CI: 4.3–13.2). Every cm increase in HRD was associated with 88% increase in odds of bleeding interventions (OR:1.88; 95% CI: 1.61–2.19) and an HRD≥3.5 cm was associated with 7.7-fold increase in odds of intervention (95% CI: 4.4–13.6). In the multivariable analysis validating the nomogram variables, the model provided excellent discrimination (AUC: 0.88; 95% CI: 0.84–0.92).

Conclusions: Our results reinforce the importance of select radiologic findings in predicting interventions after renal trauma. The prediction accuracy of the proposed nomogram remains high using external data. These variables can help to better risk stratify renal injuries and to potentially reduce the number of unnecessary renal explorations.



A) The MiGUTS (Multi-institutional Genito-Urinary Trauma Study) nomogram for predicting bleeding interventions after high-grade renal trauma.
B) Receiver operating characteristic curve for validation of the nomogram using external data (AUC=0.88, 95% CI:0.84–0.92)

Session X: Plenary Papers 60-65
Paper 64: 3:20 PM - 3:40 PM

PROLONGED METABOLOMIC ALTERATIONS CHARACTERIZE PERSISTENT INFLAMMATION, IMMUNOSUPPRESSION, AND CATABOLISM SYNDROME AFTER SEVERE TRAUMA

Dara L. Horn MD, Lisa Bettcher BS, Joseph Cuschieri MD, Raftery Daniel PhD, Grant E. O'Keefe MD, MPH
University of Washington

Invited Discussant: Paul Bankey, MD

Introduction: Following trauma, persistent inflammation, immunosuppression, and catabolism are proposed to characterize delayed recovery or failure to recover. Understanding the metabolic pathways associated with these adverse outcomes may facilitate rapid identification and intervention. We sought to characterize the metabolomic profiles of trauma victims who die or develop chronic critical illness (CCI), and hypothesize that evidence of inflammation, immunosuppression, and catabolism would exist by 7 days after injury.

Methods: Trauma victims ≥ 16 years old with shock (SBP < 90 mmHg or base deficit ≥ 6 meq/L) were eligible. We excluded those with isolated severe neurologic injury. Venous blood samples collected at multiple time points were analyzed using mass spectrometry. Subjects who died or developed CCI (ICU LOS ≥ 14 days with persistent organ dysfunction) were compared to subjects who recovered rapidly (ICU LOS ≤ 7 days with no organ dysfunction), as well as uninjured controls. Principal component analysis (PCA), pathway enrichment and topology analyses, and *t*-tests were used to make broad metabolomic comparisons and identify differences in metabolic pathways and metabolite concentrations. Statistical significance was defined as a $p < 0.01$ after correcting for multiple comparisons.

Results: Of 120 eligible subjects, 5 died, 22 developed CCI, and 33 recovered rapidly. The median age was 53 years [IQR 26-61]. Subjects were predominantly male (65%) with a median ISS of 36 [IQR 29-45]. Healthy controls (n = 48) had similar age and sex distributions. Differences between injured subjects and controls, and between injury outcome groups were observed on PCA as early as 12 hours and 1 day post-injury, respectively. Comparing injury outcome groups, 36 metabolites differed significantly on day 7 and represented alterations in pathways involved in inflammation ($p < 0.001$), oxidative stress ($p < 0.001$), and amino acid metabolism ($p < 0.001$). Figure 1 plots the relative concentrations of three central metabolites in each pathway—arachidonate, kynurenine, and serine—on day 7 compared to controls.

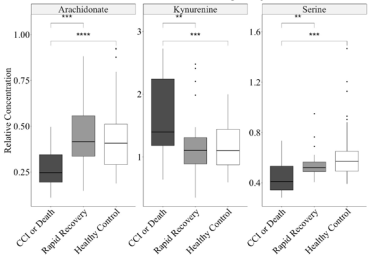


Figure 1: Relative metabolite concentrations on day 7 by group, compared to healthy controls (** p < 0.01, *** p < 0.001, **** p < 0.0001).

Conclusions: Seven days post-injury, metabolomic profiles in subjects who ultimately die or develop CCI differ significantly from those who have recovered with alterations in inflammation, immunosuppression and catabolism. This is the first study to use metabolomics to define potentially modifiable characteristics of adverse outcomes following trauma.

Session X: Plenary Papers 60-65
Paper 65: 3:40 PM - 4:00 PM

TRAUMA BAY VIRTUAL REALITY - A GAME-CHANGER FOR ATLS INSTRUCTION AND ASSESSMENT

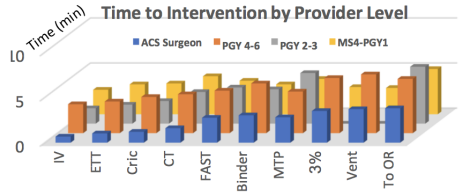
Alexander L. Colonna MD, MSCI, Riann Robbins MD, Jeanine Stefanucci PhD, Mark Durham, Sarah Creem-Regehr PhD, Brandon Patterson MSc, Benjamin Engel MSc,
Alexander Colonna MD, MSCI
University of Utah

Invited Discussant: Daniel Grabo, MD

Introduction: Medical education research highlights the need for high-fidelity, multidisciplinary, simulation training to teach complex decision-making skills such as those taught in ATLS. This approach, however, is expensive and time-intensive, limiting ATLS availabilty. Virtual reality (VR) education simulation may improve skill acquisition in a cost-effective and time-sensistive manner. We developed a novel trauma VR simulator (TVRSim) for providers to apply ATLS principles during a VR trauma resuscitation. We hypothesized the TVRSim could differentiate competency between participants with increasing levels of training and would be well accepted.

Methods: Providers at a level 1 trauma center (trauma attending (reference), novice (MS4 & PGY 1), junior (PGY 2 & 3), senior (PGY 4-6) general surgery residents) ran a blunt, polytrauma VR code. Ten critical decisions points were assessed: intubation, cricothyroidotomy, chest tube, IV access, FAST, pelvic binder, activation of MTP, administration of hypertonic saline (HTS), hyperventilation and decision to go to the OR. Learner assessment was based upon frequency and time to correct decisions. Participant satisfaction was measured using validated surveys.

Results: All 16 providers intubated, obtained IV access, and performed a FAST exam. Seniors, juniors and novices frequently failed at pelvic binder, HTS and hyperventilation decisions. Juniors also often failed at cricothyroidotomy (50%), MTP (50%) and OR (50%) decisions. Novices also failed at chest tube (40%), pelvic binder (40%), MTP (80%), HTS (80%), hyperventilation (80%) and OR (60%) decisions. Mean time to all decisions was longer for all groups compared to the attending.(fig) Mean number of decisions/min was significantly higher for the attending (2.6) compared to others (senior=1.4, junior=1.1, novice=1.4, $p < 0.05$). None of the juniors and novices saved the VR patient while 75% of seniors and the attending succeeded. Participants found TVRSim comfortable, easy to use/interact with/performance enhancing, and helped develop skills and learning.



Conclusions: TVRSim was able to discern decision-making abilities among trainees with increasing training level through measuring a combination of number of correct decisions, time to decision and survival of the VR patient. All trainees felt the platform enhanced their performance and facilitated skill acquisition and learning. If TVRSim is further validated, it could be a useful adjunct to teach and test trauma resuscitation skills on an individual level or as part of ATLS.

Session XI:
Quickshot Session I

1-13

Friday, September 18, 2020
9:00 AM - 10:18 AM
Moderator: Jeffrey Claridge, MD

Session XI: Quickshot Session I 1-13
Quickshot 1: 9:00 AM - 9:06 AM

PATTERN-BASED ANALYSIS OF GENE EXPRESSION PROFILE BY CANONICAL DISCRIMINANT ANALYSIS COULD IDENTIFY THE PATHOPHYSIOLOGY REGARDLESS OF THE SEVERITY

Goro Tajima MD, PhD, Eri Uemura MD, Ayako Tokunaga PhD, Miyuki Miura, Takahiro Umehara PhD, Kazuya Ikematsu MD, PhD, Osamu Tasaki MD, PhD
Nagasaki University Hospital Acute & Critical Care Center

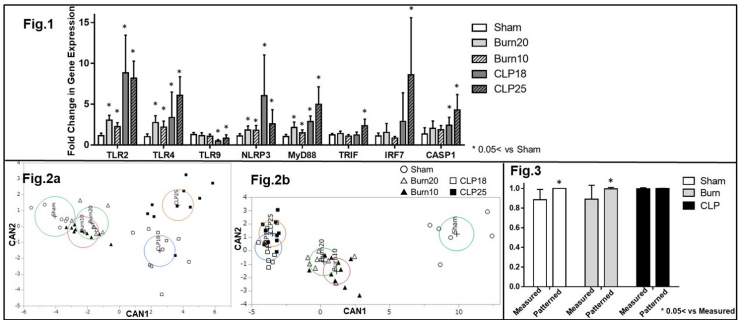
Invited Discussant: Lawrence Diebel, MD

Introduction: Under the severe systemic inflammation, it is difficult to identify the pathophysiology using a single biomarker which varies according to the severity. We reported that there were distinctive patterns of gene expression of the innate immune receptors according to the injury in 76th AAST meeting. We aimed to clarify that the pattern-based analysis of the gene expression profile could determine the pathophysiology regardless of the severity.

Methods: We employed cecal ligation and puncture (CLP) using 18G and 25G needle, and 20% and 10% full thickness burn injury model for the different severity inflammation. C57BL/6 mice underwent sham (n=6), CLP18, 25 (n=10 in each), or Burn20, 10 (n=10 in each). 24 hours after injury, mice were sacrificed, and total RNA was extracted from whole blood. Using quantitative RT-PCR, we investigated gene expression of innate immune receptors and signaling molecules (Fig.1). All the measured data was scaled to the relative value divided by the largest mean value in the parameters for patterning. Canonical discriminant analysis (CDA) was performed using the measured data and the patterned data, and compared the diagnostic rate according to the injury regardless of the severity

Results: Gene expressions of TLR2, TLR4, NLRP3 and MyD88 were significantly increased in all the groups compared to sham ($p < 0.05$). That of TLR9 was significantly decreased in both CLP groups compared to sham ($p < 0.05$) (Fig.1). CDA using measured data could considerably distinguish each groups (Fig.2a). On the other hand, CDA using patterned data showed identification according to the pathophysiology more clearly (Fig.2b). Pattern-based analysis showed higher diagnostic rate in sham (88.5% vs 100%) and Burn (88.2% vs 99.5%) regardless of the severity compared to measured data ($p < 0.05$) (Fig.3).

Conclusion: Pattern-based analysis of the gene expression by CDA could identify the pathophysiology clearly regardless of the severity.



Session XI: Quickshot Session I 1-13
Quickshot 2: 9:06 AM - 9:12 AM

CAN THE USE OF A PUBLICLY-AVAILABLE SAFETY ALERT APP IMPROVE URBAN TRAUMA TEAM PRE-HOSPITAL NOTIFICATION?

Leandra Krowsoski MD, Charles DiMaggio PhD, Rafael Sedaghatzandi, Spiros Frangos MD, Cherisse Berry MD, Marko Bukur MD, Manish Tandon MD, Douglas Isaacs MD, H. Leon Pachter MD, Michael Klein MD
NYU School of Medicine

Invited Discussant: John Porter, MD

Introduction: Pre-hospital notification is a core component of mature trauma systems and is associated with improved survival. Although Emergency Medical Services (EMS) commonly provide pre-notifications, numerous factors, including primarily focusing on patient care, may delay communications. Citizen® is a publicly-available mobile app that monitors emergency radio transmissions to inform users of surrounding urban area safety threats. This app has been used informally by trauma surgeons at our institution to stay apprised of nearby public safety incidents that could potentially lead to trauma team activations. We hypothesized that the app may provide earlier pre-notification than conventional EMS contact. The objective of this study was to assess the ability of this app to provide timelier trauma team pre-notification and to investigate the accuracy of the information provided.

Methods: All trauma activation alerts at an urban Level 1 trauma center over a two-year period (July 2017-June 2019) were retrospectively reviewed. These alerts were compared to public safety alerts broadcast by the Citizen® app within the trauma center's catchment area over the same timeframe and matched by incident using temporal, geographic, mechanistic, and demographic information. Only incidents that were deemed a match were included in the analysis. Our primary outcome was the difference in notification times between EMS-prompted hospital notification and the app notification. Information and timestamps between traditional notifications (i.e. field EMS to central dispatch to hospital) and the app were compared using the Mann-Whitney U test. We estimated agreement and Cohen's kappa for interrater reliability between sources for injury causes and mechanisms, as well as the sensitivity, specificity and predictive value of the app compared to EMS notifications.

Results: One hundred twelve subjects were matched from 107 incidents. Citizen® app notifications preceded EMS 95.5% of the time (107/112). The mean difference between EMS and app notification times was 42 minutes (95% CI 32, 52) with a range of -15 minutes to 329 minutes. Ten patients involved in five multiple-casualty incidents (MCI) were identified; all were categorized as MCIs by the app an average of 36 minutes before the traditional system (95% CI 25, 47), with notification times ranging from 9 minutes to 56 minutes earlier (Figure 1). Under a non-parametric paired Mann-Whitney U test, the time differences for notifications were statistically significant for both MCI ($p=0.006$) and individual incidents ($p < 0.001$). Overall agreement on mechanism of injury for the two sources was 69.6% with a kappa of 0.61 ($p < 0.001$); the app was most accurate in correctly identifying gunshot wounds with a sensitivity, specificity, and predictive value all greater than 90%.

Conclusions: A publicly-available mobile app that informs users about community safety incidents can provide timely trauma team pre-notification with reasonable information accuracy. Further studies are needed to define how to best integrate crime surveillance and safety alert mobile apps into current pre-notification processes to strengthen 21 st-century trauma communication systems.

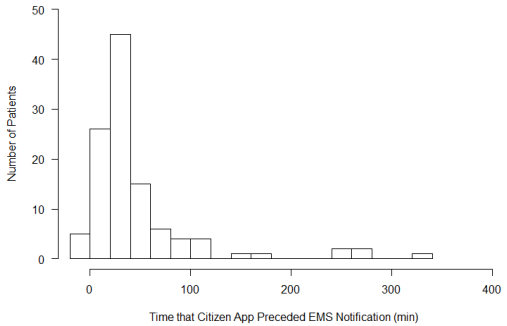


Figure 1: Differences in Notification Times

Session XI: Quickshot Session I 1-13
Quickshot 3: 9:12 AM - 9:18 AM

DAYS THAWED DOES NOT AFFECT SURVIVAL, BLEEDING, OR BIOMARKERS IN PATIENTS RECEIVING PREHOSPITAL FRESH FROZEN PLASMA: PAMER SECONDARY ANALYSIS

Katherine Reitz MD, Daniel Gruen PhD, Francis X. Guyette MD, Joshua B. Brown MD, MSc, Mark Yazer MD, Brian Daley MD, MBA, Richard S. Miller MD, Brian G. Harbrecht MD, Jeffrey A. Claridge MD, MSc, Herbert A. Phelan, III MD, Brian Zuckerbraun MD, Jason Sperry MD
UPMC

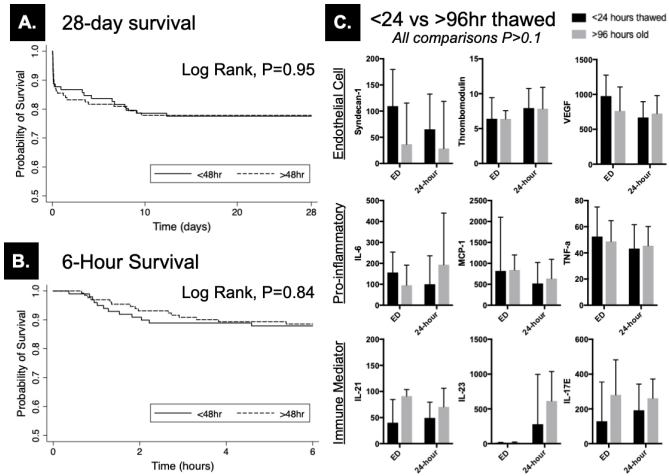
Invited Discussant: Martin Schreiber, MD

Introduction: Prehospital plasma administration during air medical transport reduces the endotheliopathy of trauma, circulating pro-inflammatory cytokines, and 28-day mortality among traumatically injured patients at risk of hemorrhagic shock. To facilitate prehospital plasma administration, each hospital base stored thawed plasma for up to 5 days (120 hours). Animal models suggest longer storage of thawed plasma increases the risk of early death. However, no clinical data currently exists evaluating the age of thawed plasma and its association with post-traumatic mortality.

Methods: We performed a secondary analysis from the prehospital plasma administration randomized controlled trial, PAMPer. Patients at risk for hemorrhagic shock were randomized 1:1 to 2 units of prehospital plasma or standard of care. Among patients randomized to plasma, we dichotomized the days of thawed plasma into < 48 and > 48 hours comparing baseline characteristics and 24-hour transfusion requirements. Survival analysis was performed to determine the survival benefit of plasma by time thawed. Inflammatory cytokines were quantified in those with plasma thawed < 24 and > 96 hours at emergency department (ED) admission and 24 hours later, compared with Kruskal–Wallis.

Results: 230 patients received prehospital plasma, 99 (43%) received plasma thawed for < 48 hours. There were no statistically or clinically significant differences in age (45 years [SD 17]), mechanism of injury (blunt, N=46 [20%]), injury severity score (24 [SD 15]), prehospital interval (47 minutes [SD 21]), or interfacility transfers (N=52 [23%]; all p>0.5). There were also no differences in ED vitals: heart rate (107 [SD 22]), systolic blood pressure (106mmHg [SD 33]), and Glasgow coma scale (8 [SD 6]; all p > 0.2). Kaplan-Meier curve (**FigA, B**) demonstrates no differences in 28-day (p=0.95) or 6-hour (p=0.84) mortality. There were no differences 24-hour packed red blood cell transfusions (< 48, 3 [IQR 1,6] vs > 48, 3 [IQR 0, 7]; p=0.52) or multisystem organ failure (< 48 hours, N=64 [65%] vs > 48 hours, N=81 [62%]; p=0.66) among > 24-hour survivors (N=198 [86%]). There were no differences in endothelial, pro-inflammatory, immune cytokines among plasma thawed for < 24 or > 96 hours (all P > 0.1; **FigC**).

Conclusion: Despite preclinical data, we provide no evidence that longer storage of thawed plasma confers negative outcomes among patients at risk of hemorrhagic shock.



Session XI: Quickshot Session I 1-13
Quickshot 4: 9:18 AM - 9:24 AM

STANDARDIZATION OF OPIOID PRESCRIPTION AFTER TRAUMA (STOP TRAUMA): A PROSPECTIVE INTERVENTION TO REDUCE EXCESSIVE OPIOID PRESCRIPTION.

Eric Walser MD, Amy Makish, Patrick Muprhy MD, MSc, MPH, Luke Hartford MD, MSc, Laura Allen MSc, Collin Clarke MD, Daryl Gray MD, Richard Hilsden MD, Neil Parry MD, Ken Leslie MD, Kelly Vogt MD, MSc
Western University

Invited Discussant: Alexandra Briggs, MD

Introduction: Opioid abuse is one of the major contemporary issues in health care, and trauma patients are at high risk for post-injury opioid use disorders. We undertook this study to determine if the introduction of a standardized pain management pathway was associated with 1) at least equivalent pain control and 2) a reduction in opioid prescription amongst patients admitted to a Canadian Level I trauma centre.

Methods: This was a prospective trial between January 2019 and February 2020, with a standardized pain management pathway introduced in September 2019. Trauma patients admitted for > 24 hours and discharged home were eligible. Those with an ICU stay > 14 days, age > 85 years, or those using opioids at admission were excluded. The intervention included: 1) physician and nursing education; 2) emphasis on multi- modal analgesia; 3) patient and family education. Rational prescribing based on inpatient opioid use was recommended, but discharge prescriptions were at clinician discretion. Patients completed a modified Brief Pain Inventory at their first trauma clinic visit (within 2 weeks of discharge). The primary outcome was patient-reported pain on a 10-point scale, compared using a two-sample *t*-test for non-inferiority (NI). Sample size for NI ($p < 0.025$) was determined *a priori* to be 44 patients in each group. Secondary outcomes were compared using chi-square test, Mann-Whitney U test, and independent samples *t*-test, where appropriate.

Results: A total of 147 patients were included; 100 pre- intervention (Pre-I) and 47 post- intervention (Post-I). The mean pain scores were 4.7 (SD 2.3) in the Pre-I phase and 4.3 (SD 2.6) in the Post-I phase (mean difference -0.4, 97.5% CI -1.4 to 0.5, $p < 0.001$ for NI, $p=0.34$ for superiority). Secondary outcomes are compared in Table 1. The reduction in discharge prescription OME (oral morphine equivalents) corresponds to a 38% reduction in overall opioid prescription.

Variables	Pre-I (n=100)	Post-I (n=47)	*p*
Age, mean (SD)	49.8 (18.4)	48.8 (18.5)	0.76
Gender, n male (%)	77 (77)	32 (68)	0.31
LOS, median days [IQR]	3.5 [2-5]	3.0 [2-6]	0.77
ISS, mean (SD)	15.5 (7.7)	14.9 (8.5)	0.66
Good[a] pain control in hospital, n (%)	76 (76)	32 (68)	0.31
Good[a] pain control post- discharge, n (%)	59 (59)	26 (53)	0.67
Discharge Rx total OME, median [IQR]	**72 [0-144]**	**0 [0-144]**	**0.013***
Patients discharged with opioid Rx, n (%)	67 (67)	22 (47)	0.019*
Patients receiving additional opioid Rx post-discharge, n (%)	22 (22)	9 (19)	0.67

a- Patients rating their pain control Good or Very Good on a 5- point Likert scale, **Rx-** prescription

Table 1. Characteristics and outcomes of patients treated pre- and post- intervention.

Conclusion: A standardized multimodal pain pathway with emphasis on patient and provider education was NI with respect to post-discharge pain and significantly reduced opioid prescription following trauma. We believe implementation of similar protocols will have a significant impact on the opioid crisis.

Session XI: Quickshot Session I 1-13
Quickshot 5: 9:24 AM - 9:30 AM

THE RELATIONSHIP BETWEEN CORTISOL REPONSE AND THE DEVELOPMENT OF CHRONIC PAIN IN TRAUMATICALLY INJURED PATIENTS

Colleen Trevino PhD, Timothy Geier PhD, Rachel S. Morris MD, Terri deRoon-Cassini PhD
Medical College of Wisconsin

Invited Discussant: Preston Miller, MD

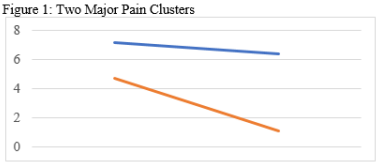
Introduction: The relationship between pain and stress is widely accepted, yet the underlying neuroendocrine mechanisms involved are less understood. Cortisol secretion during a non–pain-related stress response, found during the fight or flight response, may distract attention from a concurrent painful stimulus, thereby inhibiting pain. However, when pain is the stressor, cortisol secretion may intensify its experience and condition a fear-based memory of pain. Although these hypotheses have not been validated, it seems logical cortisol dysfunction contributes to the development of chronic pain. This study attempts to determine the relationship between acute pain, chronic pain, and the stress response in the traumatically injured population.

Methods: Secondary analyses of a prospective observational study with participants admitted to a Midwestern Adult Level I Trauma Center post traumatic injury, with interview and serum cortisol taken at hospitalization (baseline) and 6 months after discharge was completed using Ward's Method hierarchical cluster analysis, Pearson's correlations, and linear regressions.

Results: Two major clusters were identified (Figure 1). The Chronic Pain (CP) group were those participants who had severe pain at discharge and continued to have severe pain. The Resolved Pain (RP) group were those who had moderate pain at discharge and their pain improved or resolved. Pain score at discharge significantly, negatively correlated with baseline cortisol levels (r= -0.142, p=0.02). Minority status, single individuals, low cortisol at baseline, and greater psychological distress at baseline significantly increased the likelihood of developing chronic pain (Figure 2).

Conclusions: Higher baseline pain scores were associated with low cortisol. Low cortisol and greater psychological stress, which also appear to be associated with minority status and single individuals, contribute to the development of chronic pain in the traumatically injured population. Trauma victims who do not have an adequate cortisol response to acute injury and pain are at risk for the development of chronic pain after injury. Further exploration is needed to determine the etiology of a blunted cortisol response and may be associated with pre-injury stressors.

Figure 1: Two Major Pain Clusters



		Mean Baseline Pain Rating (SD)	Mean 6 Month Pain Rating (SD)
Chronic Pain	n=45	7.2 (2.1)	6.4 (1.9)
Resolved Pain	n=123	4.7 (2.5)	1.1 (1.4)

Figure 2: Likelihood of Developing Chronic Pain

	n Chronic Pain	n Resolved Pain		OR (95% CI)
High BL Cortisol	13	72	15.3% of high BL cortisol with CP	0.29 (0.14-0.60)*
Low BL Cortisol	32	51	38.6% of low BL cortisol with CP	1.00 (1.00-1.00)*
Minority	31	57	35.2% of minorities with CP	2.56 (1.24-5.29)*
White	14	66	17.5% of whites with CP	1.00 (1.00-1.00)*
No Relationship	23	40	57.7% of singles with CP	2.12 (1.06-4.25)*
Relationship	22	81	27.2% of relationship with CP	1.00 (1.00-1.00)*

$P < 0.001$

Session XI: Quickshot Session I 1-13
Quickshot 6: 9:30 AM - 9:36 AM

TRAUMA CENTER DESIGNATION CAN NULIFY THE EFFECT OF CARE DISCONTINUITY

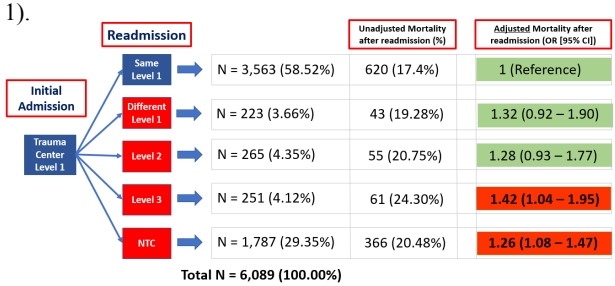
Manuel Castillo-Angeles MD, MPH, Cheryl Zogg MPH, Molly Jarman PhD, MPH, Stephanie Nitzschke MD, Reza Askari MD, Zara Cooper MD, MSc, Ali Salim MD, Joaquim Havens MD
Brigham and Women's Hospital

Invited Discussant: Daniel Margulies, MD

Introduction: Care discontinuity, readmission to a non-index hospital following surgery, has been shown to increase mortality in emergency general surgery. It is unknown if this effect exists in trauma patients. We hypothesize that the established systems and standards of care associated with trauma center designation would negate this effect. Our goal was to determine the effect of trauma center designation on mortality in the setting of care discontinuity.

Methods: This was a retrospective analysis of Medicare inpatient claims (2014-2015) of older adult trauma patients admitted to Level 1 trauma centers. Care discontinuity was defined as readmission within 30 days to a non-index hospital. Trauma center designation was categorized as Level 1, 2, 3, and Non-trauma centers (NTC). Multivariate logistic regression analysis was performed to determine the association of trauma center designation, care discontinuity and mortality.

Results: There were 188,734 patients admitted to a level 1 trauma center. Of these, 6,089 (20.22%) were readmitted within 30 days of discharge. Overall 30 day-mortality after readmission was 20.8%. After adjusted analysis, there was no difference in mortality between patients readmitted to the same level 1 (index), different level 1 (non-index), or level 2 trauma centers. Patients readmitted to level 3 or NTC had higher odds of mortality (Figure 1).



Conclusion: Mortality after readmission for trauma in the elderly is very high. Unlike emergency general surgery, care discontinuity within similarly designated trauma centers is not associated with increased mortality. Readmission to a less advanced or non trauma center is associated with increased mortality. It is likely the process measures and established standards of care associated with trauma center designation contribute to this outcome. This supports the use standardized processes of care in other at-risk patient groups, including emergency general surgery.

Session XI: Quickshot Session I 1-13
Quickshot 7: 9:36 AM - 9:42 AM

APHERESIS PLATELETS HAVE COMPROMISED AGGREGATION COMPARED TO POOLED PLATELETS

Christina Riojas MD, Michael Ekaney PhD, Juan Carillo-Garcia BS, Iain McKillop PhD, Susan Evans MD
Carolinas Medical Center, Atrium Health

Invited Discussant: Noelle Saillant, MD

BACKGROUND: Platelets, which are routinely used for the clinical correction of coagulopathy, have limited availability due to short shelf life (5 days). Previous studies have identified cold storage and cytochrome c (cyt c) supplementation as protective of ex vivo platelet function in pooled platelets and cold stored whole blood. Because apheresis platelets are the predominant source of stored platelets, we sought to determine the effect of storage temperature and cyt c on platelet aggregation function in apheresis platelets stored in platelet additive solutions (PAS). We hypothesized that cold storage and cyt c supplementation preserves function of apheresis platelets.

METHODS: Apheresed platelets (n=5) were collected into InterSol-PAS (Fresenius Kabi), and divided into 3 separate bags designated as control (vehicle), cyt c-d1 (100μM cyt c added day 1) and cyt c-d1/10 (100μM cyt c added day 1 and day 10). Platelets were stored at 4°C without agitation. Sequential aliquots (5 mL; days 1, 5, 10, and 15) were collected and platelet mapping thromboelastography (PM-TEG) assessing adenosine diphosphate (ADP) and arachidonic acid (AA) receptor platelet stimulation, oxygen consumption, and biochemical parameters were measured. In order to establish baseline function for comparison, platelet coagulation was determined on day 1 in pooled platelets from 5 donors.

RESULTS: Baseline ADP and AA induced aggregation were substantially impaired in apheresis platelets compared to pooled platelets, and this persisted throughout storage even with cyt c supplementation. Apheresis platelets also demonstrated a decline in oxygen consumption at day 5, 10 and 15 compared to day 1. Initial lactate concentration was similar for apheresis and pooled platelet aliquots, although pH was significantly lower in apheresis platelet aliquots. Lactate concentration rose significantly in the apheresis platelet aliquots throughout storage compared to baseline.

CONCLUSIONS: Apheresis platelets demonstrate markedly depressed aggregation function immediately after collection compared to pooled platelets which does not recover despite administration of cyt c. This dramatic aggregation suppression may be attributed to the mechanical nature of the apheresis collection process, which is fundamentally different than the process for collecting pooled platelets. The platelet additive solution may also have an impact on the decreased function. Subsequent studies to determine the impact of this suppressed ex vivo aggregation on in vivo bleeding are warranted. If decreased in vivo function is shown to correlate with poor effect from platelet transfusion, techniques to ameliorate or avoid this would help optimize use of platelets.

Session XI: Quickshot Session I 1-13
Quickshot 8: 9:42 AM - 9:48 AM

TRAUMA PATIENT TRANSPORT TIMES AND MORTALITY UNCHANGED DESPITE TRAUMA CENTER PROLIFERATION

Michael Jones MD, Jordan Paulus BS, Kristina Chapple PhD, James Bogert MD, Hahn Soe-Lin MD, Jordan Jacobs MD, Jordan A. Weinberg MD
Dignity Health, St. Joseph's Hospital and Medical Center

Invited Discussant: Nicholas Namias, MD, MBA

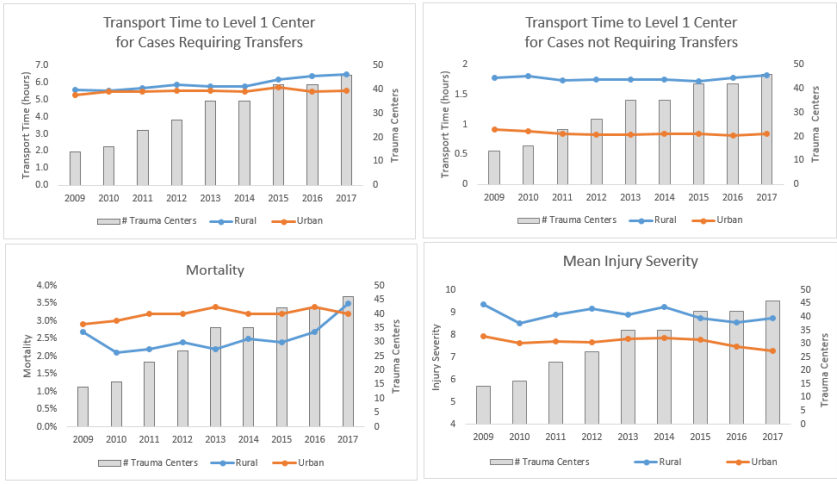
Introduction: In certain regions of the U.S. there has been a dramatic proliferation of trauma centers. The goal of our study was to evaluate transport times and patient mortality during this period of trauma center proliferation.

Methods: Aggregated data summarizing level 1 trauma center admissions in Arizona between 2009 and 2017 were provided to our institution by the Arizona Department of Health Services. We evaluated transport times, injury severity and mortality for both rural and urban injuries.

Results: Data included statistics summarizing 230,505 level 1 trauma admissions in the state of Arizona. The number of state-designated trauma centers during this time increased from 14 to 46, with level 1 centers increasing from 8 to 13. The median scene to level 1 transport time remained relatively unchanged in urban areas from 1.0 to 0.98 hours from 2009 to 2017. In rural areas, transport times were nearly three times longer with the median scene to facility time increasing from 2.59 to 3.56 hours. Figure 1 demonstrates median transport times to level 1 centers for urban and rural with (upper left) and without (upper right) interfacility transfers. From 2009 to 2017, there was an upward trend in both urban and rural mortality by 0.3% (2.9% vs 3.2%) and 0.8% (2.7% vs. 3.5%), respectively (Figure 1 – lower left); Slight decreases in mean ISS (rural 9.35 vs. 8.23; urban 7.94 vs 7.28) were observed over this period (Figure 1 – lower right).

Conclusion: Despite the 3-fold increase in the number of state-designated trauma centers, neither transport time nor mortality has decreased in both rural and urban areas. These findings highlight the need for regulatory oversight regarding the number and geographic placement of trauma centers.

Figure 1. Transport times, mortality and injury severity for level 1 trauma center admissions in rural and urban areas.



Session XI: Quickshot Session I 1-13
Quickshot 9: 9:48 AM - 9:54 AM

IMMUNE SIGNATURES CORRELATE WITH CLINICAL OUTCOME AFTER TRAUMA INJURY

April Mendoza MD, MPH, Susan Raju Paul MD, Majed El Hechi MD, Leon Naar MD, Charlie Nederpelt, Inge Van Erp, Sarah Mikdad, George Velmahos MD, PhD, Mark Poznansky MD, PhD, Patrick Reeves PhD
Massachusetts General Hospital

Invited Discussant: Jennifer Leonard, MD, PhD

Introduction: Major injury results in an early cascade of immunologic responses that can increase susceptibility to complications including infection. We propose that detailed immune profiling can identify immune signatures that correspond to patient outcomes.

Methods: Trauma patients were prospectively enrolled between Sept 2018 and December 2019. Serial whole blood samples were obtained from trauma patients (median ISS 24 [21-34]) at days 1 and 3 after injury, and from age- and sex-matched uninjured controls using a standardized protocol for fixation, storage, and staining. Samples were labeled for mass cytometry with a 38-marker panel. Computational clustering of immune cells and a Spearman's analysis was used to identify correlations between cell population frequencies, clinical measures, and patient outcomes (Figure). Strength of correlation was determined by R2 values and subsequent analysis of variance was calculated between groups to identify significant changes.

Results: Samples from 18 patients and 4 controls were collected. Analysis revealed 10 immune cell clusters having a R^2 >0.69 that correlated with one or more clinical outcomes. At day 3, neutrophil and other myeloid-origin epitope signatures had a positive correlation with increased ICU and hospital length of stay (LOS). Conversely, CD4 T-cell subtypes such as Th17 and effector T-cell subsets were associated with improved patient outcomes including: decreased ventilator-days (R^2 =-0.76), hospital-acquired pneumonia (R^2=-0.69), and organ dysfunction (R^2=-0.73). An elevation of myeloid dendritic cells by day 3 (p=0.02) was associated with an increased ICU and hospital LOS.

Conclusion: Computational analyses of deep immune profiling of trauma recovery demonstrate an association with specific immune populations and patient outcomes early after injury. Our results suggest that alterations in myeloid-origin cell types, namely neutrophils and other granulocytic subsets, likely contribute to immune dysfunction after injury. Preservation of effector-T cell functions correspond with decreased hospital LOS and less organ dysfunction. Overall, these data demonstrate the central role of innate immunity in the dysbiosis observed after severe injury and the importance of a competent adaptive response. Future studies will further characterize the myeloid subsets to better understand their role in adaptive immunity recovery and behavior.

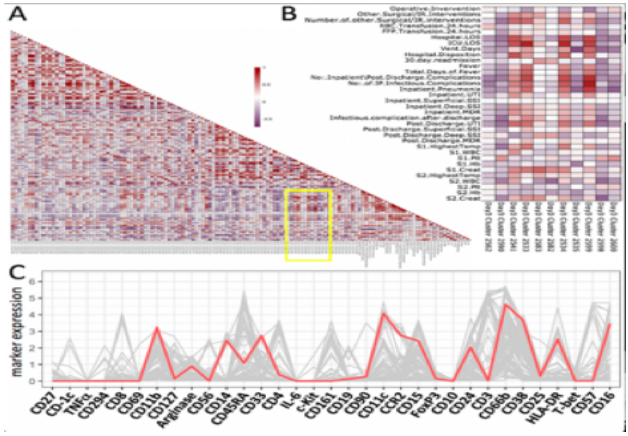


Figure. Correlation of immune clusters to clinical data. A. Color coded matrix of all clusters detected from 18 patients across day 1 and day 3, correlated to clinical measures on a scale of 1 to -1. Correlation values were determined based on cluster frequency relative to clinical measures for individual patients. B. Expanded view of yellow box from panel A. C. Parallel coordinate plot illustrating the phenotypic profile of a single cluster (red line), all other clusters mapped for context (grey lines).

Session XI: Quickshot Session I 1-13
Quickshot 10: 9:54 AM - 10:00 AM

THE EFFECT OF THE AFFORDABLE CARE ACT ON RATES OF INPATIENT REHABILITATION HOSPITAL ADMISSION IN A MATURE TRAUMA SYSTEM

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Penn Medicine Lancaster General Health

Invited Discussant: Edward Cornwell, III, MD

INTRODUCTION: The beneficial effects of acute rehabilitation for trauma patient are well documented but can be limited due to insurance coverage. The Patient Protection and Affordable Care Act (ACA) went into effect on March 23, 2010. We sought to analyze the likelihood of discharge to rehab for trauma patient before and after the implementation of the ACA. We hypothesized that there would be a higher rate of inpatient rehabilitation hospital (IRH) admission after the ACA was put into effect.

METHODS: The Pennsylvania Trauma Outcome Study (PTOS) database was retrospectively queried from 2003-2017 for all trauma patients admitted to accredited trauma centers in Pennsylvania who also had a Functional Status at Discharge (FSD). Admission to an IRH was determined using discharge destination. Two categories were created to represent periods before and after ACA was implemented: 2003-2009 (pre-ACA) and 2010-2017 (post-ACA). A multilevel mixed-effects logistic regression model controlling for age, injury severity, and FSD assessed the adjusted impact of ACA implementation on IRH admissions.

RESULTS: From the PTOS query, 341,254 patients had FSD scores and of these patients, 47,523 (13.9%) were admitted to IRH. Patients who were severely injured were more likely to be admitted to IRH. Compared to FSD scores signifying complete independence at discharge, those with lower FSD had significantly increased odds of IRH admission. The odds of IRH admission post-ACA implementation significantly increased when compared to pre-ACA years (AOR: 1.10; 95%CI: 1.08-1.13, $p < 0.001$, AUROC: 0.826).

CONCLUSION: The implementation of the ACA significantly increased the likelihood of discharge to IRH for trauma patients. This suggests that the ACA may have positively impacted access to inpatient rehabilitation centers.

Table 1. Multivariate analysis of ACA implementation on rehab admission rates from the PTOS database

		IRH Admission
Variable	**AOR** (95% CI)	***p***
ACA implementation	**1.10** [1.08-1.13]	**<0.001**
ISS		
Mild: 0-9	Reference	---
Moderate: 10-16	1.90 [1.85-1.96]	<0.001
Severe: 17-25	3.46 [3.36-3.56]	<0.001
Profound: 26-75	7.92 [7.63-8.23]	<0.001
FSD		
Complete Independence: 20	Reference	---
Independence with Device: 15-19	11.68 [11.25-12.14]	<0.001
Modified Dependence: 10-14	18.42 [17.61-19.27]	<0.001
Complete Dependence: 5-9	15.37 [14.47-16.33]	<0.001
		AUROC: 0.826

Session XI: Quickshot Session I 1-13
Quickshot 11: 10:00 AM - 10:06 AM

PREDICTORS OF SURVIVAL AFTER CRANIOTOMY IN GERIATRIC PATIENTS WITH TRAUMATIC BRAIN INJURY

Muhammad Zeeshan MD, Kartik Prabhakaran MD, Faisal Jehan MD, James Feeney MD, Muhammad Khan MD, Rifat Latifi MD, Peter Rhee MD, MPH
Westchester Medical Center

Invited Discussant: Jennifer Hubbard, MD

Introduction: As the population of trauma patients continues to age, traumatic brain injury (TBI) poses a high risk of morbidity and mortality amongst the elderly. While craniotomy can be a potentially life-saving intervention in patients with TBI, it is unclear as to how many and which type of geriatric trauma patient would benefit from craniotomy. The aim of our study was to assess the factors predictive of survival in geriatric TBI patients who underwent craniotomy.

Methods: We performed a 2-year analysis of ACS-TQIP database (2015-2016) and included all geriatric trauma patients (> 65y) with isolated severe TBI who underwent craniotomy. We excluded patients with concomitant severe injuries to other organs (i.e. any other body region AIS > 2), had penetrating mechanism of injury, who were transferred or dead on arrival. Patients were studied for demographic data, pre-hospital anticoagulant use, ISS, AIS-Head, and frailty. Frailty was calculated using the modified frailty index (mFI). Our principal outcome measure was in-hospital mortality. Multivariate regression analysis was performed to identify predictors of survival.

Results: We identified 46,359 geriatric patients with isolated severe TBI out of which 9.9% (n=4,621) patients underwent craniotomy and were included in our analysis. Mean age was 71+7y, 63% were male, and 80% were caucasian. Overall mortality was 27% (n=1247). On regression analysis, age < 84 (OR: 2.14[1.8-3.1]), mFI < 0.27 measured by modified frailty index (2.49[2.01-4.57]), ≤ 2 concomitant morphologies of TBI (3.24 [2.45 – 5.64]), and absence of pre-hospital anticoagulants (4.21 [3.21 – 8.210] were independently associated with survival.

Conclusion: One out of every 10 geriatric trauma patients with isolated severe TBI underwent craniotomy, and almost 1 out of every 4 patients who underwent craniotomy died. Younger age (< 84), low frailty index, single morphology of intracranial bleed, and absence of pre-hospital anticoagulant use are independently associated with a higher rate of survival. Identifying predictors of survival after craniotomy for TBI may improve resource utilization amongst geriatric trauma patients

Session XI: Quickshot Session I 1-13
Quickshot 12: 10:06 AM - 10:12 AM

ADMINISTRATION OF VALPROIC ACID IN CLINICALLY APPROVED DOSE IMPROVES NEUROLOGIC RECOVERY AND DECREASES BRAIN LESION SIZE IN SWINE SUBJECTED TO HEMORRHAGIC SHOCK AND TRAUMATIC BRAIN INJURY

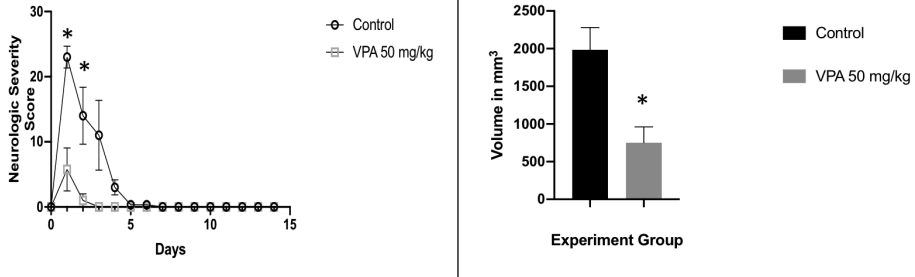
Glenn Wakam MD, Ben Biesterveld MD, Michael Kemp MD, Umar F. Bhatti MD, Rachel O'Connell BS, Alizeh Shamshad BS, Ali Siddiqui BS, Aaron Williams MD, Hasan B. Alam MD
University of Michigan

Invited Discussant: Ali Salim, MD

Background: Hemorrhagic shock and traumatic brain injury (TBI) continue to be the leading causes of morbidity and mortality in trauma. We have previously shown that treatment with valproic acid (VPA) at a dose of 150 mg/kg improves neurologic recovery and decreases brain lesion size in swine models of TBI and hemorrhage. However, 150 mg/kg is higher than the Food and Drug Administration (FDA) approved dose of 60 mg/kg, which raises concerns about dose related toxicity. In order to translate this treatment into clinical practice, validation of drug efficacy at a lower dose is necessary. In this large animal study, we evaluated neurologic outcomes, brain lesion size, and drug pharmacokinetics after administration of an FDA approved dose of VPA. We hypothesized that a dose of 50 mg/kg will improve neurologic outcomes and decrease brain lesion size in swine subjected to TBI and hemorrhagic shock

Methods: Yorkshire swine (n = 4/cohort) were subjected to TBI and hemorrhagic shock (40% of total blood volume). Animals remained in hypovolemic shock for 2 hours (simulating delayed medic response time in the battlefield) before resuscitation with normal saline (3x hemorrhage volume; control) or normal saline + single dose VPA (50 mg/kg). Neurologic severity scores [Range: 0 (no deficit)-32 (severe deficit)] were assessed daily for 14 days, and brain lesion size was measured using magnetic resonance imaging on postinjury day (PID) 3.

Results: Shock severity, response to resuscitation, and laboratory data were similar in both groups. VPA treated animals demonstrated significantly lower neurological severity scores (Figure) on PID 1 (23±4 versus 5.5±7 in control and VPA groups, respecively; p = 0.003) and PID 2 (14±6 versus 1±3 in the control and VPA groups, respectively; p=0.028). VPA treated animals had significantly smaller brain lesion sizes (1985.1±588.5mm^3 versus 751.3 ±364.7mm^3 in the control and VPA groups (figure), respectively; p=0.025).



Conclusion: In swine subjected to TBI and hemorrhagic shock, administraton of an FDA approved dose of VPA is safe, and associated with smaller brain lesion size and faster neurological recovery. These findings could facilitate earlier translation of VPA into clinical practice for the treatment of TBI.

Session XI: Quickshot Session I 1-13
Quickshot 13: 10:12 AM - 10:18 AM

TRENDS IN UTILIZATION OF WHOLE-BODY COMPUTED TOMOGRAPHY IN BLUNT TRAUMA: A 9-YEAR RETROSPECTIVE STUDY USING TRAUMA QUALITY IMPROVEMENT PROJECT (TQIP) DATABASE

Corinne Bunn MD, Brendan Ringhouse MD, Purvi Patel MD, Fred A. Luchette MD, MSc, Richard Gonzalez MD, Marshall Baker MD, MBA
Loyola University Chicago

Invited Discussant: Sharmila Dissanaike, MD

Introduction: Advances in computed tomography (CT) have led to increasing implementation of whole-body CT (WBCT) protocols in blunt trauma. The use of WBCT in awake, clinically stable patients has sparked controversy regarding unnecessary radiation exposure and increase costs of care. We aim to evaluate national trends in the utilization of WBCT imaging in clinically stable, neurologically intact patients admitted to an American College of Surgeons (ACS) level I and II centers after blunt trauma.

Methods: We queried the ACS Trauma Quality Improvement Project (TQIP) database to identify patients aged 18-65 years presenting after MVC to a level I or II trauma center with initial systolic blood pressure (SBP) > 100mg, a Glasgow Coma Scale (GCS) of 15 and having had CT imaging within 2 hours of arrival. WBCT was defined as simultaneous CT of the head, chest and abdomen. A CT of only one or two regions was defined as selective CT. Annual percentages of WBCT vs selective CT for level I and II centers were calculated and stratified by Injury Severity Score (ISS). Univariate analysis was performed to identify variables associated with use of WBCT between trauma centers. Multivariable regression was use to evaluate significance of trend over time and overall risk adjusted odds for WBCT.

Results: A total of 333,559 patients were identified; 202,657 (60.8%) had selective CT and 218,040 (39.8%) had WBCT. In patients with low severity injury (ISS of 0-9), the rate of WBCT at level II centers consistently exceeded that of level I center. Univariate analysis of patients with ISS 0-9 revealed that WBCT was performed more commonly at level II than level I centers in patients discharged directly from the ED (22.0% vs 18.4% p

Conclusion: Over the last 9 years, there has been an increasing utilization of WBCT relative to selective CT in adults after MVC who arrive hemodynamically stable and neurologically intact. In patients with ISS of 0-9, level II trauma centers are utilizing WBCT in patients with no associated head, chest or abdominal injury and patients who do not require surgery more frequently when compared to level I trauma centers.

Session XII:
Quickshot Session II
14-26

Friday, September 18, 2020
10:30 AM - 11:48 AM
Moderator: Robert McIntyre, MD

Session XII: Quickshot Session II 14-26
Quickshot 14: 10:30 AM - 10:36 AM

THE EXTENT TO WHICH GEOGRAPHY EXPLAINS ONE OF TRAUMA'S TROUBLING TRENDS: INSURANCE-BASED DIFFERENCES IN APPROPRIATE INTER-FACILITY TRANSFER

Cheryl K. Zogg PhD, MSc, MPH, Molly Jarman PhD, MPH, Kevin M. Schuster MD, MPH, Adrian A. Maung MD, Kimberly A. Davis MD, MBA
Yale University School of Medicine

Invited Discussant: Kristan Staudenmayer, MD, MSc

Introduction: Trauma systems were developed to facilitate the direct transport and transfer of patients with major and complex traumatic injuries to designated Trauma Centers (TC). Despite efforts to ensure equal access to high-quality trauma care, research suggests that when presenting to non-trauma centers (NTC), uninsured adults are more likely to be transferred, often resulting in more favorable outcomes compared to better-insured patients. Variations in geography have been suggested to explain the trend. The objective of this study was to determine the extent to which geography as measured by (1) clustering of hospitals within state-based emergency health services (EHS) and national trauma referral regions (TRR) and (2) distance/time by road to the nearest L1 or L2 TC account for insurance-based differences in appropriate inter-facility transfer.

Methods: Florida state inpatient (SID) and emergency department (SEDD) claims from 2008-2017 were used to identify adult trauma patients aged 18-64 years initially presenting to NTC Emergency Departments (EDs) with an overall Injury Severity Score (ISS) > 15. Sub-analyses considered adults with gunshot wounds, acetabular fractures, severe traumatic brain injuries, and hand amputations regardless of ISS. In each case, increasingly complex risk-adjusted multilevel (mixed-effects) logistic regression models were used to determine differences in the relative odds of direct admission-vs-transfer and subsequent outcome measures (30-day mortality, readmission, major morbidity).

Results: A total of 19,663 adults with ISS > 15 presenting to NTC EDs satisfied inclusion criteria. Of these, 3,952 adults were uninsured; 32.9% (1,300) of uninsured adults were transferred. In contrast, 18.1% of adults with private insurance (1,478/8,179), 17.2% with Medicaid (465/2,702), 19.1% with Medicare (*e.g.* Social Security Disability; 437/2,286), and 16.5% with other forms of insurance coverage (*e.g.* TRICARE; 416/2,514) were transferred. Corresponding risk-adjusted OR of direct admission-vs-transfer are presented as Model 1 in **Figure** (*e.g.* private-vs-uninsured OR[95%CI]: 2.22[2.04-2.42])**.** Accounting for clustering of hospitals within EHS regions reduced risk-adjusted OR by an average of 2.0% (Model 2; private-vs-uninsured: 2.17[1.98-2.36]]). Within national TRR it reduced risk-adjusted OR by an average of 6.5% (Model 3; private-vs-uninsured: 1.95[1.75-2.15]). Further risk-adjustment for time and distance by road to the nearest L1 or L2 TC explained up to 10.1% of differences in transfer status between patients but did not remove the insurance-based triage effect, nor did it account for resulting differences in outcomes (*e.g.* 30-day mortality admitted-vs-transferred OR[95%CI]: 1.85[1.13-3.04]). Stratification by distance to the nearest L1 or L2 TC further defied expectations, suggesting that the triage disparity actually became more pronounced among NTC EDs with more ready access to higher-level trauma care (lowest tertile: +0.6%, highest tertile -28.4%). Results among condition-specific sub-analyses were similar. No analyses pointed toward geographic clustering of regional insurance triage patterns.

Conclusion: Variations in geography explained part, but not all, of insurance-based differences in trauma system utilization and appropriate inter-facility transfer. The persistence of greater transfer rates and better outcomes among uninsured adult patients questions the success of transfer-guideline implementation and speaks to room for improvement in trauma system structure.

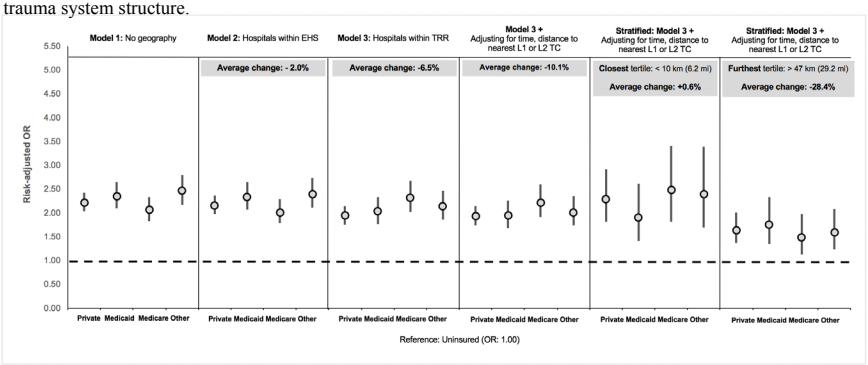


Figure. Results represent risk-adjusted odds ratios (OR; circle) and corresponding 95% confidence intervals (95%CI; black bar) taken from multilevel (mixed-effects) logistic regression models. All models accounted for clustering of patients within hospitals and were risk-adjusted for differences in patient age on index admission, gender, Elixhauser comorbidities, overall ISS, and head/neck AIS.

Session XII: Quickshot Session II 14-26
Quickshot 15: 10:36 AM - 10:42 AM

PERSISTENT INFLAMMATORY CATABOLIC SYNDROME AFTER HYPOTHERMIA IN TRAUMA PATIENTS

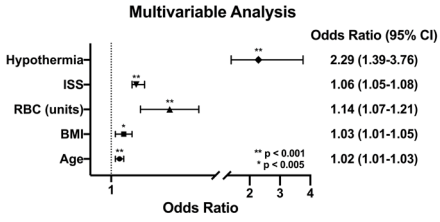
David Miranda MD, MSc, Rebecca Maine MD, MPH, Mackenzie Cook MD, Grant E. O'Keefe MD, MPH, Saman Arbabi MD, MPH, Eileen M. Bulger MD, Bryce R. Robinson MD, MSc, Joseph Cuschieri MD
Harborview Medical Center

Invited Discussant: Susan Evans, MD

Introduction: Persistent inflammatory catabolic syndrome (PICS) occurs frequently in patients who survive severe injury. However, the modifiable factors associated with developing PICS remain poorly elucidated. Previous work has suggested that hypothermia on presentation is associated with increased mortality, and rapid correction is associated with improved outcome. Given the reduction in early mortality due to improved care, we hypothesized that admission hypothermia (AH) is associated with the development of PICS, and that rapid intervention to correct AH would improve outcome.

Methods: To determine the association of AH and PICS, we analyzed prospectively collected data (Cohort 1) in the Inflammation and Host Response to Injury database. AH was defined as initial body temperature ≤ 34.5◦ C. PICS was defined as death or multi-organ failure > 14 days after injury. Univariable analyses involved Student's T-test and Pearson's Chi square. Logistic regression controlled for age, BMI, Injury Severity Score (ISS), blood product transfusion, and initial shock status. To assess the effect on PICS of intravascular rewarming (IVR), we analyzed prospectively collected data from a single center of hypothermic patients from 2013-2018 (Cohort 2) and performed similar statistical analyses.

Results: Of the 1675 patients in Cohort 1, there was no significant difference in age, BMI, or ISS between patients who had AH (n=254) and those who did not (n=1,421). On univariable analysis, 120/254 (47.2%) of patients with AH had PICS, compared to 134/1421 (9.4%) without AH who had PICS, $p < 0.001$. On multivariable logistic regression, AH was associated with increased risk of PICS, OR 2.29 (1.39-3.76) but not increased risk of death OR 1.3 (0.9-1.9). In 89 patients with AH in Cohort 2, univariable analysis revealed 45/68 (66.1%) without IVR had PICS, compared to 6/21(28.5%) with IVR who had PICS, $p < 0.001$. There was no effect of IVR on mortality. Multivariable logistic regression showed patients not receiving IVR had increased risk of PICS, OR 3.67 (1.21-8.98).



Conclusions: Hypothermia is associated with the development of PICS in severely blunt injured patients without an effect on mortality. Rapid correction of hypothermia with IVR is associated with a significant reduction in the development of PICS. Thus, prompt identification of patients with hypothermia should guide the clinician to rapidly rewarm injured patients to prevent the development of PICS and improve outcome.

Session XII: Quickshot Session II 14-26
Quickshot 16: 10:42 AM - 10:48 AM

RESUMPTION OF LONG TERM ANTICOAGULATION AFTER TRAUMATIC INTRACRANIAL HEMORRHAGE IN GERIATRIC PATIENTS -- A BAD IDEA?

Adrian W. Ong MD, Alison Muller, Pamela Jones, Anthony Martin, Forrest B. Fernandez M.D.
Reading Hospital

Invited Discussant: Jody DiGiacomo, MD

Background: Cessation of anticoagulation (AC) after traumatic intracranial hemorrhage (tICH) is necessary, but it is unclear if risk benefit analysis supports resumption of AC after discharge from hospital in geriatric patients at risk for recurrent tICH. We hypothesized that AC resumption after tICH is not associated with long term hemorrhagic complications.

Methods: We conducted a 4-year prospective observational study enrolling patients on AC admitted with tICH and surviving to discharge. Patients who had no follow up after discharge were excluded. Events of interest (major bleeding, arterial and venous thromboembolism [VTE], acute myocardial infarction [AMI], transient ischemic attack or stroke [TIA/S], new or worsened tICH and death) were recorded up to 24 months after discharge. Patients who had AC resumed within 3 months after tICH were compared to those without AC resumption at 3 months with univariable analyses. A p value of less than 0.05 was considered significant.

Results: 179 patients survived to discharge with 35 lost to follow up, leaving 144 patients with a median (interquartile range, [IQR]) age of 82 (75-86) for further analysis. Indications for AC were most commonly atrial fibrillation (AF) (78%) and VTE (17%). 114 (94%) had no tICH in the preceding 5 years. Median (IQR) follow-up period was 22 (7-24) months, with 50 (35%) resuming AC within 3 months of discharge. Compared to those without AC resumption, those with AC resumption were younger (median age 80.5 vs. 83 years, p=0.02), had similar Charlson Comorbidity Index scores (median, 5 vs 5, p=0.1), CHA_2DS_2-VASc scores (median, 4 vs 4), rates of TIA/S (8% vs 16%, p=0.1), VTE (6% vs 1%, p=0.1), AMI (0% vs 3%, p=0.6), arterial thromboembolism (0% vs 3%, p=0.6), major bleeding (10% vs 12%, p=0.8) and readmission for new or worsened tICH (8% vs 14%, p=0.2). The follow-up periods were similar in both groups (median, 24 vs 21 months, p-0.2), with equivalent mortality rates (24% vs 32%, p=0.3).

Conclusion: Over 90% of anticoagulated geriatric patients surviving to discharge after an episode of tICH had no tICH in the preceding 5 years, but mortality was substantial in the subsequent 24 months after discharge from an episode of tICH. AC resumption within 3 months was not associated with an increased risk of hemorrhagic or thrombotic complications. The risk benefit analysis for resumption of AC continues to be challenging in this cohort and should be further evaluated through large longitudinal cohort studies.

Session XII: Quickshot Session II 14-26
Quickshot 17: 10:48 AM - 10:54 AM

CAN VARIATIONS IN INSULIN REQUIREMENTS BE AN EARLY INDICATOR OF SEPSIS IN BURN PATIENTS?

Simran Singh MBA, Cathurika S. Dhanasekara PhD, Nadia Tello BS, Parker Southerland BS, Adel Alhaj Saleh MD, Jennifer Kesey, Sharmila Dissanaike MD
Texas Tech University Health Sciences Center

Invited Discussant: David Harrington, MD

Introduction: Early identification of sepsis is a key step in reducing morbidity and mortality. Burn patients pose an additional challenge to early identification, due to their hypermetabolic state, and loss of skin barrier to infection.[1] Thus, many sepsis studies have excluded burn patients, limiting evidence regarding sepsis recognition following burns.[2,3] The American Burn Association (ABA) diagnostic criteria includes an increase in insulin requirement > 25 % over 24 hours as an indication of possible sepsis.[4] However, there is no conclusive evidence as to the time point at which insulin requirements start to increase in sepsis. Therefore, we aimed to determine the exact time point at which the insulin requirements increase among non-diabetic burn patients with sepsis.

Methods: A retrospective chart review in non-diabetic burn patients ≥ 20% TBSA during 2010-2018 who received a blood culture for suspected sepsis according to 2007 ABA diagnostic criteria. Absolute insulin requirement at intervals (0, 24, 48, and 72, and 96 hours prior to a blood culture) were Box-Cox transformed and compared vs. -96 hours reference using mixed-effects models accounting for within-patient dependencies using the lmerTest package in R (version 3.5.3).

Results: Fifty-eight patients (84% men, age 44 ± 17 years, TBSA 49 ± 17.5%), were included in the study. Forty-two patients had positive blood cultures (72%) with 81% being positive for gram-negative organisms. When cube root of daily insulin requirement was regressed on each time point (24, 48, 72, and 96 hours prior to obtaining blood culture) in a mixed-effects model with -96 hours as the reference category, statistically significant positive effects were observed for -48, -24, and 0 hours (Table 1).

Conclusion: Daily insulin requirement seem to increase 48 hours prior to development of other clinical signs of sepsis, and can be used as a sensitive early marker.

Table 1. Summary of Regression cube root of insulin requirement vs. time points.

	Estimate (β)	SE	df	t-statistic	p-value
Intercept	3.130	0.262	275.994	11.966	
-72 hours	0.235	0.183	275.994	1.285	0.120
-48 hours	0.435	0.182	275.994	2.388	**0.018**
-24 hours	0.464	0.182	275.994	2.547	**0.011**
0 hours	0.485	0.182	275.994	2.665	**0.008**

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Session XII: Quickshot Session II 14-26
Quickshot 18: 10:54 AM - 11:00 AM

CALCIUM SIGNALING DRIVES FEMALE-SPECIFIC PLATELET HYPERACTIVITY: A MECHANISTIC EXPLORATION OF SEX DIMORPHISMS IN PLATELET FUNCTION

Julia R. Coleman MD, MPH, Ernest E. Moore MD, Kenneth Jones PhD, Marguerite Kelher MSc, Sanchayita Mitra, Mitchell J. Cohen MD, Jason Samuels MD, Christopher Silliman MD, PhD
University of Colorado-Denver

Invited Discussant: Stephen Cohn, MD

Introduction: Females demonstrate hypercoagulability relative to males, which confers survival benefit in the setting of trauma-induced coagulopathy; however, the mechanism remains unknown. We have described that female platelets have increased activation with adenosine diphosphate (ADP) stimulation, whereas male platelets have increased activation with platelet-activating factor (PAF). PAF stimulates the P2Y1 receptor, which increases intracellular calcium, while ADP stimulates the P2Y12 receptor, which decreases intracellular cAMP. Platelet estradiol receptor signaling converges on these same pathways. We hypothesize that the sex-based differences in platelet activity are due to nongenomic effects of estradiol, as evidenced by sex dimorphisms in platelet RNA and cAMP signaling.

Methods: Apheresis platelets were collected from healthy volunteers. For cAMP, $1x10^8$ platelets/mL were activated with 10 μM of ADP or 2 μM of PAF, and intracellular cAMP levels were measured from the cell lysates by ELISA. For RNA sequencing, RNA was isolated using Qiagen RNeasy kit and sequenced on Illumina HiSeq2000. A custom computational pipeline was used for discovery of differential gene expression.

Results: Platelets from 12 healthy volunteers were assayed for intracellular cAMP (6 males, 6 females). There were no differences in cAMP levels by sex after ADP (3.0±0.4 pmol/mL in males versus 3.2±0.2 pmol/mL in females, p=0.49) or PAF stimulation (3.0±0.3 pmol/mL in both sexes, p=0.56). Platelets from 12 separate healthy volunteers were assayed for RNA (6 females, 6 males). There were significant differences by sex in RNA sequences related to calcium signaling. Specifically, TREML1 RNA, which encodes proteins that propagate platelet activation by enhancing calcium signaling, was 1.77-fold higher in females versus males (26.43 versus 14.91, p=0.007). Best1 RNA, which encodes proteins promoting intracellular calcium flux, was 1.38-fold higher in females versus males (225.32 versus 162.92, p=0.01).

Conclusion: Sex dimorphisms exist in platelet RNA transcripts involved in calcium signaling required for platelet activation, which may be affected by estradiol through nongenomic action.

Session XII: Quickshot Session II 14-26
Quickshot 19: 11:00 AM -11:06 AM

MANAGING ACUTE UNCOMPLICATED APPENDICITIS IN FRAIL GERIATRIC PATIENTS: A SECOND HIT MAY BE TOO MUCH

Mohamad Chehab MD, Michael Ditillo DO, Lourdes Castanon MD, Letitia Bible MD, Molly Douglas MD, Samer Asmar MD, Narong Kulvatunyou MD, Lynn Gries MD, Bellal Joseph MD
The University of Arizona

Invited Discussant: Joseph Sakran, MD, MPA, MPH

Introduction: Some studies have proposed the use of antibiotics only in cases of acute uncomplicated appendicitis (AUA). However, there remains a paucity of data evaluating this nonoperative approach in the vulnerable frail geriatric population. The aim of this study is to examine long-term outcomes of frail geriatric patients with AUA treated with appendectomy compared to initial nonoperative management.

Methods: We conducted a one-year (2017) analysis of the Nationwide Readmissions Database and included all frail geriatric (age ≥65) patients with a diagnosis of AUA. Frailty was assessed using the 5-factor modified frailty index (mFI). Patients were stratified into those undergoing appendectomy at index admission (OP) vs. those receiving antibiotics only without operative intervention (NOP). Patients in the NOP group were excluded if they expired during their index admission. Primary outcome measure for the OP group was procedure-related complications. Primary outcome measure for the NOP group was 6-month failure of NOP (return with uncomplicated or complicated appendicitis; need for appendectomy at non-index admission; missed appendiceal neoplasm). Secondary outcome measures were mortality, overall hospital length of stay (LOS), and healthcare costs. Multivariate regression analysis was performed adjusting for demographics and comorbidities.

Results: A total of 5613 frail geriatric patients with AUA were identified: 4242 (75.6%) in the OP group and 1371 (24.4%) in the NOP group. Patients in the OP and NOP were comparable in terms of age (74±7 vs. 75±7 years; $p = 0.094$), sex (46 vs. 47% male; $p = 0.132$), and mFI (0.34 vs. 0.36; $p = 0.089$). 8.5% of patients in the OP group had procedure-related complications, while 16.8% of patients in the NOP group failed NOP within 6 months. 6-month mortality was significantly higher in the NOP group compared to the OP group (2.3 vs. 1.1%; $p < 0.001$). Also, patients in the NOP group had a significantly greater number of 6-month overall hospitalized days (5 [3,10] vs. 3 [2,6]; $p < 0.001$) and higher 6-month overall costs (16 [12,27] vs. 11 [8,19] $K; $p < 0.001$) and hospital charges (46 [22,89] vs. 32 [23,49] $K; $p < 0.001$). On multivariate analysis, NOP was independently associated with increased mortality (OR 2.1 [1.3-3.2]; $p = 0.003$).

Conclusion: NOP of frail geriatric patients presenting with AUA was associated with increased mortality. One in six patients failed NOP within 6 months and subsequently had longer hospital stays and higher healthcare costs. Appendectomy may offer better outcomes in managing AUA in the frail geriatric population.

Session XII: Quickshot Session II 14-26
Quickshot 20: 11:06 AM - 11:12 AM

DIFFERENCES IN RATE OF INTERVENTION FOR BLUNT SPLENIC INJURY IN ADOLESCENTS BETWEEN ADULT AND COMBINATION ADULT/PEDIATRIC CENTERS

Arthur D. Grimes MD, Alessandra Landmann MD, Kenneth Stewart PhD, Jeremy Johnson MD, Ryan Kennedy MD
University of Oklahoma

Invited Discussant: Mary Edwards, MD

Introduction: Pediatric Trauma Society (PTS) guidelines for management of blunt splenic injury (BSI) recommend aggressive non-operative management. This is divergent when compared to adult guidelines. Adolescent patients, age 13-17 years, while included in pediatric trauma guidelines, are often under-represented in studies of pediatric patients. Many adolescent patients are treated at adult or non-pediatric trauma centers. We hypothesize there is no difference in the adjusted odds of surgical/embolization splenic interventions by age group for patients age 6 to 24 years arriving at adult only or combination adult and pediatric trauma centers.

Methods: National 2017 Trauma Quality Improvement (TQIP) data were used to conduct a retrospective study of patients age 6 to 24 years who presented with BSI to an adult or adult/pediatric combination trauma center. Three age groups were defined (age 6-12, 13-17, 18-24). Covariates included sex, spleen organ injury scale (OIS), gender, > 40mL/Kg or > 4 units of blood transfused in first 24hrs, and final injury severity score (ISS). An intervention was defined as a spleen-specific surgical, angiography, or embolization procedure. Association of need for spleen intervention and age group was assessed using multivariable adjusted logistic regression. Area-under-curve (AUC) and Hosmer-Lemeshow goodness-of-fit (H-L) statistics were used to assess model discrimination and fit respectively.

Results: 579 patients age 6-12, 1283 age 13-17, and 3389 age 18-24 were included. At adult only centers, spleen interventions among 13-17 year olds (17.0%) were more similar to 18-24 year olds (19.6%) than to 6-12 year olds (6.9%). At combination centers, intervention among 13-17 year olds (10.1%) was closer to the 6-12 group (7.3%) than to the 18-24 group (20.7%). Interaction was present for age group and center type so separate models were developed. Adjusted odds for splenic intervention at adult only centers were 2.3 (95%CI 1.3, 4.1) and 3.1 (95%CI 1.8, 5.3) times higher for 13-17 year olds and 18-24 year olds respectively, when compared to those age 6-12 (AUC 0.84, H-L p=0.31). At combination centers, compared to ages 6-12, the adjusted odds of splenic intervention were higher for 18-24 year olds (OR 3.9 95%CI 2.3, 6.6) but no longer significant for 13-17 year olds (OR 1.7 95%CI 0.95, 3.0) (AUC 0.86, H-L p=0.40).

Conclusion: We demonstrate that adolescent patients, age 13-17, are more likely to undergo interventions for BSI when compared to patients age 6-12 at adult only trauma centers. The elevated OR persists, despite similarities in severity of organ injury and need for blood product transfusion. The incidence of splenectomy has not decreased in this age group over the past 18 years, despite recommendations from the PTS. Further efforts to selectively study this group and disseminate guidelines is warranted.

Session XII: Quickshot Session II 14-26
Quickshot 21: 11:12 AM - 11:18 AM

HOSPITAL COSTS FOR FIREARM INJURIES BY U.S. REGION, 2005-2015

Sarabeth Spitzer MD, Lakshika D. Tennakoon MD, MSc, Joseph Forrester MD, MSc,
David A. Spain MD, **Thomas G. Weiser MD, MPH**
Stanford University Medical Center

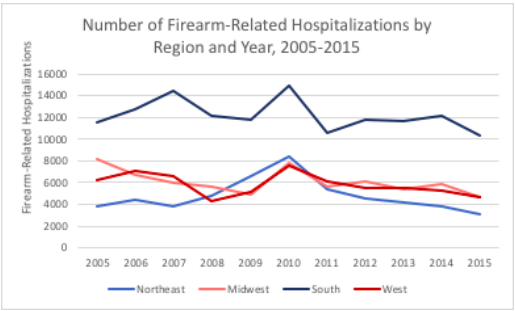
Invited Discussant: Sigrid Burruss, MD

Introduction: Firearm injuries are a costly public health challenge nationally. As payments for firearm injuries are frequently covered by government-sponsored programs, understanding regional differences may be useful to craft appropriate policies, especially since state gun laws vary widely. We estimated the number of hospitalizations and hospital costs for patients injured by firearms from 2005-2015 for each region of the United States and analyzed cost burden by payer status.

Methods: We used the Healthcare Cost and Utilization Project Nationwide Inpatient Sample to identify patients admitted for firearm injuries from 2005 to 2015. We converted hospitalization charges to costs, which were inflation-adjusted to 2015 dollars. We used survey weights to create regional estimates. We used the Nationwide Readmission Database 2010-2015 to assess the frequency of readmissions at 30 days and associated hospital costs for each region, applied them proportionally to the earlier years, and estimated the share borne by government insurance coverage.

Results: Firearm-related hospital admissions were highly variable within the US. It was highest in the South, which also had the highest proportion of injuries to total population (0.11%). Total regional admissions during the 11 years of this study were 52,797, 66,734, 134,008, and 64,004 for the Northeast, Midwest, South, and West respectively. In the Northeast, regional costs were $1.19 billion (13.8% of total), of which 55.7% was covered by a government payer; for the Midwest, costs were $1.71 billion (19.8% of total), 39.9% of which was covered by the government; in the South costs were highest at $3.59 billion (41.5% of total), but government plans only covered 33.8% ; and costs for the West were $2.15 billion (24.9%), with government programs covering 46.1% of the cost burden.

Conclusions: Hospital admissions and costs for firearm injuries demonstrated wide variation over the past decade. Injury control strategies have not been well applied to this national public health crisis. Costs per patient were also variable, suggesting opportunities for improvement. Government insurance programs cover 41.1% of costs, indicating that tax dollars heavily subsidize the financial burden of firearm injuries.



Session XII: Quickshot Session II 14-26
Quickshot 22: 11:18 AM - 11:24 AM

COMPARISON OF SURGICAL RIB FIXATION BETWEEN PATIENTS WITH AND WITHOUT FLAIL CHEST

Alice Piccinini MD, Thomas J Martin, Eric Benoit MD, Sean F. Monaghan MD, Andrew Stephen MD, Stephanie N. Lueckel MD, Charles A. Adams, Jr. MD, Tareq Kheirbek MD
Rhode Island Hospital

Invited Discussant: Raminder Nirula, MD, MPH

Introduction: Surgical rib fixation (SRF) has emerged as a valuable option for rib fractures associated with flail chest (FC), and was recently proposed for the management of non-flail chest (NFC) with improvement in pain scores and quality of life. We investigated the difference in outcomes of the procedure between flail and non-flail chest.

Methods: The Trauma Quality Improvement Program 2017 database was queried for rib fracture patients that underwent surgical fixation procedure using ICD-10 codes. We compared demographics, time to surgery, length of stay (LOS), ICU admission and duration, rate of intubation, ventilator days ventilator associated pneumonia (VAP), discharge disposition and mortality. Statistical analysis was performed using SPSS version 23.

Results: We identified 150,340 patients with rib fractures, of whom 6,578 (4.4%) had FC and 2,391 underwent SRF (1.6%). Surgical rib fixation was used more frequently in FC (1042/6,578, 15.8% vs NFC 1349/143,762, 0.9%, $P < 0.001$), and 1167 (49%) were performed at university hospitals (FC 50.1% vs NFC 47%, NS), and the majority were men (74.2%, no difference between the two groups). A higher proportion of patients with more than 3 fractured ribs in the NFC group who underwent fixation had (FC 77.4% vs NFC 85%, $p < 0.001$), There were no differences in age (FC 55.6±15.4 vs NFC 54.7±15.6, NS), time to surgery (*median* 4 days in both groups, NS), unplanned ICU admission (6.7% vs 5.6%, NS), respiratory failure (3.4% vs 2.4%, NS), or number of days on ventilator (median: 7 vs 8, NS) between the groups. Flail chest patients had higher ISS (median: 22 vs 17, $p < 0.001$), ICU LOS (8 vs 6 days, $p < 0.001$), Hospital LOS (13 vs 11 days, $p < 0.001$), need for intubation (57.8% vs 39.4%, $p < 0.001$), VAP (6.7% vs 3.6%, $p < 0.001$), and mortality (3.5% vs 1.7%, $p=0.006$). Of SRF patients who survived, 55.1% were discharged home (FC 51.3% vs NFC 58.1%, $p <0.001$). Adjusting for age, gender, ISS, hospital LOS, need for intubation, ICU admission, and VAP, surgical rib fixation was not associated with statistically higher odds of mortality in FC compared to NFC (OR:1.48, 95%CI: 0.82-2.66).

Conclusion: In our analysis of a recent national sample of patients with rib fractures, surgical rib fixation is still potentially under-utilized, especially among patients with non-flail chest, who fared comparably well. There was a low rate of reported complications and mortality. The observed higher mortality in patients with flail chest appears to be due to differences between the groups in injury severity and not directly related to rib fixation. Further investigation should be performed to properly identify patients who would benefit from surgical rib fixation.

Session XII: Quickshot Session II 14-26
Quickshot 23: 11:24 AM - 11:30 AM

LAPAROSCOPIC TRANSCYSTIC COMMON BILE DUCT EXPLORATION IMPROVES OUTCOMES IN EMERGENCY GENERAL SURGERY (EGS) PATIENTS WITH CHOLEDOCHOLITHIASIS

John A. Michel-Ruddy MD, Ashkan Moazzez MD, MBA, Matthew B. Bloom MD, Joseph R. Sirody MD, Sydney Read MD, Kwang Kim, Kelsey Luna BS, Alyson Morgan BS, Angela L. Neville MD, Brant Putnam MD, Dennis Y. Kim MD
Harbor-UCLA Medical Center

Invited Discussant: Edgardo Salcedo, MD

Introduction: Implementation of an acute care surgery (ACS) model improves outcomes including decreased time to surgery and length of stay (LOS) in patients with acute biliary diseases requiring laparoscopic cholecystectomy (LC). The impact of an ACS service on outcomes among patients with common bile duct (CBD) stones is less clear, as timing of ERCP is usually based on consultant availability. The objective of this study was to compare outcomes between single-stage laparoscopic transcystic CBD exploration (LCBDE) and two-stage LC+ERCP for CBD stones. We hypothesized that LCBDE results in decreased LOS and complications compared to LC+ERCP for EGS patients with CBD stones.

Methods: We performed a 2.5-year retrospective case-control analysis of adult patients admitted to an urban level 1 trauma center with a diagnosis of choledocholithiasis or acute mild gallstone pancreatitits (GP). LCBDE patients were compared to those who underwent LC+ERCP. Variables analyzed were patient demographics, operative details, and outcomes. The main outcome measure was hospital LOS. Secondary outcomes were time to surgery, operative case duration, and complications. Coarsened exact matching (CEM) was performed to compare LCBDE to LC+ERCP patients on a 1:1 basis to control for age, gender, BMI, and an admission diagnosis of choledocholithiasis.

Results: Of 1265 patients, 214 (16.9%) were diagnosed with choledocholithiasis and 52 (4.1%) with GP. LCBDE was performed in 75 patients (28.2%) and these patients were younger, with a lower BMI, and higher incidence of choledocholithiasis (all $p < .01$). On unadjusted analysis, time to surgery was shorter, procedural duration was longer, and there were no differences in LOS or complications between groups. On CEM, 48 LCBDE patients were matched to 48 LC+ERCP patients. Similar to the unmatched analysis, LCBDE resulted in a decreased time to LC and longer operative time (**Table**). However, LOS was decreased in patients undergoing LCBDE and the incidence of post-operative complications did not differ between groups.

	LCBDE (n = 48)	LC +ERCP (n = 48)	*p* value
LOS, days	3.0 ± 1.3	4.6 ± 1.7	<.001
Admission to OR, days	1.2 ± 0.9	2.7 ± 1.2	<.001
Total procedure time, min	203 ± 93	167 ± 54	.03
Unable to clear CBD	3 (6.3%)	3 (6.3%)	1.0
Pancreatitis	2 (4.2%)	1 (2.1%)	.56
Readmission	6 (12.5%)	3 (6.3%)	.29

Conclusion: When compared to LC+ERCP, single-stage LCBDE reduces time to surgery and LOS, with no difference in complications in patients with choledocholithiasis. Further study is required to identify potential barriers to the more widespread adoption and implementation of LCBDE in the EGS setting.

Session XII: Quickshot Session II 14-26
Quickshot 24: 11:30 AM - 11:36 AM

MULTICENTER VALIDATION OF THE BOWEL INJURY PREDICTION SCORE (BIPS) FFOR IDENTIFYING PATIENTS REQUIRING SURGERY

Michael Wandling MD, MSc, Joseph Cuschieri MD, Rosemary A. Kozar MD, PhD, Amanda Celii MD, Clay C. Burlew MD, Robert McIntyre MD, Walter L. Biffl MD, Lucy Kornblith MD, Julie A. Dunn MD, Kimberly A. Peck MD, Stefan Leichtle MD, S. Rob Todd MD, Daniel Lollar MD, Thomas J. Schroeppel MD, Michelle K. McNutt MD
University of Texas Health Science Center at Houston

Invited Discussant: Ruben Peralta, MD

Introduction: Identifying patients who require surgical intervention for blunt bowel and mesenteric injury (BBMI) remains a challenge, particularly in traumatic brain injury (TBI) where exam may be unreliable. A pilot trial showed the Bowel Injury Prediction Score (BIPS) could identify patients requiring therapeutic laparotomy. We hypothesize 1) that BIPS can be validated in a prospective multi-center study and 2) that BIPS remains accurate in the setting of TBI.

Methods: Patients were prospectively enrolled at 15 U.S. trauma centers following blunt trauma with suspicion of BBMI on CT scan between July 1, 2018 and July 31, 2019. BIPS was calculated by assigning one point each for: 1) WBC >= 17,000, 2) abdominal tenderness, and 3) injury grade >= 4 on CT scan. A total score >= 2 identifies BBMI requiring laparotomy. Risk-adjusted odds ratios for need for laparotomy for BIPS components were calculated. Sensitivity, specificity, PPV, NPV, and ROC curves were calculated to validate the predictive ability of BIPS. The accuracy of BIPS in TBI was similarly evaluated.

Results: Of 313 patients meeting enrollment criteria, 38% had BBMI requiring therapeutic laparotomy. There were no demographic differences between those requiring therapeutic laparotomy and those who did not. Logistic regression identified BIPS components of WBC >= 17,000 (OR=1.5, p=0.18), abdominal tenderness (OR=3.8, p < 0.01) and CT grade >= 4 (OR=11.1, p < 0.01) as independent predictors of need for laparotomy. Patients with BIPS >= 2 were 8.8 times more likely to have surgically significant BBMI vs. those with BIPS >= 2 as an accurate predictor of BBMI requiring therapeutic laparotomy including the subset of TBI patients.

	All Patients	Mild/Mod TBI (GCS 8-15)	Severe TBI (GCS <8)
Sensitivity	71.7%	72.0%	70.0%
Specificity	77.7%	73.9%	92.3%
PPV	66.7%	64.3%	82.3%
NPV	81.5%	80.1%	85.7%
AUROC	0.75	0.73	0.81

Conclusions: The easily calculated BIPS provides both positive and negative prediction of need for therapeutic laparotomy in patients with BBMI. In the setting of TBI with an unreliable abdominal exam, BIPS remains an accurate predictor. Calculation of BIPS during the initial management of patients with BBMI can be a useful adjunct in determining who should be taken to the operating room versus who can be safely managed non-operatively.

Session XII: Quickshot Session II 14-26
Quickshot 25: 11:36 AM - 11:42 AM

READY FOR PRIME TIME? PGY-5 RESIDENT AUTONOMY AND PERFORMANCE IN EMERGENCY GENERAL SURGERY USING SIMPL CASE EVALUATION DATA

Adam C. Nelson MD, Amy N. Hildreth MD
Wake Forest Baptist Health

Invited Discussant: Michael Cripps, MD

Introduction: There is a paucity of data regarding graduating general surgery resident experience with emergency general surgery (EGS), and case volume is not a surrogate for competence. As an alternative, the System for Improving and Measuring Procedural Learning (SIMPL) is an electronic, competency-based evaluation with qualitative assessments of surgical proficiency for varying case complexity. We sought to characterize chief resident experience with EGS using SIMPL evaluations. Since EGS cases are complex and often technically difficult, evaluations of cases with higher complexity may provide insight into residents' ability to independently perform EGS cases after graduation. We hypothesized that residents would have lower measures of autonomy and performance for EGS cases of the highest complexity.

Methods: SIMPL evaluations of PGY-5 surgery residents from 2015 to 2020 were queried for the seven most common laparoscopic and open EGS procedures. The relative frequency of each case type, rates of high case complexity, meaningful autonomy, and practice-ready or better performance were determined. Logistic regression was used to characterize resident autonomy and performance with respect to case complexity. Mixed-effects modeling was used to control for case complexity, time trends, multiple procedures, rater stringency, individual trainee and program characteristics, and procedure type.

Results: 3,818 evaluations were included. Laparoscopic cholecystectomy, laparoscopic appendectomy, open and laparoscopic colectomy accounted for 78% of EGS total case volume. Thirty-five percent of cases were high complexity. For these complex cases, 71% of evaluations characterized chiefs as having meaningful autonomy and 78% as having practice-ready or better performance. High case complexity versus low and moderate complexity was an independent predictor of both lower levels of autonomy (OR 0.25, $p = 0.001$) and performance (OR 0.44, $p = 0.001$).

Conclusions: The majority of chief resident EGS case volume is derived from exposure to only a minority of case types. Chief residents are not universally ready for independent performance of highly complex EGS procedures. Metrics are needed to better define resident exposure to emergency cases; our findings suggest a need for additional training in acute care surgery for those wishing to practice emergency surgery.

Session XII: Quickshot Session II 14-26
Quickshot 26: 11:42 AM - 11:48 AM

DO PATIENTS WITH MINIMAL BLUNT THORACIC AORTIC INJURY (BTAI) REQUIRE TEVAR?

Joseph J. DuBose MD, Kristofer Charlton-Ouw MD, Benjamin Starnes, Naveed Saqib MD, Elina Quiroga MD, Jonathan Morrison MD, PhD, Bruce Gewertz MD, Ali Azzizadeh
Uniformed Services University of the Health Sciences

Invited Discussant: Demetrios Demetriades, MD, PhD

Objective(s): The optimal management of "minimal" BTAI remains controversial, with experienced centers o!ering therapy ranging from medical management (MM) to TEVAR. We analyzed contemporary management and outcomes of BTAI.

Methods: The Aortic Trauma Foundation (ATF) registry was utilized to examine demographics, injury characteristics, management and outcomes of patients with BTAI.

Results: 296 patients from 28 international centers were analyzed; mean age 44.5 (SD 18); 76% (225/296) male; mean ISS 34 (SD 14). BTAI was classified as Grade I 22.6% [67/296]; Grade II 17.6% [52/296]; Grade III 47.3% [140/296]; Grade IV 12.5% [37/296]). Overall mortality was 14.2% (42/296); aortic related mortality (ARM) 4.7% (14/296). Among all deaths, 33%(14/42) were ARM. Open repair was required for only 2% [Table 1], with most undergoing TEVAR (58.4%) or MM (28.0%). TEVAR complications occurred in 3.4% (6/173), most commonly Type 1 endoleak (2.3%; 4/173). Among patients with minimal aortic injury (MAI, GI+GII), 78% (93/119) received MM, while 22% underwent TEVAR. No di!erence in overall or ARM between MM and TEVAR was noted for Grade I-II injuries; although 2 patients undergoing initial MM required intervention for injury progression (both by TEVAR).

Conclusions: Among trauma victims with BTAI, ARM occurs in 1/3. TEVAR has replaced open repair but remains equivalent in outcomes to MM forMAI. Our data supports modification of current BTAI practice guidelines.

SVS Grade	Aortic-related death prior to opportunity for repair	Medical Mgmt alone	Open repair	TEVAR	Aortic-related mortality
1 (N = 67)	0% (0/67)	91.0% (61/67)	0% (0/67)	9.0% (6/67)	1.5% (1/67)
2 (N = 52)	0% (0/52)	61.5% (32/52)	0% (0/52)	38.5% (20/52)	1.9% (1/52)
3 (N = 140)	0.7 (1/140)	11.4% (16/140)	1.4% (2/140)	86.4% (121/140)	1.4% (2/140)
4 (N = 37)	16.2% (6/37)	2.7% (1/37)	10.8% (4/37)	70.3% (26/37)	27.0% (10/37)
All BTAI (N =296)	2.4% (7/296)	28.0% (83/296)	2.0% (6/296)	58.4% (173/296)	4.7% (14/296)

Management type	All-cause mortality	Aortic-related mortality
Overall (N=296)	14.2% (42/296)	4.7% (14/296)
Medical management alone (N = 83)	8.4% (7/83)	0% (0/83)

PETER C. CANIZARO, M.D.

June 30, 1935 - September 3, 1990

Peter C. Canizaro was born on June 20, 1935, in Vicksburg, Mississippi. He received his B.A. degree from the University of Texas, Austin, in 1956 and his M.D. degree from the University of Texas Southwestern Medical School, Dallas, in 1960. Following an internship at Parkland Memorial Hospital/UTSMS, he spent two years as a Captain in the Surgical Research Unit, Brooke Army Hospital, Fort Sam Houston. Following another year as a NIH Research Fellow, he completed his surgical residency at Parkland/UTSMS from 1964-1968. He remained on staff at Parkland/UTSMS from 1968-1974, and then subsequently served on the faculty at the University of Washington (1974-1976) and Cornell University Medical Center (1976-1981) where he became Professor of Surgery.Dr. Canizaro became Professor and Chairman of the Department of Surgery at the Texas Tech University Health Sciences Center in 1982 and remained there until his untimely death in 1990. Dr. Canizaro was an innovative surgical scientist who made multiple contributions to the field of trauma and resuscitation. Examples of topics covered in his published manuscripts include the following:

1960	Distribution changes in extraceullular fluid during acute hemorrhage (with G. Tom Shires, M.D.)
1963	Use of dextran
1963	Use of hypertonic glucose
1969	Diagnostic abdominal paracentesis in trauma
1970	Fluid resuscitation of hemorrhagic shock
1971	Use of Ringer's lactate during shock
1974	Oxygen-hemoglobin dissociation curve
1975	Stroma-free hemoglobin
1985	Ultrasound detection of fluid collection
1986	Endopeptidase in human lung

In recognition of Dr. Peter Canizaro's outstanding contributions to the science of trauma, the AAST has presented the Canizaro Award since 1993 to the best paper by a new member in their first two years of membership.

PETER C. CANIZARO AWARD

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AAST Abstracts of Papers

Posters

Group One: Abdominal Trauma
Poster Professors: Neil Parry, MD; Jason Smith, MD

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Poster Professors: Karyn Butler, MD; Tiffany Bee, MD

Group Three: Emergency General Surgery
Poster Professor: Linda Ding, MD

Group Four: Extremity and Vascular Trauma
Poster Professors: Brian Williams, MD; Morgan McMonagle, MD, MB, BCh, BAO

Group Five: Geriatrics
Poster Professors: Nicole Goulet, MD; Scott Armen, MD; Sasha Adams, MD

Group Six: Neurologic Trauma
Poster Professor: Gail Tominaga, MD

Group Seven: Outcomes / Guidelines
Poster Professors: Scott D'Amours, MD; S Robb Todd, MD; William Chiu, MD; Nacy Parks, MD: Sarah Moore, MD

Group Eight: Pediatric Trauma
Poster Professor: Aaron Jensen, MD, MS

Group Nine: Pre-Clinical / Translational
Poster Professors: Michaela West, MD, PhD; Phil Efron, MD

Group Ten: Shock/Transfusions
Poster Professors: Zsolt Balogh, MD, PhD; Andrea Long, MD; Travis Polk, MD

Group Eleven: Soft Tissue / Head and Neck Trauma
Poster Professor: Sharven Taghavi, MD, MPH

Group Twelve: Thoracic Trauma
Poster Professor: Lawrence Lottenberg, MD

Group Thirteen: Trauma Systems and Epidemiology
Poster Professors: Thomas Esposito, MD, MPH; Lisa Knowlton, MD, MPH; Kimberly Joseph, MD; Christine Cocanour, MD

Poster #1

STATEWIDE SYSTEM-BASED GEOGRAPHIC APPROACH TO TRAUMA CARE ACCESS

Nicolas W. Medrano MSc, Cynthia Villareal, Michelle Price PhD, Brian J. Eastridge, MIMIC Study Group
National Trauma Institute

Introduction: The Multi-Institutional Multi-Disciplinary Injury Mortality Investigation in the Civilian Pre-Hospital Environment (MIMIC) study developed a novel geographic information system (GIS) model to estimate the total pre-hospital time for emergency medical services (EMS) based upon a specified injury location from EMS or forensic records. Our aim was to apply the MIMIC model to state-wide populations to estimate trauma center access using the composite pre-hospital interval, from the time the 9-1-1 call was received until arrival at the nearest trauma center. This includes time taken for the EMS unit to dispatch, response time to the scene, time spent on the scene, and time taken to transport the patient to the nearest trauma center.

Methods: GIS-based models were built using ArcGIS 10.6 for four states (CT, MD, NM, OK) participating in the MIMIC study. These models include ground EMS, air EMS and designated level I, II, and III trauma center locations. Ground EMS locations within the state were collected from the respective state Departments of Health. Air EMS base locations were obtained from the Atlas and Database of Air Medical Services (ADAMS) for locations within the state and in neighboring states response jurisdiction. Designated trauma center locations within and in immediately adjacent regions of neighboring states were collected from the American Trauma Society Information Exchange Program. This trauma system infrastructure was connected to a street network with traffic data to estimate the total prehospital interval. A previous meta-analysis of pre-hospital care times was added to account for dispatch and on-scene times. Finally, the model used US Census block group population weighted centroids to determine the population with access within 45- and
60-minute intervals.

Results: Engaging ground EMS, the model predicted 45 and 60-minute access to level I and II trauma centers as follows: CT (71.4%, 97.3%), MD (57.2%, 77.8%), NM (25.9%,40.6%), and OK (29.9%, 49.3%). When air EMS was integrated into the model, all sites demonstrated enhanced access for both 45 and 60-minute intervals: CT (98.1%, 100%), MD (88.9%, 96.9%), NM (43.6%, 64.1%), OK (56.1%, 82.6%). When level III trauma centers are included in analysis, increases in access were seen for all sites.

Conclusion: This GIS model is the first to analyze trauma center access incorporating the entire pre-hospital interval, utilizing street network traffic data, and the complete trauma system. This approach can be replicated with other states and provides a means to more realistically assess the current state of trauma systems and may aid in future trauma system development.

Poster #2

TOURNIQUET APPLICATION DOES NOT COMPROMISE EXTREMITY GRAFT PATENCY IN CIVILIAN TRAUMA PATIENTS: AN ANALYSIS FROM THE AAST PROSPECTIVE OBSERVATIONAL VASCULAR INJURY TREATMENT (PROOVIT) REGISTRY

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Introduction: Tourniquet usage is an effective method to temporarily stop life-threatening extremity hemorrhage in trauma patients. Although prior studies have shown no association of tourniquet usage and limb loss due to arterial occlusion, few studies have examined the association between pre-hospital tourniquet application with extremity arterial graft revascularization outcomes in civilian trauma patients. Due to the potential risk of vascular occlusion with the use of tourniquets, we investigated the relationship between pre-hospital tourniquet application and in-hospital graft patency for trauma patients with extremity vascular injuries undergoing arterial repairs.

Methods: We analyzed a subset of patients from the PROOVIT registry, the largest registry of traumatic vascular injuries in the civilian population, who underwent open or endovascular definitive arterial repair using a vascular conduit. Patients undergoing primary repair or angioplasty were excluded. Patients who had pre-hospital tourniquet application were compared to those who did not. The primary outcome of the study was in-hospital graft occlusion. Graft occlusion was defined by the need for repeat operations or interventions due to either thrombosis or stenosis of initial arterial repair. The secondary outcome of the study was amputation rate. Data were analyzed using students t-test and X^2 test.

Results: 584 cases of arterial injuries were included in the study (42.3% upper extremity and 57.7% lower extremity injuries). Tourniquets were used in 119 cases (20.4%), and 465 arterial injuries (79.6%) had no tourniquet placement. No differences were seen in AIS extremity or Mangled Extremity Severity Score in patients with or without tourniquet. Patients with tourniquet had significantly worse admission systolic blood pressure (117 vs. 123, $p < 0.05$) and more units of PRBC transfused within 24hrs of admission (7.44 vs 5.00, $p < 0.05$). There was no significant difference in the rate of graft thrombosis/stenosis between the tourniquet and non-tourniquet groups (9.24% vs 10.5%, p=0.68). Tourniquet placement was also not associated with an increased rate of amputation (5.88% vs 8.17%, p=0.40). The most commonly occluded upper extremity vessel was the brachial artery, and the most frequently occluded lower extremity vessel was the popliteal artery in both cohorts. Within the tourniquet group, tranexamic acid (TXA) usage did not associate with increased rate of graft occlusion (6.25 vs. 9.71, p=1.00) or amputation (0 vs. 6.80, p=0.59).

Conclusion: Pre-hospital tourniquet application did not compromise early graft patency in trauma patients undergoing arterial repairs. Tourniquet usage with or without TXA is a safe method for hemorrhage control in civilian trauma patients with extremity arterial injury.

Poster #3

DOES REVERSAL OF DIRECT ORAL ANTICOAGULANTS IN A GERIATRIC HIP FRACTURE POPULATION AFFECT POSTOPERATIVE BLOOD LOSS AND TRANSFUSION REQUIREMENTS? A PROPENSITY MATCHED ANALYSIS

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Introduction: Anticoagulation reversal is often performed for geriatric patients prior to hip fracture repair to lower the risks of blood loss and need for transfusions. However, recent studies have suggested that anticoagulant reversal may not decrease these risks. Reversal of direct oral anticoagulants (DOACs) poses a unique challenge compared to traditional anticoagulants because reversal methods are expensive, not always available, and because they are cleared more rapidly. We hypothesized that DOAC reversal has no effect on postoperative blood loss and the need for postoperative transfusion in geriatric hip fracture patients.

Methods: This was a retrospective propensity matched study across six US level I trauma centers. Geriatric patients (≥ 65 y/o) admitted from 01/2014-01/2018 with isolated fragility hip fractures requiring surgical intervention were included. Patients who were not taking pre-injury DOACs were excluded. Methods considered as anticoagulant reversal were: idarucizumab, fresh frozen plasma (FFP), factor VIIa, and the "wait and watch" method. Patients who went to surgery > 24 hours after the last dose of anticoagulation medication were considered reversed using the wait and watch method. The primary outcome was the total volume of postoperative blood loss. Secondary outcomes included total volume of postoperative packed red blood cells (pRBC), intensive care unit length of stay (ICU LOS), and hospital length of stay (HLOS). Volumes are reported in milliliters (mL). Propensity scores were used to balance the two groups based on variables that were significantly different between groups including: comorbidity count, dementia, and congestive heart failure. Paired Student's t-tests, Wilcoxon paired rank sum test and McNemar's tests were used when appropriate; alpha=0.05.

Results: There were 91 patients identified; 51 patients were reversed prior to surgery and 40 patients were not reversed. Patients were taking the following DOACs: rivaroxaban (55%), apixaban (36%), dabigatran (8%), and edoxaban (1%). After propensity matching, there were 62 patients (31 reversed, 31 not reversed) included in the analysis. The wait and watch method was the only method of anticoagulation reversal utilized. Patients were well matched for age, gender, pre-injury medications, presenting clinical characteristics, and comorbidities. Compared to those not reversed, patients who were reversed had a longer time to surgery (mean, 43 hours vs. 19 hours, $p < 0.001$). Only 13% of patients had postoperative blood loss (13% reversed and 13%not reversed); the median volume of postoperative blood loss was 150 mL for those reversed and 200 mL for those not reversed, p=0.85. Only 15% of patients had postoperative pRBCs transfused (13% reversed and 16% not reversed); the median volume of pRBCs transfused postoperatively was 350 mL for those reversed and 330 mL for those not reversed, p=0.76. The mean HLOS was significantly longer for those reversed compared to those not reversed (8 vs. 5 days, p=0.001). The ICU LOS was not statistically different; 3 days for those reversed and 4 days for those not reversed, p=0.88.

Conclusions: Anticoagulation reversal of DOACS for geriatric patients with isolated hip fracture requiring surgery may be contributing to delayed surgery and an increased HLOS, without having a significant effect on post-operative blood loss or transfusions. Despite the small sample size, these data suggest that DOAC reversal may not be necessary prior to surgical repair of isolated hip fracture.

Poster #4

ANALYSIS OF AUDIT-C SCORE AS A PREDICTOR FOR ALCOHOL WITHDRAWAL SYNDROME IN TRAUMA PATIENTS AT A COMMUNITY LEVEL 1 TRAUMA CENTER

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Introduction: The Clinical Institute Withdrawal Assessment for Alcohol-Revised (CIWA-Ar), an assessment tool used to guide symptom-triggered therapy (STT) in patients exhibiting signs and symptoms of Alcohol Withdrawal Syndrome (AWS), is currently used to guide STT in every patient that admits to daily alcohol use at this institution. Given the lack of screening tools validated for the prediction of AWS, it was hypothesized that CIWA-Ar and associated STT were likely being used inappropriately, leading to poor resource stewardship and overtreatment of patients. The primary objective of this study was to investigate the admission Alcohol Use Disorders Identification Test-Consumption (AUDIT-C), an evidence-based screening tool used to identify hazardous alcohol use, ability to predict AWS among hospitalized trauma patients in order to guide more selective use of CIWA-Ar and STT.

Methods: Retrospective review conducted of adult patients, meeting study selection criteria, with recorded AUDIT-C responses admitted to the trauma service between January 1, 2018 and December 31, 2018 at a single, Level 1 Community Trauma Center. Absent a definitive diagnosis of AWS, an Alcohol Withdrawal Syndrome score (AWS Score) was created based on DSM-V criteria and known risk factors of AWS which was then validated using tabular classification techniques, logistic regression, ROC analyses, and bivariate Pearson correlation statistics. Outcomes included use of benzodiazepines, restraints, CIWA-Ar, and length of stay. CIWA-Ar scores were adjusted for comorbidities to address confounding.

Results: After exclusions, a total of 662 hospitalized adult trauma patients were included, predominately geriatric (age $\geq$ 65, 68%) and female (60%). AWS was defined by AWS Score $\geq$ 3 in patients with moderate alcohol use as defined by an admission BAC > 0.08 and/or admission AUDIT-C score $\geq$ 4 (AUC = 0.993, 95% CI [0.988, 0.998], $P < 0.0005$). Using ROC analyses, an AUDIT-C score $\geq$ 5 yielded significant agreement with AWS with 89.3% and 97.1% sensitivity and specificity, respectively; AUC = .991, 95% CI [0.984, 0.999], $P < 0.0005$) in patients with moderate alcohol use (n = 60). Furthermore, of the 53 patients placed on CIWA-Ar protocol based on clinical judgement alone, 43% had AUDIT-C scores < 5, reflective of inappropriate use.

Conclusion: Admission AUDIT-C scores $\geq$ 5 in the setting of current moderate alcohol use can be used to predict AWS and guide selective use of alcohol withdrawal protocols (CIWA-Ar) in hospitalized, adult trauma patients. As the study population was predominately geriatric, further research is indicated to determine if similar findings are observed in younger patient populations.

Poster #5

CORRELATION BETWEEN FRAILTY SCALE AND BIOMARKERS OF OXIDATIVE STRESS IN GERIATRIC TRAUMA PATIENTS

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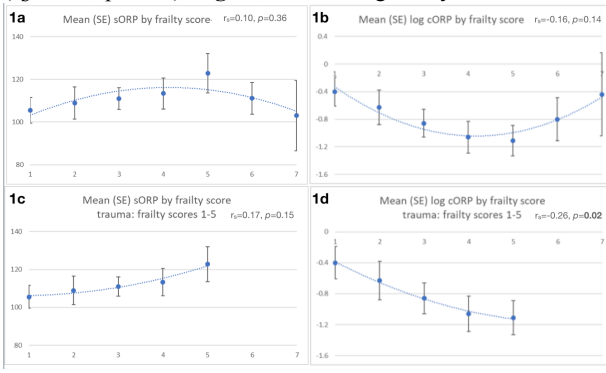
Introduction: Frailty is a state of systematic physiologic decline and hampered capacity for the body to recover from illness or injury. Currently available measures of frailty include clinician-administered scales; there are no known rapid quantitative measures to assess frailty. Whether oxidative stress is a marker for frailty has not been elucidated. The objective of this study is to determine whether oxidation-reduction potential (ORP), a measure of oxidative stress, is correlated with frailty.

Methods: This prospective, observational cohort study was performed among geriatric trauma patients (≥65 years) admitted to a level I trauma center. Plasma samples were tested using the RedoxSYS™ system to measure static ORP (an aggregate measure of oxidative stress) and capacity ORP (a measure of antioxidant reserves). Capacity ORP values were log transformed for normality. Frailty was measured with the Canadian Study of Health and Aging (CSHA) Clinical Frailty Scale (7 point scale; 1=robust health and 7=complete dependence). Spearman rank correlation examined the relationship between frailty and ORP.

Results: There were 93 geriatric trauma patients in our study. The mean (SD) frailty score was 3.5 (1.7), the mean log capacity ORP was -0.8 (0.9) and the mean static ORP was 112 (27). The majority (62%) of patients had low antioxidant reserves, defined as a log capacity ORP less than -0.7. We identified a u-shaped relationship between ORP and frailty score (**Fig1 a,b**), resulting in a non-significant correlation. In the subset with frailty scores 1-5 (86% of patients), there was a significant correlation between log capacity ORP and frailty (r_S=-0.26, p=0.02), **Fig1 c,d**. Increasing frailty scores were correlated with decreasing antioxidant reserves.



Conclusions: The amount of antioxidant reserves as measured by capacity ORP appears to be a quantitative marker to differentiate the degree of frailty ranging from robust health (1) to mild frailty (5). These results suggest that being partially or completely dependent (frailty scores 6-7) may modify the relationship between ORP and frailty score.

Poster #6

VENOUS LIGATION VERSUS REPAIR: CONSIDERING THE THROMBUS

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Introduction: Traumatic lower extremity venous injuries are most commonly managed with either a vein ligation or repair. Current literature discusses an increased risk of developing deep vein thrombosis (DVT) and pulmonary embolism (PE) with either of these strategies but most studies are underpowered to assess the actual risk. It is unclear whether patients who are treated with lower extremity vein ligation or repair require postoperative anticoagulation. In this study we focus on lower extremity venous injuries and hypothesized that vein ligation would be associated with an increased DVT risk but a lower PE risk.

Methods: Patients in the National Trauma Data Bank (NTDB: 2008-2014) with at least one iliac, femoral, popliteal, or tibial venous injury and who received either a vein ligation or repair were analyzed. The rate of DVT and PE were compared between groups.

Results: A total of 1,214 patients were identified. There was no difference between patients who received a vein ligation versus a repair with respect to age, injury severity score, or initial systolic blood pressure (p=0.14-0.36). Sixty-eight percent (n=821) of patients received a venous repair. There was no difference in the odds of developing either a DVT or PE between patients who were treated with vein ligation or repair. There was also no difference between groups when accounting for anatomic location of injury (Table 1). When compared to the general trauma population, any venous intervention was associated with an increased odds of developing a DVT but not in developing a PE (OR = 2.92 ($p < 0.0001$) and 0.66 ($p = 0.11$), respectively).

Table 1. Comparison of DVT and PE rates based on anatomic location.

Vein	Procedure	DVT (%)	OR	P Value	PE (%)	OR	P Value
Iliac	Ligation (139)	8.6	0.63	0.20	0.7	0.31	0.23
	Repair (222)	13.1			2.3		
Femoral	Ligation (168)	13.1	1.37	0.23	1.8	2.30	0.3
	Repair (383)	9.9			0.8		
Popliteal	Ligation (51)	3.9	0.38	0.20	0.0	-	-
	Repair (163)	9.8			0.0		
Distal	Ligation (36)	5.6	0.71	0.70	0.0	0.00	0.64
	Repair (52)	7.7			1.9		
Total	Ligation (394)	9.6	0.90	0.60	1.0	0.50	0.29
	Repair (820)	10.6			1.1		

OR = Odds Ratio

Conclusions: The decision to ligate versus repair a vein is multifaceted. Patients who receive an intervention for a lower extremity venous injury do develop DVTs more frequently compared to the general trauma population but the risk of DVT or PE is not increased with vein ligation when compared to repair. This suggests post-operative anticoagulation may not be necessary after operative treatment of lower extremity venous injuries.

Poster #7

FIREARM TRAUMA: RACE AND INSURANCE INFLUENCE MORTALITY AND DISCHARGE DISPOSITION

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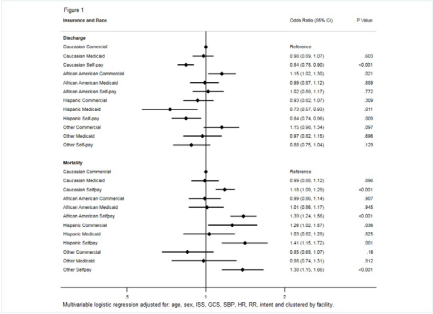
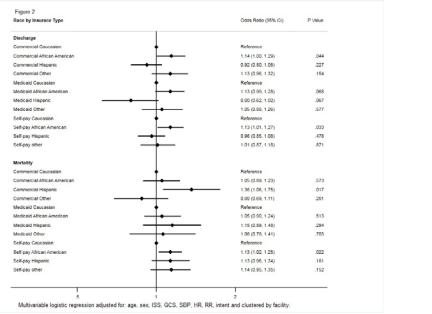
Introduction: Health insurance status and race impacts mortality and discharge outcomes in the general trauma population. It remains unclear if disparities exist by race and/or insurance in outcomes following firearm injuries. The purpose of this study was to assess differences in mortality and discharge based on race and insurance status following firearm injuries.

Methods: The National Trauma Research Database (2007-16) was queried for firearm injuries. In order to minimize bias due to missing data, we utilized multiple imputation for variables associated with outcomes following traumatic injury. Multivariable regression analysis, clustered by facility, was used to assess differences in mortality and discharge disposition.

Results: We identified 120,005 patients. The average age was 31, 88.6% were male, and 50% African American. Overall mortality was 11.5%. Self-pay insurance significantly increased mortality rates in all racial groups compared to Caucasians with commercial insurance (Fig 1). Hispanic Medicaid and self-pay patients were significantly less likely to discharge with post-hospital care compared to commercially insured Caucasians (Fig 1). When examining racial differences in mortality and discharge by individual insurance types, commercially insured Hispanic patients and African American self-pay patients with firearm injury were significantly more likely to die compared to similarly insured Caucasian patients (Fig 2).

Conclusions: Victims of firearm injuries with a self-pay insurance status have a significantly higher rate of mortality. Hispanic Medicaid and self-pay patients were significantly less likely to discharge with post-hospital care compared to Caucasians with like insurance. Continued efforts are needed to understand and address the relationship between insurance status, race, and outcomes following firearm violence.





Poster #8

CONTEMPORARY MANAGEMENT OF AXILLOSUBCLAVIAN ARTERY INJURIES: DATA FROM THE AAST PROOVIT REGISTRY

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Introduction: Endovascular repair is increasingly utilized for repair of axillo-subclavian arterial injuries. The contemporary management of endovascular repair (ER) and open repair (OR) for these injuries were compared.

Methods: The American Association for the Surgery of Trauma (AAST) PROspective Observational Vascular Injury Treatment (PROOVIT) registry was used to identify patients with axillo-subclavian arterial injuries from 2013 - 2019. Demographics and outcomes were compared between patients undergoing ER vs OR.

Results: 167 patients were identified, with intervention required in 107 (64.1%). Among these, 24 patients underwent open damage control surgery (primary amputation = 3, ligation = 17, temporary vascular shunt = 4). The remaining 83 patients (91.6% male; mean age 26.0 ± 16) underwent repair an at initial procedure with either ER (36, 43.4%) or OR (47, 56.6%). ER and OR patients were similar with regards to presentation and demographics [Table] with the only exception that ER was more commonly employed for traumatic pseudoaneurysms ($p=0.004$). ER was associated with lower 24-hour transfusion requirements ($p=0.012$), but otherwise the two groups were similar with regards to in-hospital outcomes [Table]

Conclusion: Endovascular repair is now employed in > 40% of axillo-subclavian arterial injuries amenable to repair at initial operation. This approach is associated with lower 24 hour transfusion requirements and otherwise comparable outcomes to open repair.

	Total (N = 83)	**Open Repair (N = 47)**	**Endovascular Repair (N = 36)**	***p-value***
Demographics				
Age, years (Median +/- IQR)	26.0 +/- 16	27.5 +/- 16	24.5 +/- 11	*p = 0.979*
Male, % (n/N)	91.6% (76/83)	89.4% (42/47)	94.4% (34/36)	*p = 0.341*
Penetrating, % (n/N)	66.3% (55/83)	66.0% (31/47)	66.7% (24/36)	*p = 0.976*
Transection, % (n/N)	39.8% (33/83)	44.7% (21/47)	33.3% (12/36)	*p = 0.295*
Occlusion, % (n/N)	25.3% (21/83)	21.3% (10/47)	30.6% (11/36)	*p = 0.335*
Partial transection / flow limiting defect or pseudoaneurysm % (n/N)	42.1% (35/83)	36.1% (17/47)	50.0% (18/36)	*p = 0.237*
Admission Hypotension (SBP < 90 mm Hg), % (n/N)	12.7% (10/79)	11.4% (5/44)	14.3% (5/35)	*p = 0.743*
ISS ≥ 15, % (n/N)	63.9% (46/72)	60.0% (24/40)	68.8% (22/32)	*p = 0.442*
Extremity AIS ≥ 3, % (n/N)	41.2% (28/68)	50.0% (19/38)	30.0% (9/30)	*p = 0.096*
In-hospital outcomes				
Total PRBCs first 24 hours, units (Median +/- IQR)	2.0 +/- 7	2.5 +/- 9	1.0 +/- 6	*p = 0.012*
Reintervention on repair, % (n/N)	8.4% (7/83)	8.5% (4/47)	8.3% (3/36)	*p = 1.000*
Repair thrombosis / stenosis, % (n/N)	4.8% (5/83)	4.3% (2/47)	8.3% (3/36)	*p = 1.000*
Delayed amputation, % (n/N)	4.8% (5/83)	2.1% (1/47)	5.6% (2/36)	*p = 0.576*
Hospital LOS (Median +/- IQR)	8.0 +/-13	7.5 +/- 13	9.0 +/- 15	*p = 0.864*
Mortality, % (n/N)	1.2% (1/83)	0% (0/47)	2.8% (1/36)	*p = 0.434*

Poster #9

SHARK-RELATED INJURIES IN HAWAI'I TREATED AT A LEVEL 1 TRAUMA CENTER

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Introduction: Although rare, human-shark interactions can result in a wide spectrum of injuries. This is the first study to characterize shark-related injuries (SRIs) in the state of Hawai'i.

Methods: This is a retrospective review of the State of Hawai'i Division of Aquatic Resources (DAR) Shark Incidents List between January 1, 2009 and December 31, 2019. Trauma registry data and medical records were reviewed in patients treated for SRIs at the only Level 1 trauma center in Hawai'i.

Results: Sixty-one patients sustained SRIs in the Hawaiian Islands: 25 Maui, 16 O'ahu, 12 Hawai'i, and 8 Kaua'i. Species involved with SRI were 25 tiger, 4 cookiecutter, 2 Galapagos, 2 requiem, and 1 white tip; 26 were unidentified and 1 was either a Galapagos or sandbar. Thirteen (52%) of all tiger shark injuries occurred between September and November. Four cases were fatal – all died on scene in Maui with shark species unknown. Forty-five survivors (78.9%) received definitive care at regional facilities, including one urgent care. Twelve (21.1%) were treated at the Level 1 trauma center, of which 2 were transferred in for higher level of care. Eleven of 12 (91.7%) had extremity injuries with 3 lower extremity amputations (25%), 2 vascular injuries (16.7%), and 5 nerve injuries (41.7%). Only one had an injury to the abdomen. All patients had local bleeding control in the prehospital setting with 9 (75%) tourniquets and 3 (25%) hemostatic/pressure dressings applied for truncal or proximal extremity injuries. Mean time from injury to emergency department arrival was 1 hour 3 minutes.

Conclusion: The majority of SRI are managed at regional facilities. Prehospital hemorrhage control is an important survival skill as time to definitive care may be prolonged. For cases treated at the Level 1 trauma center, nerve injuries were common and should be suspected even in the absence of major vascular injury. Correlating shark behavior with these observed seasonal injury patterns may help improve public awareness and ocean safety.

Poster #10

DOES PRE-OPERATIVE RESUSCITATION IN SEPTIC EMERGENCY GENERAL SURGERY (EGS) PATIENTS DECREASE MORTALITY?

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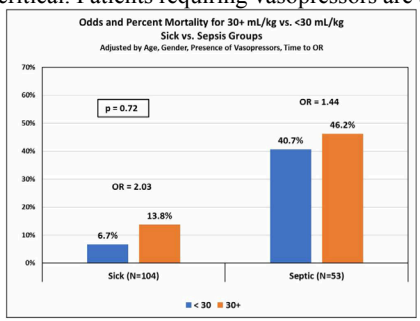
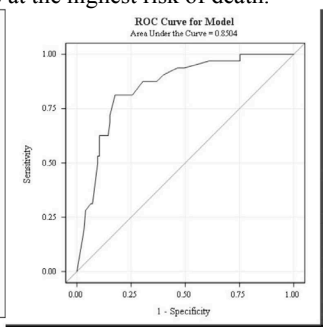
Introduction: In patients with intra-abdominal sepsis, pre-operative resuscitation stabilization may prevent intra-operative hemodynamic instability and improve outcome. The NCCN-Surviving Sepsis Campaign recommends resuscitation with 30 ml/kg crystalloid and/or vasopressors for patients with hypotension or elevated lactate. We hypothesize that EGS patients with intraabdominal sepsis requiring emergency surgery for source control benefit from preoperative resuscitation.

Methods: Retrospective review of a prospectively collected EGS database from January 2011 to June 2019. Patients with intra-abdominal infection who underwent an operation within 24 hours of hospital arrival were included. Patients were stratified as septic group (SG) vs severe sepsis group (SSG). The SG was defined as patients needing urgent abdominal source control (OR w/in 24hours) and the SSG defined as a quick Sequential Organ Failure Assessment (qSOFA) ≥ 2 and lactate ≥ 2 mmol/L. We collected demographics, preoperative volume of resuscitation fluid, need for vasopressors, and time to OR. The primary outcome was in-hospital mortality. Comparisons were made using Pearson's Chi-square statistics. A logistic regression model was constructed to adjust for clinically relevant factors.

Results: There were 157 patients with an average age of 54 (±17) years. Half were male. The median lactate was 1.8 (interquartile range 1.3-2.9) mmol/L, and time to OR was 5.8 hrs. (3.2-12.6). Overall mortality was 20.4%. Multivariate regression analysis demonstrated volume resuscitation > 30 ml/kg was associated with higher mortality in each group. However, when comparing the two groups in terms of the effect of volume resuscitation on the risk of mortality, there was no significant difference (p= 0.72). The ROC for the logistic regression model was 0.85 (see graph). Mortality was higher for time to OR > 8 hours though not statistically significant (OR 1.68, 95% CI 0.59-4.80). The use of vasopressors (Odds ratio 4.78, 95% CI 1.58 – 14.51) was associated with increased mortality.

Conclusion: Pre-operative volume resuscitation to stabilize EGS patients with sepsis or severe sepsis does not decrease mortality. Source control within 8 hours of presentation is critical. Patients requiring vasopressors are at the highest risk of death.





Poster #11

CURRENT MANAGEMENT AND CLINICAL OUTCOMES FOR PATIENTS WITH HEMODYNAMIC INSTABILITY DUE TO SEVERE PELVIC FRACTURE IN LEVEL-1 TRAUMA CENTERS: MULTI-INSTITUTIONAL TRIAL

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Introduction: The mortality rate of pelvic fracture patient with hemodynamic instability is still high. Different combinations of hemostatic procedures are used in each hospital, but reports on the clinical outcomes associated with them are limited. Therefore, the purpose of this multi-center study was to evaluate the current management and clinical outcomes for patients with hemodynamic instability due to pelvic fracture in level-1 trauma centers.

Methods: Three regional trauma centers were participated in this study, and 157 patients who were admitted between January 2015 and December 2018 were enrolled. Patient's clinical data were collected prospectively as part of Korean trauma data bank and were analyzed retrospectively.

Results: The mean age was 59.3 years, and 107 (68.2%) were men. The most common injury mechanism was auto-pedestrian accident, followed by fall, and motor vehicle crash. The mean admission systolic blood pressure was 86.7mmHg, and serum lactate level was 6.68mmol/L. Twenty-four (15.3%) patients had cardiac arrest in emergency room(ER), the mean injury severity score was 39.1, and the mean probability of survival (TRISS) was 48.7%. Pelvic angiography and preperitoneal pelvic packing were performed in 66(44%) and in 89 patients (56.7%), respectively. Resuscitative endovascular balloon occlusion of the aorta (REBOA) was performed 27(17.2%). Pelvic external fixation(PEF) and ligation of internal iliac artery(LIIA) were conducted in 20 (12.7%) and 13 (8.3%) patients, respectively. Seventy-three (46.5%) patients died, including 40 (25.5%) who died from acute hemorrhage. When we evaluated the change of hemostatic procedure by year, REBOA and pelvic binder continued to increase ($p < 0.001$, $p = 0.005$), but PEF significantly decreased ($p = 0.006$). Logistic regression analysis showed that age (OR 1.067, $p < 0.001$), admission lactate (OR 1.292, $p = 0.006$), combined abdominal injury (OR 55.076, $p < 0.001$), REBOA (OR 13.215, $p = 0.003$), period 2017 (OR 0.104, $p = 0.008$) and 2018 (OR 0.181, $p = 0.040$) were independent factors associated with mortality. As risk factors for mortality due to hemorrhage, cardiac arrest in ER (OR 14.754, $p < 0.001$), combined chest (OR 3.987, $p = 0.035$) and abdominal injuries (OR 25.191, $p < 0.001$), and LIIA (OR 18.897, $p = 0.003$) were found.

Conclusion: Since establishment of regional trauma center, hemostatic procedures has been performed for patients with hemodynamic instability due to pelvic fracture in regional trauma centers. Because LIIA was identified as an independent risk factor for hemorrhagic death, it should be carefully determined to use. REBOA was also identified as an independent risk factor for mortality, so complications besides the hemostatic effect must be considered.

Poster #12

ARTIFICIAL INTELLIGENCE MODEL PREDICTS MORTALITY IN RURAL TRAUMA PATIENTS UTILIZING PRE-HOSPITAL PARAMETERS

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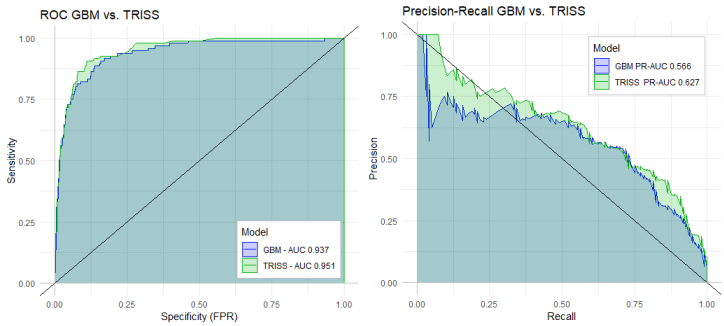
Introduction: Traditional trauma scores are heavily reliant on abbreviated injury score (AIS), with Trauma Injury Severity Score (TRISS) being the gold standard. Reliance on AIS limits accessibility to real time patient care. We present a customized machine learning model to predict risk of mortality utilizing information available *en route* to and immediately after admission to definitive care that is specifically tailored to our aging, rural population.

Methods: Ten year single center Level I Trauma Registry Data (2010-2019) comprised the retrospective data set. Mortality was defined as patient death prior to discharge. Machine learning techniques were compared and performance assessed using accuracy, sensitivity, specificity, positive (PPV) and negative predictive values (NPV), and Area Under the Curve (AUC) discrimination. Model performance was then compared to TRISS.

Results: 5,271 admissions comprised the data set for the machine learning model; of which, 327 (6.2%) expired. Gradient Boosting Machine (GBM) method demonstrated the best performance: ROC-AUC 0.94, PR-AUC 0.57, accuracy 0.95, sensitivity 0.65, specificity 0.98, PPV 0.56, and a NPV of 0.98. TRISS performance metrics were: ROC-AUC 0.95, PR-AUC 0.63, accuracy 0.94, sensitivity 0.71, specificity 0.96, PPV 0.53, and a NPV of 0.98. Variables included in our model were: scene and initial Emergency Department (ED) Glasgow coma scale, respiratory rate, systolic blood pressure, heart rate, age, scene pulse O_2, mechanism of injury, gender, and time between scene and ED measurements.



Conclusion: Early prediction of mortality using data collected *en route* and within minutes of arrival following injury is possible utilizing artificial intelligence. Prompt recognition of mortality risk following injury allows proactive treatment strategies to mitigate morbidity and mortality in this vulnerable population.

Poster #13

THE CONTINUUM OF TRAUMA INDUCED COAGULOPATHY: BLUNT INJURY AND CLOT PHENOTYPE

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Introduction: Trauma-induced coagulopathy (TIC) is not a discrete disorder but a continuum of dysfunctional clot formation. Lethal phenotypes of TIC are characterized by platelet dysfunction, endotheliopathy, depletion of coagulation factors, particularly fibrinogen, and varying degrees of fibrinolysis. While thromboelastography (TEG) is useful in defining these phenotypes, admission TEG values are often paradoxically normal. In a single center study, we previously described a ratio between the Maximum Amplitude (MA) to R-time (MAR ratio). A low MA, relative to a normal R-time, identifies a hypocoaguable phenotype associated with high mortality. The purpose of this study was to utilize multi-center data to determine the relationship between the MAR ratio and mortality, including the role of fibrinogen depletion.

Methods: The PROPPR database was queried for all patients collected prospectively from 12 Level I trauma centers. Patients with isolated severe head injuries and without admission TEG were excluded from the analysis. Patients were divided into blunt and penetrating injury cohorts. The MAR ratio was created for each patient by dividing the MA by the R-time from the admission TEG. Youden's index was used to assign an MAR cutoff value to assess odds of early and late mortality using multivariable logistic regression. A similar model was used to assess fibrinogen and thrombogram values between ratio groups.

Table. MAR Ratio & Mortality (Blunt)

Variable	Odds Ratio (95% CI)
6 Hour Mortality (AUC=0.8503)	
MAR - Low	-ref-
MAR - High	0.064 (0.023, 0.182)
24 Hour Mortality (AUC=0.8226)	
MAR - Low	-ref-
MAR – High	0.070 (0.026, 0.188)
30 Day Mortality (AUC=0.8090)	
MAR - Low	-ref-
MAR - High	0.082 (0.031, 0.213)

*Multivariate logistic regression controlled for the following variables: age, AIS (chest, abdomen, extremity), admission shock index, pre-hospital crystalloid volume, scene/transport time, time of first PRBC transfusion & PROPPR randomization arm.

Results: 547 patients were included. In penetrating injury (n=263), the MAR ratio was not associated with either early or late mortality. In patients with blunt injury (n=284), there was a significant association between low MAR ratios and 6 hour, 24 hour and 30 day mortality (Table). Though there was no difference in fibrinogen concentration (Low: 131 mg/dL (91, 202) vs. High: 187 mg/dL (140, 240), p=0.9707) or onset of thrombin generation (Lag time: Low 3min (2.7, 3.6) vs. High 3min (2.7, 3.7), p=0.0516), peak thrombin concentration (Low: 197.5 nmol/L (138.8, 249.7) vs High: 250.6 nmol/L (204.9, 297.1), p<0.0001) and total thrombin formation (Low: 1132 nM/min (958, 1422) vs. High: 1305 nM/min (1097, 1498), p=0.0083) were significantly decreased in Low MAR patients.

Conclusion: TIC is a complex pathophysiology including many phenotypes of dysfunctional clot. The admission MAR ratio is an early biomarker of a particular dysfunctional phenotype. We postulate that the ratio identifies a phenotype characterized by impaired thrombin generation, with coagulopathy and mortality driven by a large burden of tissue injury, in blunt injury. This is supported by the fact that similar trends are not seen in penetrating injury patients, who have lesser volumes of tissue injury. Endotheliopathy and tissue factor release likely plays a role in the cascade of impaired thrombin burst due to early fibrinogen consumption and thus the weaker clot identified by the MAR ratio.

Poster #14

THE IMPACT OF DELAYED TIME TO FIRST CT HEAD ON FUNCTIONAL OUTCOMES AFTER BLUNT HEAD TRAUMA WITH MODERATELY DEPRESSED GCS

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Introduction: Recent work suggested that patients with moderately depressed GCS on ED arrival who did not undergo immediate computed tomography scan of the head (CTH) had delayed time to neurosurgical intervention and longer ED length of stay (LOS). The objective of the present study was to determine the impact of delayed time to first CTH on functional neurologic outcomes at hospital discharge and other secondary outcomes in this group of patients.

Methods: In this retrospective observational study, all blunt trauma patients presenting to our Level I trauma center (11/2017-10/2019) with first ED GCS 9-12 were identified from the trauma registry and included. Transferred patients and those with extracranial AIS≥3 were excluded. The study population was stratified into Immediate (≤1h) and Delayed (1-6h) CTH groups based on time from ED arrival to first CTH. Outcomes included functional neurologic outcomes at hospital discharge (based on Glasgow Outcomes Scale (GOS) and Modified Rankin Scale (MRS)), time to disposition decision out of the ED, time to neurosurgical intervention, and ED LOS.

Results: After exclusions, 204 patients met the criteria for study inclusion. Overall, 69% (n=140) underwent Immediate CTH and 31% (n=64) had Delayed CTH. Time to first CTH was 0.5h [0.4-0.7] vs. 1.6h [1.3-2.3] ($p < 0.0001$). Median ED GCS was 11 in both groups and there was no difference in median Head AIS (3[2-4] vs. 3[3-4], p=0.078). Median ISS was comparable (2[1-10] vs. 1[1-10], p=0.614). More patients in the Immediate CTH group met standard criteria for trauma team activation (32% vs. 6%, $p < 0.0001$). Median GOS score was 5 [4-5] in both groups (p=0.378). Median MRS score was 2 [1-3] in both groups (p=0.346). Patients in the Immediate CTH group had shorter time to ED disposition decision (3.1h [1.5-6.4] vs. 5.1h [3.6-7.2], $p < 0.0001$), faster time to craniotomy (2.1h [1.4-3.3] vs. 4.4h [3.5-6.1], p=0.055), and shorter ED LOS (6.3h [3.6-9.7] vs. 7.8h [5.2-12.3], p=0.002). After CTH was completed, times to ED disposition decision, craniotomy, and ED exit equalized between the Immediate and Delayed CTH groups (p=0.286, p=0.254, and p=0.298, respectively).

Conclusion: Immediate CTH for blunt trauma patients with moderately depressed GCS in the ED shortened time to disposition decision out of the ED, time to neurosurgical intervention, and time to ED exit, but had no effect on functional neurologic outcomes. Additional resource allocation to expedite CTH in this patient population may have benefits for both patients and hospitals as time to first CTH appears to be a rate-limiting step in the care of patients with moderately depressed GCS.

Poster #15

MACHINE LEARNING IMPROVES ECHOCARDIOGRAPIC ASSESSMENT OF STROKE VOLUME AND CARDIAC OUTPUT WHEN COMPARED TO PULMONARY ARTERY CATHETER

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Introduction: Most point-of-care echocardiography (POC-E) does not include quantitative metrics of stroke volume (SV) and cardiac output (CO), which requires obtaining both the left ventricular outflow tract diameter (LVOTD) and LVOT velocity time integral (VTI). We hypothesized that a previously derived machine learning model of LVOTD ($LVOTD^{CM}$) will be as accurate as human expert measurement ($LVOTD^{HEM}$) of SV as compared to pulmonary artery catheter (PAC).

Methods: Over 20 months, a convenience sample of patients receiving a PAC from our cardiac lab or surgical ICUs were enrolled. CO was measured using three measures of PAC thermodilution and the SV calculated (average CO/heart rate). LVOTD and VTI were obtained by POC-E. SV derived from $LVOTD^{CM}$ and $LVOTD^{HEM}$ are compared to SV measured by PAC.

Results: 84 patients were enrolled. In 59 patients the SV could be assessed, 70% with $LVOTD^{HEM}$ and 92% with $LVOTD^{CM}$. In the 56 patients with complete data, 33 (59%) were male with a mean age 61±9.8 years. Seventeen (30.4%) were on mechanical ventilation, of which 53.5% were in the post-operative period. Valvular dysfunction was seen in 57% of patients, valvular regurgitation was seen in 21.4% (mitral), 14.3% (aortic), and 40% (tricuspid). A majority of patients (67%) had intact left ventricular function, with others having mild (1.8%), moderate (8.9%), severe (10.7%) dysfunction. Correlation between PAC was good for both measures (CM 0.84 and HEM 0.82). Bland Altman analysis comparing PAC and HEM yields a mean bias for difference of 3.1 with 95% limits of agreement (LOA) of -28.8 and 34.9. When comparing PAC and CM, bias was 1.75 and LOA of -29 and 32.5.

Conclusion: This computer model estimating the LVOTD allows accurate calculation of the SV and CO with POC-E using only the VTI. This simplifies the assessment while increasing the yield of POC-E from 70% to 92% of patients, while removing the error associated with LVOTD measurement. Adding objective, quantitative, and repeatable measures to POC-E could significantly improve its utility to the bedside clinician in guiding therapy of the critically ill.

Poster #16

PRACTICE CHARACTERISTICS AND JOB SATISFACTION OF ACUTE CARE AND GENERAL SURGEONS

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Introduction In the early 2000s trauma surgeons were in a predicament. Advances in the care of the injured, including non-operative management of solid organ injury, significantly reduced operative case volume and correspondingly, career satisfaction. Concurrently there were increasing numbers of patients requiring emergent surgery for non-trauma related illnesses and inadequate surgeon availability for these patients. In 2003 members from ACS, AAST, EAST, and WTA met to discuss these issues. From this meeting the field of acute care surgery emerged, followed by a fellowship in 2008. Despite having a discrete fellowship, the identity and character of current acute care surgery practices remain ill-defined. Thus, we sought to describe contemporary academic and non-academic acute care and general surgical practices and evaluate job satisfaction within these two disciplines.

Methods A cross-sectional survey was distributed via email in 2018 to Fellows of the American College of Surgeons. A subset analysis was performed for respondents who completed general surgery residency alone and who reported completing a fellowship in any combination of surgical critical care, trauma, or acute care surgery. Nonresponse weights adjusted for respondent sex, age, and subspecialty training between respondents and the whole surveyed population. We examined practice characteristics and job satisfaction, and compared these between academic and non-academic surgeons.

Results From the 3,807 respondents, 1148 completed general surgery residencies and reported no fellowship training (303 academic, 845 non-academic) and 362 reported training in critical care, trauma, and/or acute care surgery (253 academic, 109 non-academic). Academic acute care surgeons (AACS) reported seeing more consults in the emergency department (22 vs 13, $p < 0.0001$) and a lower percentage of ambulatory cases (15% vs 31%, $p < 0.0001$) than non-academic acute care surgeons (NACS). While AACS reported taking less call per month (6 vs 8, $p < 0.0001$) than NACS, they spent more hours per week on administrative (13 vs 8, $p < 0.0001$), research (5 vs 1, $p < 0.0001$), and teaching activities (10 vs 4, $p < 0.0001$). Similarly, academic general surgeons reported less call per month than non-academic general surgeons (7 vs 10, $p < 0.0001$) and a lower percentage of ambulatory cases (65% vs 56%, $p < 0.0001$). AACS were more likely than NACS to report that work encroaches on their personal time ($p = 0.0134$) and insufficient time for family life ($p = 0.0101$). These statistically significant differences are not seen between academic and non-academic general surgeons. Overall, both academic acute care and general surgeons report higher rates of career satisfaction than their non-academic colleagues ($p = 0.0246$ and 0.0005, respectively).

Conclusions While academic acute care surgeons report taking less call, they have more work-related obligations with less time for personal and family life. Despite these constraints, academic acute care and general surgeons are more satisfied with their careers compared to non-academic surgeons.

Poster #17

A NEW, PARSIMONIOUS PREOPERATIVE RISK ASSESSMENT TOOL SURPAS ACCURATELY PREDICTS OUTCOMES IN EMERGENCY SURGERY

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Introduction: The SUrgical Risk Preoperative Assessment System (SURPAS) is a parsimonious, user-friendly risk stratification tool integrated into the electronic health record. SURPAS requires the manual input of only five preoperative risk variables at the point of care and predicts risk of 12 postoperative adverse events. It is applicable to >3000 operations. Developed from ACS-NSQIP data, it is not specific to emergency surgery. Several emergency surgery risk stratification tools exist; however, none provide equivalent feasibility and convenience to SURPAS. Therefore, we sought to evaluate SURPAS's performance in predicting 30-day mortality and overall morbidity in emergency surgery patients. Secondly, we compared SURPAS to one of the standard risk stratification tools, the Emergency Surgery Score (ESS).

Methods: We calculated SURPAS and ESS risk predictions for 30-day postoperative mortality and overall morbidity for 205,318 emergency surgical patients from the ACS-NSQIP 2009-2018 database. Patients with missing variables were excluded. We compared the performance of each model using Hosmer-Lemeshow goodness of fit statistics, C-Indices and Brier Scores. Estimates from each model were compared to known outcomes.

Results: We estimated risk for 663,720 emergency surgery patients. 1.7% (n=11,085) of patients were excluded for missing a variable for the SURPAS model; 67.4% (n=447,317) of patients were excluded for missing a variable for the ESS model, most commonly a laboratory value. SURPAS and ESS estimates for mortality and overall morbidity were similarly accurate. SURPAS tended to slightly underestimate risk of mortality and morbidity (8.1%; 35.9%) while ESS slightly overestimated these (10.1%; 43.8%) compared to observed rates (8.9%; 38.8%). C-Indices for mortality and morbidity and Brier score for morbidity were slightly better for SURPAS, while Brier score for mortality was slightly better for ESS.

Conclusions: Both SURPAS and ESS accurately predict postoperative risk of 30-day mortality and overall morbidity in a large cohort of emergency surgery patients. However, SURPAS is easier to implement and the variables are more often available at the time of assessment compared to ESS. SURPAS offers a parsimonious, rapid, accurate and user-friendly tool for preoperative risk stratification in emergency surgery.

Poster #18

THE ELDERLY PATIENT ONE YEAR AFTER TRAUMA: PALLIATIVE PERFORMANCE SCALE PREDICTS FUNCTIONAL OUTCOMES

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Introduction: Many elderly individuals value quality-of-life over survival but the ability to predict long-term function after trauma is limited. Palliative Performance Scale (PPS) predicts discharge and 6-month outcomes in elderly trauma patients. The purpose of this study was to investigate whether PPS predicts 1 year outcomes.

Methods: Prospective observational study of trauma survivors $\geq$ 55 years, discharged alive. Patients were stratified by pre-injury PPS high (> 80) or low (< 80). Outcomes were functional status at 1 year measured by Glasgow Outcome Scale Extended (GOSE), Euroqol-5D and SF-36. Adjusted relative risks (aRR) were obtained using modified Poisson regression.

Results: Follow-up was achieved on 215/301 patients (71%). Post-discharge mortality was 30% in low PPS patients vs 8% in high PPS patients ($P < 0.001$). At one year, the high PPS patients had a greater median GOSE (Figure) as well as an increased percentage with improvement in GOSE from discharge (66% vs 27% $P < 0.001$). Low PPS predicted poor GOSE (1-4)(aRR, 3.03; 95% confidence interval [CI], 2.0-4.5) and death at 1 year (aRR, 4.49; 95% CI 2.1-9.6). An increased percentage of low PPS patients reported difficulty with mobility (91% vs 46% $p < 0.0001$), self-care (52% vs 19% $p < 0.001$), and usual activities (82% vs 56% p=0.002). The SF36 demonstrated that high PPS patients had better physical functioning, social functioning and general health vs. low PPS.

Conclusion: Low Pre-Injury PPS predicts mortality and poor functional outcomes one year after trauma. Low PPS patients were more likely to decline, rather than improve over time. Although functional outcomes improve in high PPS patients, they still experience significant pain, and limitations in mobility and performing regular activities one year after discharge.

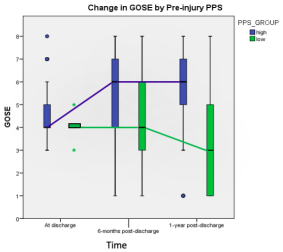

Figure: Box plots of Palliative Performance Scale (High vs Low) and Post Discharge Functional outcomes (6 months and 1 year)
•outlier *Extreme outlier

Poster #19

A NEW, PRESSURE-REGULATED BALLOON CATHETER HAS IMPROVED INFLATION/DEFLATION CONTROL FOR PARTIAL RESUSCITATIVE ENDOVASCULAR BALLOON OCCLUSION OF THE AORTA (REBOA)

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INTRODUCTION: Resuscitative endovascular balloon occlusion of the aorta (REBOA) is an effective maneuver to control bleeding and raise central aortic pressures in some scenarios of shock. However, existing technology such as the ER-REBOA™ catheter achieves an "all or nothing" inflation, deflation and aortic occlusion profile, limiting its ability to allow small amounts of flow past the balloon to mitigate distal ischemia. This study introduces a new technology called pREBOA-PRO™ which has pressure-regulated inflation and a balloon containing flow channels and compares it to the ER-REBOA™ catheter in its ability to achieve targeted, distal aortic perfusion and partial REBOA.

METHODS: The new pREBOA-PRO™ device (7 Fr), which includes a pressure-regulated safety or "pop-off" valve, was compared to the ER-REBOA™ in a bench testing and a porcine model. Balloon inflation, deflation and occlusion properties were first compared in a non-pulsatile, silicone circuit as the flow rate distal to the balloon was measured continuously (N=20). To compare the two devices' ability to achieve partial occlusion *in vivo* including target distal perfusion (TDP), balloons were inflated to occlude the thoracic aorta of swine (N=8) following hemorrhage and incrementally deflated to a goal flow of 300 ml/min. Femoral mean arterial pressure (MAP) was monitored as the surrogate for distal aortic perfusion.

RESULTS: In bench testing, the balloon volume change required to transition from occlusion to baseline flow was significantly greater for pREBOA-PRO™ compared to ER-REBOA™ in zone 1 simulated tubing (9.08 mL ± 1.06 vs. 2.32 mL ± 0.11, p less than 0.001) and in zone 3 simulated tubing (6.41 mL ± 0.35 vs. 1.80 mL ± 0.25, p less than 0.001). Additionally, the ER-REBOA™ catheter demonstrated a linear and abrupt change in distal flow upon incremental balloon deflation and a limited ability to titrate to partial occlusion. In contrast, the pREBOA-PRO™ demonstrated a more controlled, precise increase in distal flow with small, incremental amounts of manual balloon deflation. In-vivo testing showed less variation in distal MAP with pREBOA-PRO™ compared to ER-REBOA™ following an area under the curve analysis (585ml/min ±141 vs. 1149ml/min±499, respectively). The pressure-regulating safety valve of pREBOA-PRO™ was effective in all cases and there were no instances of balloon or vessel rupture with intentional over-inflation.

CONCLUSION: This study is the first to report preclinical testing of a new REBOA technology that achieves pressure-regulated occlusion with a balloon designed for partial REBOA and targeted distal aortic perfusion. The pREBOA-PRO™ device provides a greater level of control compared to existing technology, which may make it easier to establish desired amounts of flow to distal organs, extend the time over which REBOA can be applied, and mitigate the unwanted sequelae of distal ischemia.

Poster #20

LOST IN TRANSLATION: EVALUATION OF AN AUTOMATED SOFTWARE METHOD VERSUS A DELPHI PROCESS TO TRANSLATE THE AAST DEFINED EGS ICD-9 CODES INTO ICD-10

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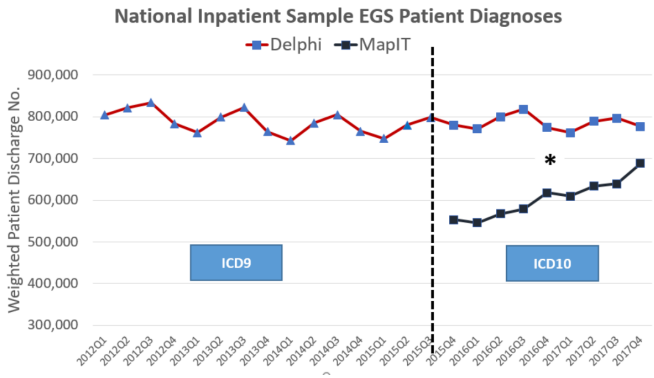
Introduction: In 2013 the AAST defined an EGS specific ICD-9 codeset. The United States converted to ICD-10 in October 2015 and since then no uniform codeset has been available to study EGS. Our group recently translated the ICD-9 codes into ICD-10 using a Delphi process, and we hypothesized that this would better correlate to prior national estimates than automated ICD-10 software mapping (MapIT).

Methods: The NIS was queried from 2012-2017 for AAST-defined EGS ICD-9 Codes in the primary diagnosis field and ICD-10 translation of these codes through two methods: MapIT and a Delphi codeset translated by a panel of Acute Care Surgeons. EGS patient volume, demographics, and outcomes were evaluated between the MapIt and Delphi codes using Rao-Scott chi-square tests. EGS prevalence using weighted hospital discharge after the ICD-10 transition was the primary outcome of interest. Given sample size, p values are not reported as all were p less than 0.0001.

Results: There were 11,829,785 EGS patient discharges in the ICD-9 era; 7,074,601 Delphi and 5,439,517 MapIT in the ICD-10 era. EGS prevalence per quarter is displayed in the Figure, demonstrating a statistically significant decrease in patient number from ICD-9 to MapIT per quarter (mean per quarter of 788,652 vs 604,390) but similar from ICD-9 to Delphi (788,652 vs 786,067). The number of patient discharges was significantly higher in Delphi group compared to MapIT. Demographics and prevalence per diagnosis group were clinically similar between ICD-9 and Delphi, as were length of stay (4.7 vs 4.6 days) and inpatient mortality (1.30% vs 1.25%).

Conclusion: The Delphi created ICD-10 EGS codeset provides a more robust, accurate translation of the AAST ICD-9 codes than automated software. This codeset can be used to inform EGS research on a national, regional, and local level to study and improve our patients' care.



Poster #21

A CALL FOR STANDARDIZATION: PRACTICE PATTERNS AND MANAGEMENT OF CRITICAL ILLNESS-RELATED CORTICOSTEROID INSUFFICIENCY IN SURGICAL INTENSIVE CARE UNITS

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Introduction: Critical illness-related corticosteroid insufficiency (CIRCI) is a known sequela of severe injury and illness, yet its diagnosis and management are challenging. We hypothesized that CIRCI has significant variability in its diagnosis and management within surgical intensive care units (SICUs). Our study aimed to assess the state of practice of CIRCI in the American College of Surgery Committee on Trauma (ACS COT) certified level 1 trauma centers.

Methods: An 11-item questionnaire was developed based on a CIRCI literature search with expert input from medical endocrinology, acute care surgeons, and surgical intensivists to assess practice patterns of CIRCI. In particular, we surveyed the method of diagnosis of CIRCI, the management of corticosteroids in septic and hemorrhagic shock, and the use of mineralocorticoids in septic shock. Prior to distribution, it was validated across 2 separate institutions by board-certified critical care surgeons. The questionnaire was then distributed to trauma surgeons and surgical intensivists within level 1 trauma centers in regions 4 and 6 of the ACS COT (Southeastern United States). This survey was open from April 2019 to January 2020.

Results: A total of 56 responses were collected with a response rate of 70% - at least one member of all level 1 trauma centers in the study replied. 72% of respondents indicated they evaluate or manage CIRCI on a weekly basis. In regards to the diagnosis of CIRCI, only 5% of respondents use a formal protocol and 32% do not use laboratory testing. While a majority of respondents (94%) use corticosteroids to treat vasopressor refractory septic shock, 66% of those surveyed have not implemented mineralocorticoids as part of the management. Finally, 83% of respondents indicated a knowledge gap exists in the therapeutic value of corticosteroids for hemorrhagic shock and 30% of respondents sometimes administer corticosteroids to patients in hemorrhagic shock.

Conclusions: This survey demonstrates the extreme variability in diagnosing and managing CIRCI. Most providers are appropriately treating sepsis-related CIRCI with corticosteroids, but only 33% are compliant with level 1 evidence demonstrating improved mortality in treating CIRCI with hydrocortisone plus fludrocortisone. Methods of diagnosis of CIRCI are very variable and there is a large knowledge gap in the therapeutic role of corticosteroids and laboratory assessment of CIRCI in hemorrhagic shock. These responses obtained from a large majority of respondent surgeons at level 1 trauma centers across 2 separate ACS COT regions reflect an opportunity for regional and national improvement in CIRCI – both in closing the knowledge gap in CIRCI and the need for further research.

Poster #22

WEIGHT-BASED ENOXAPARIN USE IN TRAUMA PATIENTS, ARE ANTI-FACTOR XA LEVELS NECESSARY?

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Introduction: Enoxaparin is the established treatment modality for deep vein thrombosis (DVT) chemoprophylaxis in trauma patients. Literature suggests that weight-based dosing is superior to standard dosing based on measured anti-factor Xa levels. However, the data showing if continued monitoring of anti-factor Xa levels is necessary is limited.

Methods: A retrospective analysis reviewing adult trauma patients admitted between January 1, 2018 to February 28, 2019. Three-hundred patients who received at least three consecutive doses of enoxaparin 0.5 mg/kg every 12 hours for DVT prophylaxis prior to an anti-factor Xa peak level met inclusion criteria. The percentage of patients who achieved the goal anti-factor Xa peak level in the range of 0.2 to 0.6 unit/mL was the primary endpoint. The incidence of newly diagnosed venous thromboembolism (VTE) and bleeding complications were assessed as secondary endpoints.

Results: Ninety-one percent of patients had an anti-factor Xa level within the target range, 7.7% were below goal, and 1.3% were above goal. Of the critically ill patients, 87.2% of patients had anti-factor Xa peaks within goal, while 93.4% of non-critically ill patients achieved the target. Obese patients had anti-factor Xa peaks within goal in 95.6%, compared to 88.2% in non-obese patients ($p = 0.031$). Bleeding complications requiring surgical intervention occurred in three patients ($p=0.012$). Newly diagnosed VTE occurred in 2.0% of patients.

Conclusions: Use of weight-based enoxaparin dosing in trauma patients routinely achieved the anti-factor Xa goal range 85% of the time. Therefore, routine monitoring of anti-factor Xa levels may not be necessary for weight-based enoxaparin dosing. Bleeding complications and incidence of VTE were similar to previously described studies.

Poster #23

MAKING THE CALL IN THE FIELD: A COMPARISON OF EMS-IDENTIFIED VERSUS ICD-10 DIAGNOSIS CODING OF ANATOMIC TRAUMA TRIAGE CRITERIA

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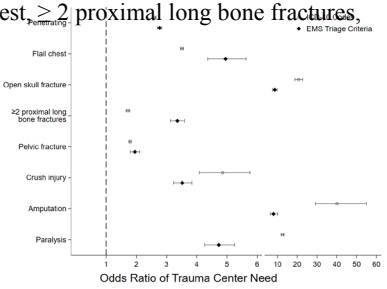
Introduction: The National Field Triage Guidelines (NFTG) were created to inform triage decisions by Emergency medical services (EMS) providers and include eight anatomic injuries that prompt EMS providers to transport to a level I/II trauma center. It is unclear how accurate EMS providers are in recognizing these anatomic injuries. Our objective was to compare EMS-identified anatomic triage criteria with ICD-10 coding of these criteria, as well as their association with trauma center need.

Methods: Scene patients ≥16 years in the NTDB during 2017 were included. NFTG anatomic criteria were classified based on EMS documentation, newly included in the NTDB, and ICD-10 diagnosis codes. Primary outcome was trauma center need (TCN), defined as ISS>15, ICU admission, ED disposition to the OR, or ED death. Prevalence and TCN were evaluated across individual anatomic triage criteria in EMS-identified and ICD-10 coded criteria. Diagnostic performance of EMS-identified vs ICD-10 coding of NFTG criteria to predict TCN was compared. Logistic regression tested the association between TCN and individual NFTG criteria.

	Prevalence			*Trauma Center Need*		
	EMS	**ICD-10**	**p-value**	**EMS**	**ICD-10**	**p-value**
Penetrating Injury	3.4%	10.1%	p<0.01	58.3%	51.8%	p<0.01
Flail Chest	0.2%	12.9%	p<0.01	74.5%	58.9%	p<0.01
Open Skull Fracture	0.2%	1.0%	p<0.01	83.8%	92.6%	p<0.01
≥2 Proximal Long Bone Fractures	0.6%	1.8%	p<0.01	65.7%	47.3%	p<0.01
Pelvic Fracture	0.4%	7.1%	p<0.01	53.8%	48.2%	p<0.01
Crush Injury	0.4%	0.1%	p<0.01	67.8%	68.0%	p=0.89
Amputation	0.1%	0.1%	p<0.01	83.5%	95.4%	p<0.01
Paralysis	0.3%	1.5%	p<0.01	71.5%	85.4%	p<0.01

Results: 669,795 patients were analyzed. The Table shows prevalence and proportion with TCN of EMS-identified and ICD-10 coded criteria. Overall, EMS-identified vs ICD-10 coded criteria were less sensitive (31% vs 59%), but more specific (91% vs 73%) and accurate (71% vs 68%) for predicting TCN. EMS providers demonstrated similar undertriage (34% vs 35%) and lower overtriage (4% vs 38%) for TCN. Odds of TCN were significantly greater for EMS-identified criteria (OR 4.51; 95% CI 4.45-4.57) vs ICD-10 coding (OR 3.75; 95%CI 3.71-3.79). EMS-identified penetrating injury, flail chest, ≥ 2 proximal long bone fractures, and pelvic fractures were associated with greater TCN than ICD-10 coding (Fig).



Conclusion: EMS providers demonstrate greater specificity and accuracy in predicting TCN, as well as markedly reducing overtriage while maintaining similar undertriage compared to ICD-10 coding. EMS identification is less sensitive for anatomic criteria; however, EMS providers appear to identify most clinically significant injuries. ICD-10 coding may not be ideal for identifying anatomic triage criteria in trauma registries or research. Further study is warranted to identify the most clinically important anatomic triage criteria.

Poster #24

THE CHALLENGES OF YOUTH: END-OF-LIFE CARE FOR YOUNG TRAUMA PATIENTS

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Introduction: Trauma remains the leading cause of death for those up to 45 years of age. However, in trauma, most goals of care (GOC) investigations have focused on geriatric patients. Young adults (YA), defined as age 16 to 40 years, represent a distinct population in a phase of life with unique psychosocial challenges. While GOC planning in this age group has been studied within oncology, it has not been well evaluated in trauma. We sought to explore how GOC planning was approached in the YA population at our trauma center, hypothesizing that this process would be prolonged and complicated by psychosocial factors.

Methods: We performed a retrospective review of registry data for all adult (age ≥ 18) patients with an ICU length of stay of at least one day at our level I trauma center from 2015 to 2019. Data was collected on baseline health status, trauma mechanism, injury severity, and hospital course. YA patients were divided into two groups based on transition to comfort measure only (CMO) and disposition. The Young-CMO group was made up of YA patients who had withdrawal of support (WOS), while the Young-Died group was composed of YA who died in the hospital without being made CMO. Targeted chart reviews were performed to assess the GOC approach including family involvement and relevant social history.

Results: A total of 4146 patients met inclusion criteria including 905 (21.8%) YA. YA patients had a median ISS of 18 (IQR 10-26) and median ED GCS of 15 (IQR 9-15). Among this cohort, 39 (4.3%) were made CMO and 11 (1.2%) died without WOS. Young-CMO patients had a high incidence of head injury (79.5%), lower ED GCS (4.3) and higher ISS (33.9). All patients had family involvement in GOC planning with 79.5% having multiple decision-makers and more than 20% encountering disagreements during the process. Multiple family meetings were required for 71.8% of families prior to WOS. All meetings emphasized patient diagnoses and prognosis but only half (53%) discussed what the patient may want in this situation. The family decision regarding GOC matched the patients' wishes in only 45% of cases. The Young-Died group had a higher rate of self-inflicted injuries (30 vs 23.1%) and 54.5% were pronounced brain dead. The approach to GOC was similar in terms of family involvement, number of meetings and relevant social history.

Conclusion: GOC planning following trauma is complicated by the acute nature of the event. While older individuals may have pre-existing advance directives, YA are unlikely to have discussed their preferences. Our study demonstrates the majority of severely injured YA patients are not able to participate in the GOC process and the decision making falls on their families. Given that many of these patients are early in their careers with young children, the decisions facing the families are likely more complex than for geriatric patients. Innovative interventions to encourage advance planning among YA and support families during this process are needed.

Poster #25

DISCOVERING THE OPTIMAL CRITICAL THRESHOLD VALUE - A WORLDWIDE ANALYSIS: USING SYSTOLIC BLOOD PRESSURE TO DETERMINE WHEN TO PLACE A REBOA

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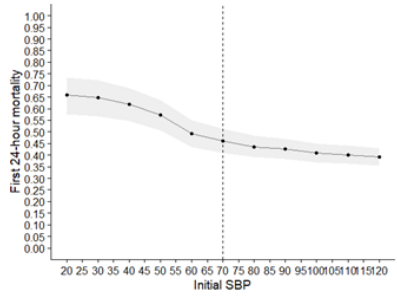
Introduction: Currently, Resuscitative Endovascular Balloon Occlusion of the Aorta (REBOA) is used as a therapeutic adjunct in Non-Compressible Torso Hemorrhage (NCTH). However, it is yet unknown what is the optimal Systolic Blood Pressure (SBP) value at which surgeons should place a REBOA to obtain better outcomes. Herein, we sought to determine the optimal SBP threshold value for placement of a REBOA in severely injured patients.

Methods: We conducted a retrospective review of all trauma patients who underwent REBOA placement in the AAST-AORTA database (U.S.A) and the ABO-Trauma Registry (Europe, Asia, Africa and South America). Patient parameters on admission: SBP pre-REBOA, ISS and 24-hour mortality were analyzed via ROC curves and univariate/multivariate logistic regression.



Results: A total of 940 cases were reviewed, of which 803 were included in the final analysis (137 were excluded due to missing data points). Mean ISS was 35.2 (SD: 15.9) and most patients (79.9%) suffered blunt trauma. Overall, 24-hour mortality was 39.1% (371) (41.3% (261) for blunt trauma and 30.8% (49) for penetrating trauma). SBP pre-REBOA had a moderate predictive capacity with an AUC of 0.604. We were able to identify that SBP pre-REBOA of < 70 mm Hg had an upper rate of mortality (mortality rate of 50% for SBP pre-REBOA of 60 mm Hg and 45.9% for 70 mm Hg). Via multivariate analysis, adjusted for trauma mechanism, injury severity and cardiac arrest prior to arrival, we found that a SBP pre-REBOA of 70 mm Hg had an OR for mortality of 1.46 (IC95% 1.06-2.02).

Conclusion: After an extensive worldwide analysis we have found that a pre-REBOA SBP of 70 mmHg appears to be the optimal minimal threshold value upon which the placement of a REBOA, if indicated, should be placed to achieve a better outcome. Beyond this point mortality rates significantly increase to more than 50% despite the use of REBOA.

Poster #26

INCREASED PARACELLULAR PERMEABILITY IN BRAIN MICROVASCULAR ENDOTHELIAL CELL MONOLAYERS TREATED WITH PLASMA FROM PATIENTS WITH SEPSIS

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Introduction: Sepsis is caused by an inflammatory immune response triggered by a bacterial infection although the pathogen could be from fungal or viral origin. In severe sepsis cases, this inflammatory response causes poor organ function and insufficient blood flow due to direct damage of the endothelial cell monolayer lining the vasculature. Endothelial cell-cell junctions are disrupted during vascular inflammation resulting in the paracellular flux of plasma fluid and proteins. Using an endothelial cell monolayer cell culture model, we investigated the *in vitro* effect of plasma collected from septic patients on endothelial barrier function.

Methods: Admitted multi-trauma patients with diagnostic injury codes of septic shock or sepsis were identified through the trauma registry. Patients were included in the study if an admission heparinized whole blood sample (< 24 hours post-admission) was obtained and stored at -80°C. Patients were excluded if they were administered a broad spectrum or targeted antibiotic prior to collection of admission sample. The study was approved by the institutional review board and consent for daily blood draws was given by the patient or their legally authorized representative. Self-proclaimed healthy individuals were also recruited and consented as controls. Immortalized human brain microvascular endothelial cells (HuBrEC) were grown to confluency on fibronectin-coated, gold-plated electrodes and monolayer resistance was monitored in real time using the Electrical Cell-Substrate Impedance Sensing (ECIS) system until a complete monolayer was formed. Monolayers were dosed with 10% heparinized plasma samples from controls and septic patients, and the effect on paracellular and transcellular permeability was monitored by measuring trans-endothelial electrical resistance (TEER).

Results: A total of 24 trauma patients with sepsis were initially included in the study. Of these, 10 patients were included in the study since the admission sample was obtained within the first 24 hours post-trauma. A total of 4 plasma samples from healthy volunteers were used as control samples. HuBrEC monolayers dosed with plasma samples from septic patients showed a significant decrease in TEER (increased permeability) versus controls with a peak drop observed between 1.5-2 hours. A 60% significant decrease in barrier function (Rb) was also observed between 1.5-2 hours when monolayers were dosed with plasma from septic patients.

Conclusion: This study demonstrates that plasma from septic patients significantly decreases endothelial barrier function. We discuss the role of pro-inflammatory cell membrane receptors on vascular permeability in our *in vitro* model.

Poster #27

INJURED BEHIND BARS: PRISONERS PRESENTING TO A LEVEL 1 TRAUMA CENTER

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Introduction: Over the past 40 years, the U.S. prison population has increased by more than 600%, and prisoners account for one of every 200 hospitalized injured patients. However, little has been previously described about the injury patterns of this unique subpopulation. We sought to describe these and other characteristics of prisoners who presented to our center after injury while incarcerated. Because penetrating trauma from an improvised weapon (e.g., shank) is frequent, we also specifically sought to compare prisoners and non-prisoners who sustained an anterior abdominal stab or shank wound, hypothesizing that such prisoners are less likely to sustain a significant injury or undergo an abdominal operation compared to non-prisoners.

Methods: We reviewed the medical records of injured adult prisoners who presented to an urban level I trauma center between February, 2011, and April, 2017. We collected information about medical and psychiatric history, injury mechanism and circumstances, and management using a standardized instrument. We linked these data to institutional trauma registry data. We described characteristics of the injured prisoners and their hospitalizations. We compared prisoners who sustained an anterior abdominal stab wound to a random sample of non-prisoners with the same mechanism of injury, with a 1:2 prisoner:control ratio. We evaluated as outcomes whether the patient sustained an intra-abdominal injury, whether an abdominal operation was performed, length of stay, and mortality.

Results: Of 14,461 hospitalized injured adults, 299 (2.0%) were injured while incarcerated [69 (24%) in county and 220 (76%) in state prisons]. 285 prisoners (96%) were male and the mean age was 40 ± 13 years. The most common mechanisms were stab wounds [109 (36%)], blunt assault [80 (27%)], and falls [73 (24%)]. 36 prisoners (12%) had self-inflicted injuries. Median Injury Severity Score was 9 (4, 16). 127 (43%) underwent an operation. 98 (33%) had a major psychiatric disorder, including mood [37 (12%)], psychotic [36 (12%)], and substance use [27 (9%)] disorders. Psychiatry consultation occurred during 45 hospitalizations (15%). Among 33 prisoners (11%) and 66 non-prisoners who sustained an anterior abdominal stab wound, prisoner status was associated with less likelihood of having an intra-abdominal injury [18% vs 47%; OR 0.35 (95% CI 0.15-0.82)] and less likelihood of undergoing an abdominal operation [42% vs 68%; OR 0.25 (95% CI 0.09-0.98)]. Median length of stay (3 vs 4 days, p=0.65) and inpatient mortality [0% vs 3%; RR 0.97 (95% CI 0.93-1.01)] did not differ between the two groups.

Conclusion: Many injured prisoners have psychiatric illness, are involved in interpersonal violence, or harm themselves. Clinicians should consider routine psychiatric evaluation for this population. Among hospitalized patients, abdominal stab/shank wounds sustained in prison are less likely to result in significant injuries or operative intervention than similar wounds in non-prisoners; serial clinical assessment of such injuries may be appropriate.

Poster #28

PREHOSPITAL END TIDAL CARBON DIOXIDE PREDICTS HEMORRHAGIC SHOCK UPON EMERGENCY DEPARTMENT ARRIVAL

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Introduction: End tidal carbon dioxide ($ETCO_2$) is a measure of both ventilation and perfusion. Emergency Medical Services (EMS) providers commonly use $ETCO_2$ to verify endotracheal tube placement. We hypothesized that low $ETCO_2$ values in the prehospital setting could be used to predict hemorrhagic shock in intubated trauma patients.

Methods: This retrospective observational study evaluated adult trauma patients intubated in the prehospital setting and managed at a single Level 1 trauma center over 2 years. Continuous $ETCO_2$ data was downloaded directly from the cardiac monitor and linked with prehospital and hospital data from the EMS and trauma registries. The primary outcome was hemorrhagic shock, defined as either Emergency Department (ED) systolic blood pressure (SBP) $\leq$ 90 mmHg or initial shock index (SI) > 0.9, and transfusion of least one unit of blood products. Deaths from hemorrhage in the ED prior to transfusion were also included. To determine a representative minimum $ETCO_2$ value for each patient, we calculated the median $ETCO_2$ every 30 seconds. We then selected the minimum value from the 30-second median values. Various threshold values of minimum prehospital $ETCO_2$ were evaluated for their predictive value of hemorrhagic shock. Sensitivity analyses were also performed to evaluate subgroup performance based on mechanism of injury, sex, and injury severity score (ISS). Results were analyzed for statistical significance using Wilcoxon Rank Sum tests.

Results: We included 175 intubated patients (84% male, 36% penetrating injury, 26%overall mortality), 75 of which were in hemorrhagic shock on ED arrival. Patients in hemorrhagic shock had a higher mortality (45% vs. 11%), a higher median ISS (29 vs. 16), a higher median initial ED lactate (6.8 vs. 3.0), and a higher occurrence of penetrating injury (52% vs. 24%). Patients in hemorrhagic shock had significantly lower median $ETCO_2$ values (see table). This pattern was consistent when stratified by mechanism of injury, ISS, sex, and mortality (see table). Of the 52 patients with a minimum prehospital $ETCO_2 \leq 25$ mmHg, 69% were in hemorrhagic shock on ED arrival; and of the 35 patients with an $ETCO_2 \leq 20$ mmHg, 83% were in hemorrhagic shock. The area under the receiver operating characteristic (ROC) curve for minimum $ETCO_2$ was 0.71 (95% CI, 0.62 – 0.79).

Conclusions: Intubated patients with hemorrhagic shock upon ED arrival had significantly lower prehospital $ETCO_2$ values, and minimum $ETCO_2$ values < 25 mmHg were highly predictive of hemorrhagic shock. Incorporating $ETCO_2$ assessment into prehospital care for trauma patients could support decisions regarding prehospital blood transfusion, triage to higher-level trauma centers, and trauma team activation.

	Minimum $ETCO_2$ (mmHg) Values with IQR		
	Hemorrhagic Shock (n = 75)	**No Hemorrhagic Shock (n = 100)**	**p-value**
Overall (n = 175)	27 (13 – 32)	33 (29 – 37)	< 0.0001*
Mechanism of Injury			
Penetrating (n = 104)	20 (9 – 32)	33 (28 – 39)	0.0003*
Blunt (n = 63)	29 (21 – 35)	33 (29 – 37)	0.020*
ISS			
< 15 (n = 61)	28 (17 – 32)	34 (30 – 40)	0.013*
≥ 15 (n =114)	26 (12 – 33)	32.5 (29 – 36)	0.0003*
Sex			
Female (n = 28)	23 (20 – 29)	31 (24 – 35)	0.08
Male (n =147)	27 (10 – 33)	34 (29 – 28)	< 0.0001*
Mortality			
Alive (n = 130)	29 (23 – 33)	34 (30 -38)	0.003*
Dead (n = 45)	13 (8 – 31)	28 (22 – 33)	0.051

* Indicates significant difference between median values as determined by Wilcoxon Rank Sum Test

Poster #29

THE AMERICAN ASSOCIATION FOR THE SURGERY OF TRAUMA RENAL GRADING SYSTEM: SHOULD SEGMENTAL KIDNEY INFARCTION BE CLASSIFIED AS A GRADE IV INJURY?

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Introduction: In 2018, the American Association for the Surgery Trauma (AAST) revised renal injury grading to include findings from radiologic imaging. One of the major changes, affecting grade IV injury, was inclusion of segmental kidney infarction (SKI). However, the evidence is limited and controversial on SKI injuries and risk for bleeding control interventions. We aimed to assess how inclusion of SKI will change the scope of grade IV renal trauma and also study the rate for interventions in grade IV injuries with and without SKI.

Methods: We used high-grade renal trauma (HGRT) data from 7 Level-1 trauma centers from 2013 to 2018 as part of the Multi-institutional Genito-Urinary Trauma Study (MiGUTS). Initial CT scans were reviewed by two radiologists who regraded the injuries based on the original 1989 and revised 2018 AAST renal trauma grading systems. Patients with grade IV injuries according to the 2018 AAST grading were included. Injuries were categorized as isolated-SKI (iSKI) if segmental or wedge-shaped parenchymal infarction(s) were the only reason for inclusion as grade IV. All other grade IV injuries were categorized as non-iSKI (including those with urinary extravasation, renal pelvis laceration, segmental renal artery or vein injury, active bleeding beyond Gerota's fascia, and complete kidney infarction without active bleeding). Bleeding interventions were defined as nephrectomy, partial nephrectomy, renorrhaphy, renal packing, and renal-related angioembolization. Descriptive statistics were used to report grading changes. Chi-squared test was used to compare bleeding control interventions between iSKI and non-iSKI grade IV injuries.

Results: A total of 560 HGRT patients with initial CT-scans available for review were screened. According to the 2018 revised AAST grading, injuries were grade III or lower, IV, and V in 56%, 42%, and 2%. Overall, 233 patients with grade IV injury were included. The injury patterns for grade IV injuries (overlaps/combined injury patterns possible) were: urinary extravasation/renal pelvis laceration (22%), segmental renal artery or vein injury (6%), active bleeding beyond Gerota's fascia (18%), complete kidney infarction without active bleeding (8%), and SKI (56%).

Overall, 117 (50%) of grade IV injuries had iSKI. Only 6% of these patients met the criteria for grade IV injuries according to the original 1989 AAST grading system, while 81% were grade III or lower and 13% were not captured in the original grading system. Rate of bleeding control interventions was 7% in iSKI patients compared to 23% in non-iSKI patients ($p < 0.001$). Of the 8 iSKI patients who received bleeding control interventions, 4 underwent renal angioembolization, 3 renal packing for bleeding control, and 1 nephrectomy.

Conclusions: Using the 2018 revised AAST grading, approximately half of the new grade-IV injuries are as a result of isolated segmental kidney infarction(s). The majority of these patients were assigned lower injury grades according to the original 1989 renal trauma grading system. This injury pattern is associated with significantly lower bleeding control interventions compared to other grade IV injuries. Including iSKI in grade IV injuries increase the heterogeneity of grade IV injuries without increasing its ability to predict the need for interventions. In future iterations of the AAST renal trauma grading iSKI could be reclassified as grade III injury.

Poster #30

INCREASING BODY MASS INDEX (BMI) IS ASSOCIATED WITH HIGHER MORTALITY, WORSENING OUTCOMES, AND HIGHLY SPECIFIC PATTERNS OF INJURY FOLLOWING TRAUMATIC INJURY: A MULTI-INSTITUTIONAL ANALYSIS OF 175,724 PATIENTS

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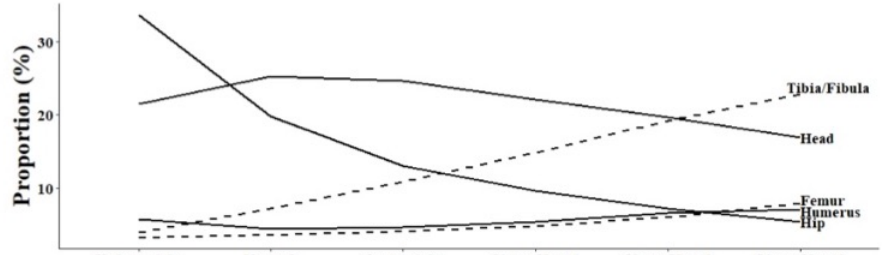
INTRODUCTION: As the prevalence of obesity has increased, trauma centers are faced with managing this expanding demographics' unique care requirements. Research on the effects of BMI in trauma patients remains conflicting. This study aims to evaluate the impact of BMI on patterns of injury and patient outcomes following trauma.

METHODS: Patients from 87 hospitals' trauma registries were selected. Those missing height, weight, disposition, or who died in the ER were excluded. BMI categories were calculated from admission height and weight and verified against the EMR. Patients were grouped by NIH-defined obesity class and compared by rate of mortality and in-hospital complications. Logistic regression was used to estimate associations, adjusting for age, gender, race, ISS, and number of comorbidities.

RESULTS: There were 175,724 patients: 55% male, mean age 58.6, mean GCS 14.5, mean ISS 8.5, only 40.4% normal weight. Increased BMI was associated with an injury pattern of increased rates of extremity fractures (humerus, femur, tib/fib) and decreased rates of hip fractures and head injuries (see table). Compared to the Normal weight group, patients were more likely to die if they were Underweight (adjusted odds ratio [AOR]: 1.20; 95% CI: [1.02-1.42]), Obese Class II (AOR: 1.26 [1.07-1.48]), or Obese Class III (AOR: 1.61 [1.35-1.92]. Obese Class III was associated with higher odds of an NTDB complication (AOR:1.21 [1.12-1.31]), and an increase in hospital LOS of 2.34 days (1.87-2.80, $p<0.001$).

CONCLUSIONS: In this large multicenter study, increasing BMI was strongly associated with higher mortality. Increasing BMI was also associated with longer LOS, increased complications, and unique injury patterns. These untoward outcomes, coupled with a distinct injury pattern, warrant care guidelines specific to the bariatric trauma patient.



	Underweight BMI <18.5 n=6,961 (4%)	Normal BMI 18.5-24.9 n=70,989 (40.4%)	Overweight BMI 25-29.9 n=54,532 (31.1%)	Obese Class 1 BMI 30-34.9 n=26,037 (14.8%)	Obese Class 2 BMI 35-39.9 n=9,697 (5.5%)	Obese Class 3 BMI >40 n=7,387 (4.2%)
Hip	33.57%*	19.83%*	13.08%*	9.63%*	7.31%*	5.44%*
Humerus	5.8%*	4.52%*	4.76%	5.45%*	6.59%*	7.09%*
Femur	3.32%	3.66%*	4.07%*	4.87%*	6%*	7.92%*
Head	21.48%*	25.29%*	24.63%*	22.06%*	19.73%*	16.85%*
Tibia/Fibula	3.95%*	7.24%*	10.93%*	14.91%*	19.24%*	22.82%*

** Group is statistically significantly different from Normal Group (p<.01)*

Poster #31

TRANEXAMIC ACID: AN OLD DOG WITH A NEW TRICK

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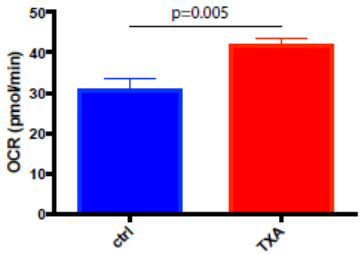
Introduction. Tranexamic acid (TXA), a plasmin inhibitor widely used to suppress fibrinolysis in hemorrhagic trauma patients, has a wide spectrum of recently identified beneficial effects including decreased tissue edema and production of proinflammatory cytokines. Our group has previously shown that in vitro TXA enhances aerobic respiration in endothelial cells and decreases the release of mitochondrial DNA (mtDNA) from granulocytes and endothelial cells and protects the endothelial monolayer from damage by exogenous mtDNA. The aim of the present study was to elucidate whether TXA has a direct effect on mitochondrial respiration.

Materials. Mitochondria were isolated from the hearts of C57/Bl6 mice by a procedure including tissue homogenization and differential centrifugation. Oxygen consumption by isolated purified mitochondria was measured using the Seahorse X96 system. TXA was applied at the concentration of 20 µg/ml similar to the dose range utilized in humans.

Results. TXA significantly increased the respiration of isolated mitochondria. The increase of oxygen consumption rate (OCR) was especially pronounced for basal respiration (Figure 1). The ADP-induced respiration was also higher in TXA- treated mitochrondria.

Discussion. Our results indicate that the stimulating effect of TXA on mitochondrial respiration is direct. The enhancement of aerobic respiration could alleviate the metabolic stress typically observed after hemorrhagic trauma and possibly other inflammatory conditions such as sepsis and cancer. We are currently using mass-spectroscopy methods to identify the specific molecular targets of TXA in mitochondria as well as identifying which specific step of the electron transport chain is acted on by TXA.

Figure 1.



Poster #32

THE ROLE OF TRANSACTIVE MEMORY SYSTEMS IN THE PERFORMANCE OF TRAUMA RESUSCITATION TEAMS

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Introduction: Multidisciplinary trauma resuscitation teams care for patients with severe traumatic injuries in high-stress environments. However, relatively little is known about the quantifiable factors that underlie trauma team performance. Transactive memory is a social psychological system by which groups encode, store, and retrieve knowledge. Transactive memory manifests through role specialization, trust in other team members' expertise, and task coordination, all of which may be paramount in trauma resuscitations. We sought to determine whether a well-developed transactive memory system (TMS) within trauma teams during initial trauma resuscitation is associated with better clinical outcomes.

Methods: We performed a retrospective cohort study of trauma resuscitations at a Level 1 academic trauma center from 2017-2019. Digital video and audio recordings of trauma bay resuscitations were reviewed by two independent investigators and coded for TMS using a validated 11-item instrument, which assessed degree of specialization, trust in other's expertise, and task coordination during the resuscitations. To prevent bias, reviewers viewed only the first 10 minutes of the resuscitation and were blinded to patient outcomes. The item scales ranged from -2 to 2, with higher scores indicating well-developed TMS. The TMS assessments were linked to clinical data from the state trauma registry. Multivariable regression models were used to test the relationship between TMS and patient outcomes, including hospital length of stay, length of stay in the intensive care unit (ICU), and duration of ventilator dependence, controlling for gender and trauma injury severity score (TRISS).

Results: We reviewed 120 trauma resuscitations, for whom clinical data were available for 100. Among the 100 patients, 66% were male, 71% were white, average age was 45±22 years, and average TRISS-derived probability of survival was 0.8±0.3. The TMS assessments showed good reliability (intraclass correlation = 0.70), internal consistency (Cronbach's alpha = 0.68), and interrater agreement (R_{WG} = 0.99). The teams' TMS scores were generally high (mean: 1.3±0.3, range: 0.3-1.7). When adjusted for gender and TRISS, higher TMS score was associated with significantly shorter length of stay in the ICU (β for log-transformed ICU length of stay: -1.0; 95% CI: -1.9, -0.1; p = 0.04) and a trend towards shorter hospital length of stay (β for log-transformed hospital length of stay: -0.8; 95% CI: -1.7, 0.1; p = 0.08), but not with duration of ventilator dependence (95% CI: -1.6, 1.1; p = 0.71).

Conclusion: Among multidisciplinary trauma resuscitation teams, a well-developed TMS is associated with shorter lengths of stay. TMS is a potentially valuable target for improving trauma team performance. Future work should identify modifiable factors contributing to TMS in order to establish actionable interventions to improve trauma team function and ultimately patient outcomes.

Poster #33

FIT BUT FRAGILE: INCREASED INJURY SEVERITY AND MORTALITY IN GERIATRIC CYCLING TRAUMA

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Introduction: Cycling has proven health benefits for the geriatric population. The risks associated with cycling are also well established. However, little is known about injury severity and outcomes of geriatric patients after bicycle trauma, or how they compare to younger adults.

Methods: This was a retrospective cohort study analyzing data from the National Trauma Data Bank (NTDB) from 2007-2015. We included younger adult (age 18-64) and geriatric (age ≥ 65) patients who presented to Level I and II trauma centers after bicycle-related trauma. The primary outcome of interest was mortality. Secondary outcomes included injury severity score (ISS), anatomic location and severity of injury, length of stay, and disposition. Chi-square, ANOVA, and Kruskal-Wallis tests were used for statistical analysis.

Results: We identified 74,195 patients, of whom 7447 (10%) were ≥ 65. Average age in the geriatric cohort was 71.4 years vs 41.6 years in the younger cohort. Mortality was significantly higher among geriatric patients compared to younger adults (4.3% vs 1.6%, $p < 0.0001$). Severe injury (ISS > 15) was significantly higher in the geriatric cohort affecting 25.8% of patients, compared to 19.5% of younger adults ($p < 0.0001$). Geriatric patients more commonly sustained injuries to the thorax compared to younger patients (33% vs 27%, $p < 0.0001$), but less commonly to the abdomen (8% vs 10 %, $p < 0.0001$). 19% of geriatric patients sustained head injury compared to 13% of younger patients ($p < 0.0001$) despite a higher incidence of helmet use among geriatric patients (55% vs 40%, $p < 0.0001$). 26% of geriatric patients were discharged to a facility compared to 10% of younger adults ($p < 0.0001$). On multivariable analysis, age ≥ 65 was independently associated with mortality (OR 3.74, 95% CI 3.05-4.59, $p < 0.0001$) and ISS > 15 (OR 1.44, 95% CI 1.34-1.54, $p < 0.0001$).

Conclusions: Compared to younger adults, geriatric patients have increased rates of severe injury and death after cycling trauma, with age ≥ 65 being an independent predictor of these outcomes. Further evolution in geriatric-specific care should focus on this active but still vulnerable trauma population.

Poster #34

SEVERITY AND PATTERNS OF INJURY IN HELMETED VS. NON-HELMETED MOTORCYCLISTS IN A RURAL STATE

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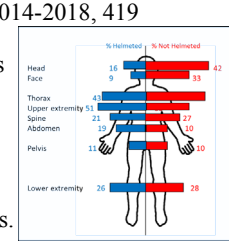
Introduction: Under current law in our rural State, there is no universal requirement for motorcyclists to wear helmets. Roughly 500 motorcycle crashes are reported by the state each year and only a fraction of those riders wear helmets. We sought to determine the difference in injury patterns and severity in helmeted vs. non-helmeted riders.

Methods: A single level 1 trauma center's registry was retrospectively reviewed for patient's involved in a motorcycle collision over a 5 year period (2014-2018). We collected demographic, injury data and patient outcome data. Patients were stratified by helmet use (n=81) or no helmet use (n=144) by injury patterns, injury severity score (ISS), Glasgow coma scale (GCS), anatomic injury score (AIS), shock index (SI), blood product use, mechanical ventilation, ICU length of stay (LOS), hospital LOS and mortality. Motorcyclists with unknown helmet use were excluded from the analysis (n= 194). Results are reported as mean, median or percent incidence ± standard deviation (SD), statistical analysis was done using either Student's t-test or Pearson's $\chi 2$ with p-value < 0.05 as significant. We also queried the State Department of Transportation data registry for State level mortality and collision incidence over the same time period to give context to our single center data analysis.

Results: Of the 2,022 state-reported motorcycle collisions between 2014-2018, 419 individuals admitted to our trauma center were analyzed (%capture= 20.7%). State-reported field fatality rate regardless of helmet use was 4%. Our inpatient mortality rate was 2%. In our center, there were no differences in mortality between helmeted vs. non-helmeted riders. Helmeted riders compared to non-helmeted riders were found to have significantly fewer head injuries (16% vs. 42%, p=0.0001), face injuries (9% vs. 33%, p=0.0001), higher GCS (14.4 vs. 13.3, p=0.03), lower face AIS (1.2 vs. 1.5, p=0.0001), lower neck AIS (0 vs. 1.7, p=0.0001), lower thorax AIS (2.3 vs. 2.8, p=0.0002), lower abdomen AIS (2.0 vs. 2.7, p=0.0001), fewer required mechanical ventilation (7% vs. 22%, p=0.004), and shorter ICU length of stay (4 vs. 6.5 days, p=0.01). In helmeted vs. non-helmeted riders, a greater number of upper extremity injuries were observed (51% vs. 33%, p=0.008) and upper extremity AIS was higher (1.9 vs. 1.6, p=0.0001).



Conclusion: The results indicate helmeted riders vs. non-helmeted riders have different injury patterns and the severity of injury was significantly lower. Notably, cervical spine injury was found to be significantly lower in helmeted riders. Non-helmeted riders sustained worse injuries and our findings support future changes in state policy regarding motorcycle helmet legislation.

Poster #35

DERIVATION AND VALIDATION OF ACTIONABLE QUALITY INDICATORS TARGETING REDUCTIONS IN COMPLICATIONS FOR INJURY ADMISSIONS

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Introduction: Around 22% of patients hospitalized for injury will develop in-hospital complications, more than three times the incidence for general admissions. Many trauma systems benchmark complications to inform quality improvement efforts and local trauma committees generally review patient charts in line with quality improvement activities. However, available quality indicators (QI) are difficult to act on because complications are generally modelled as a composite despite their different risk factors and we lack to flag patients with unexpected complications for chart review. We aimed to: i) develop and validate individual QI for targeted complications, ii) develop algorithms to identify cases for chart review.

Methods: We conducted a multicenter cohort study including all patients with an injury severity score >9 admitted between 2014 and 2018 to a level I or II trauma center in an inclusive Canadian trauma system. We used data from the provincial trauma registry to develop QI for complications selected by expert consensus: deep vein thrombosis/pulmonary embolism, decubitus ulcer, delirium and pneumonia. Prediction models, including variables describing age, sex, selected comorbidities, injury type and severity, were derived and validated using *Transparent Reporting of a multivariable prediction model for Individual Prognosis Or Diagnosis* (TRIPOD) guidelines. A committee of clinical experts were involved throughout the iterative model derivation and validation process that involved consultation of patient charts.

Results: The predictive performance of the models developed was excellent (area under the curve [AUC]≈ 0.84) and better than the composite model (AUC=0.80). QIs identified 4 hospital outliers (higher than expected incidence of complications). One hospital was flagged for DVT/PE, delirium and pneumonia. Another was flagged for decubitus ulcers, delirium and pneumonia and two other centers were flagged for a single complication: DVT/PE and decubitus ulcers, respectively. Patient-level algorithms identified on average 50 and 20 cases of unexpected complications to be reviewed per year for level I and II centers, respectively.

Conclusion: We propose four actionable QI targeting reductions in hospital complications. Our approach targets complications directly related to care, provides complication-specific benchmarks and provides lists of cases to facilitate chart review in line with local/system quality improvement initiatives. A pilot implementation project is underway in a level I Canadian trauma center.

Poster #36

EVALUATION OF LOW-VALUE CLINICAL PRACTICES IN ACUTE TRAUMA CARE: A MULTI-CENTER RETROSPECTIVE STUDY

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Introduction: Reductions in low-value clinical practices have been identified as one of the most promising ways to improve patient outcomes and reduce excess healthcare spending. The objectives of our study were to i) identify low-value practices in injury care guidelines, ii) estimate how frequently they are used in practice and iii) evaluate inter-hospital variations in their use.

Methods: We identified low-value clinical practices from internationally recognized clinical guidelines. We then developed algorithms to measure the frequency of these practices using trauma registry data and validated them with clinical experts. Finally, we conducted a population-based retrospective cohort study using data from an integrated regionalized Canadian trauma system (2014 to 2017) to calculate frequencies and assess inter-hospital variations with intra-class correlation coefficients (ICC: low if <5%, moderate if 5-19%, high if ≥20%).

Results: We identified 29 low-value practices of which 12 could be measured and validated using trauma registry data. The two low-value clinical practices with the highest absolute and relative frequencies were head computed tomography (CT) in adults with mild TBI who were negative on a validated clinical decision rule (n=2456; 21%) and cervical spine CT in adult negative on a validated clinical decision rule (n=1341; 29%). We observed high inter-hospital variation for decompressive craniotomy in severe TBI with diffuse injury (ICC=34%), and moderate variation for all practices related to magnetic resonance imaging (MRI) and CT in the emergency department (ICC=5.6% - 15.8%). Low inter-hospital variation was observed for practices related to the management of penetrating injuries and for the surgical management of blunt liver or spleen injuries.

Conclusion: We have developed and validated algorithms to evaluate 12 potentially low-value clinical practices using trauma registry data. Highest frequencies were observed for imaging in the emergency department and the highest inter-hospital variation was observed for decompressive craniotomy in severe TBI with diffuse injury. These data can be used to advance the research agenda on low-value care for injury admissions.

Poster #37

CLINICAL OUTCOMES OF PATIENTS WITH TRAUMATIC HEMOTHORAX TREATED WITH NON-OPERATIVE MANAGEMENT, VIDEO-ASSISTED THORACOSCOPIC SURGERY, OR THORACOTOMY

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Introduction: Traumatic hemothorax is initially treated with tube thoracostomy, but some patients will eventually require a more invasive intervention to evacuate clotted blood from the chest. To date, no large studies have demonstrated superior outcomes with VATS or definitively established the optimal timing of VATS post-injury.

Methods: We performed a retrospective cohort study using the American College of Surgeons Trauma Quality Programs database for 2008-2016. We included all adult patients (> 18-years-old) with an ICD code for traumatic hemothorax or traumatic hemopneumothorax and excluded those with who underwent early resuscitative thoracotomy for cardiac arrest, those who were not admitted to the hospital, and those who had a missing injury severity score (ISS) or mechanism of injury. Patients were analyzed based on trauma type (blunt or penetrating). Exposures of interest were intervention type (non-operative, early VATS (48-hours), and thoracotomy). Outcomes included hospital length of stay (LOS), ICU LOS, ventilator days, and pneumonia. Median and logistic regression were used to compare differences in outcomes across management groups.

Results: A total of 144,019 patients met inclusion criteria: 81.8% were in the non-operative group, 1.8% in the VATS group, and 16.3% in the thoracotomy group. Across both trauma types, the thoracotomy group was the youngest and had the lowest initial GCS, the highest ISS, and the highest proportions of major traumas (ISS > 15). Among patients with a blunt trauma, hospital LOS (median difference=8.0 days, 95% CI 7.5, 8.5) and probability of pneumonia (absolute difference=5.8%, 95% CI=5.1, 6.5) were highest in the late VATS group when adjusted for age, sex ISS, and initial GCS. Among patients with a penetrating injury, all outcomes were worse with late VATS, but most notably median hospital LOS was 7.7 days (95% CI=7.2, 8.2) longer than the non-operative group. Early VATS had similar or slightly worse outcomes than non-operative management in both blunt and penetrating traumas.

Conclusions: This study is the largest to date evaluating the use of VATS compared to non-operative management and thoracotomy in the treatment of hemothorax. Our results demonstrate longer ICU and hospital LOS among patients managed operatively, suggesting that we should be judicious in our use of VATS, as some patients can clearly be managed non-operatively. If VATS is to be performed, it should be performed within 48-hours of admission to optimize the potential clinical benefits.

Poster #38

SEVERE TRAUMATIC INJURY LEADS TO SUSTAINED MUSCLE LOSS WITH DECREASED QUALITY OF LIFE

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Introduction: Numerous studies have shown an acute loss of muscle mass after prolonged critical illness, but none have longitudinally shown this loss of muscle mass at follow up. It is unclear if there is an acute loss of muscle mass after trauma or if it persists over time.

Methods: Pilot prospective cohort study of older ($\geq$ 45 years) severely injured blunt trauma patients ($\geq$ 3 rib fractures, $\geq$ 1 long-bone fracture, or $\geq$ 1 solid organ injury) with 6 month longitudinal follow-up. Serial whole body muscle mass evaluations were performed at admission, 3-, and 6-months using CT morphometrics (Tomovision SliceOmatic), calculating skeletal muscle index (SMI) at the L3 vertebral body level. Quality of life (QoL) using EQ-5D survey (index of 0-1 with higher scores indicating higher quality) and frailty evaluations using Clinical Frailty Scale (CFS, scored 1-9 with higher scores indicating more frail) were recorded at baseline, 3-, and 6-months.

Results: 47 patients were prospectively enrolled. Overall, there was significant and persistent loss of muscle mass at both three (median 7.7%, n=27, $p < 0.001$) and 6-months (median 5.4%, n=23, p=0.012). Patients with high (> 7.7%, [overall population median]) compared to low ($\leq$ 7.7%) loss at 3 months had higher median APACHE II scores (12 vs 7), ICU days (7 vs 0.5), maximum Sequential Organ Failure Assessment (SOFA) scores (5 vs 4, all $p < 0.05$), Injury Severity Score (ISS, 22 vs 13.5, p=0.055), and larger QoL decrease by EQ-5D utility index (-0.2 vs -0.1, p=0.052). Amongst the entire cohort frailty scores acutely and persistently worsened at 3 months (median CFS increase 1, p=0.002), but this did not persist to 6-months. On multivariate stepwise linear regression controlling for ISS, maximum SOFA, and ICU days, only SOFA was selected with each increase in SOFA leading to a 2.8% muscle loss at 3 months ($p < 0.001$).

Conclusion: This is the first study to show trauma patients have significant acute loss of muscle mass persisting at least 6 months following injury. This is associated with decreased quality of life, and is most strongly predicted by severity of organ dysfunction during index admission.

Poster #39

UNDERSTANDING LONG-TERM OUTCOMES OF TRAUMATIC BRAIN INJURY USING CLAIMS DATA

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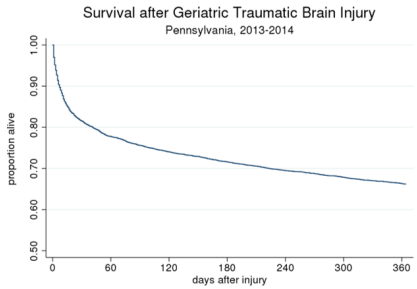
Introduction: Current trauma center benchmarking focuses on survival to hospital discharge, but the consequences of injury extend well beyond. Older adults are at increased risk of traumatic brain injury (TBI) and in-hospital mortality. Longer-term outcomes are less well understood. We used a novel data linkage strategy to measure long-term mortality and readmissions in older adults with traumatic brain injury. We hypothesized that geriatric trauma patients would not only have a high risk for mortality during initial hospitalization, but also up to 12 months post-injury.

Methods: We identified injured patients age ≥ 65 admitted to Pennsylvania trauma centers, 2013-2014. We used the Pennsylvania Trauma Outcomes Study (PTOS), a robust, state-wide trauma registry. Probabilistic matching using supervised machine learning linked patients' trauma registry records to their Medicare claims. Matching variables were injury date, demographics, and injury characteristics. Patients were considered to have TBI if they had an ICD-9 diagnosis code for intracranial injury and an abbreviated injury score (AIS) for the head and neck region ≥3. Outcomes were inpatient mortality (including hospice discharge), 1-year mortality, and readmission rates. Survival was analyzed using the Kaplan-Meier method. To estimate the contribution of TBI to mortality, patients with isolated TBI were compared to patients with isolated extremity injuries (AIS < 2 in all other body regions) using a validated, multivariable logistic regression model incorporating patient and injury characteristics and physiology identified predictors of mortality.

Results: Of 29,042 eligible PTOS patients, 16,346 (56.3%) were matched to Medicare records, and 4,843 had TBI. Matched patients were similar to unmatched in demographics and injury severity. Among TBI patients, 53.9% were female, median age was 82 (interquartile range [IQR] 75, 87), median injury severity score (ISS) was 14 (IQR 10, 19), and 87.9% were injured by fall. 752 (15.5%) patients died before discharge. Another 949 (19.6%) died within a year. Predictors of inpatient and 1-year mortality were similar: older age, male sex, lower GCS motor score, higher heart rate, and lower blood pressure. Readmission data were available for 37.9% of patients. Of survivors, 11.5% were readmitted within 30 days and 14.5% within 90 days. Compared to patients with isolated extremity injury, patients with isolated TBI had double the odds of inpatient death (OR 2.2, 95% CI 1.6, 3.1). There was no association with 1-year mortality (OR 1.2, 95% CI 0.9, 1.5).



Conclusion: Survival to discharge is a poor proxy for long-term survival in high risk patients. One in 3 older adults with TBI died within 12 months of injury, but more than half of these deaths occurred after discharge. These insights can support prognostication and patient and family counseling for these patients. Novel data linkages can extend our understanding of trauma outcomes beyond the hospital stay.

Poster #40

SURGICAL MANAGEMENT AND OUTCOMES OF ADHESIVE SMALL BOWEL OBSTRUCTION: TEACHING VS NON TEACHING HOSPITALS

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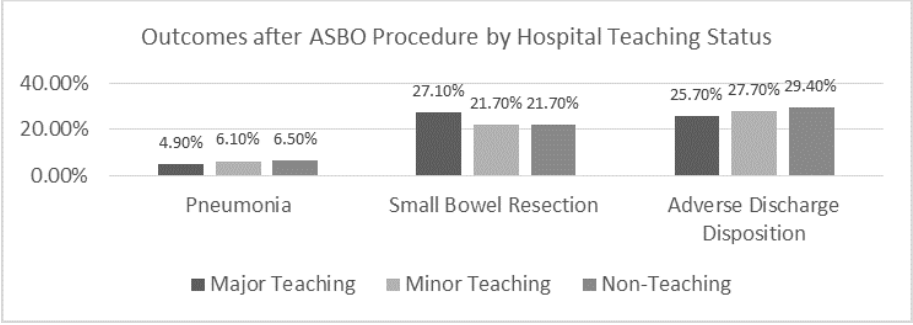
Introduction: Surgical management of adhesive small bowel obstruction (ASBO) varies widely despite established guidelines. Whether this variation is associated with facility teaching status is unknown. We hypothesized differences exist between teaching and non-teaching hospitals in ASBO surgical admissions, management, and outcomes.

Methods: Using the 2007-2017 California Office of Statewide Health Planning and Development (OSHPD) database, we identified adult ASBO patients hospitalized for surgical intervention by diagnosis and procedure codes. Hospital teaching status was defined by AAMC categories: Major teaching (MajT), Minor teaching (MinT), Non-teaching (NT). Cox regression was used to evaluate risk of death associated with each category.

Results: Of 25,047 admissions, 15% were at MajT, 32% at MinT, and 53% at NT; 3% died. MajT patients had longer hospital stays than MinT or NT patients (Median days 9 vs. 8 vs. 8, respectively; $p < 0.01$). MajT patients also had longer times to discharge post operatively (median days 7 vs. 6, MinT vs. 6 NT; $p < 0.01$) and higher rates of small bowel resection (27% MajT vs. 22% MinT vs. 22% NT; $p < 0.01$). Mean date to first surgery at MajT was 3.3 days compared with 2.6 days ($p = 0.004$) at MinT and NT. Adjusted models showed MajT hospital patients were significantly less likely to die than those treated at an NT facility (HR 0.62, 95% CI 0.49 – 0.79, $p < 0.01$) and had lower risks of in-hospital pneumonia ($p < 0.001$). Major teaching patients were also more likely to be discharged home or to a similar level of pre-admission care ($p < 0.0001$) (Fig.1). Overall, 24% of admissions were on weekends; and these patients underwent surgery 1 day sooner than weekday admissions ($p < 0.01$); however, after adjustment, this was not associated with mortality.



Conclusion: Overall mortality and morbidity of surgery for ASBO was reduced at major teaching hospitals. Nonetheless, time to surgery, hospital stay, and rate of small bowel resection were greater among these hospitals. These findings may justify the higher cost that some have associated with care at major teaching hospitals.

Poster #41

STILL IN SEARCH OF THE RIGHT PATIENT, THE RIGHT SETTING: THE USE OF IN-HOSPITAL RESUSCITATIVE ENDOVASCULAR BALLOON OCCLUSION OF THE AORTA (REBOA) FOR ISOLATED ABDOMINOPELVIC INJURY

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LAC+USC Medical Center

Introduction: The utility of resuscitative endovascular balloon occlusion of the aorta (REBOA) has been evaluated in multiple studies; however, patients included in previous studies had heterogeneous injury profiles. The purpose of this study was to examine the impact of REBOA use exclusively for patients with isolated abdominopelvic injuries. We hypothesized that the use of REBOA would improve the survival of patients whose injuries meet currently proposed indications/contraindications.

Methods: This is a retrospective cohort study using the American College of Surgeons Committee on Trauma Quality Improvement Program database from 2016 to 2017. We included trauma patients (age >16 years) admitted to Level 1/2 trauma centers for severe torso injuries (Abbreviated Injury Scale: AIS abdomen and/or pelvis 3-5). All patients with associated severe traumatic brain injury and/or thoracic injury (AIS 4 or 5) were excluded. Fully conditional specification methods were used to impute missing values. Outcomes of the patient who underwent REBOA were compared with those without REBOA in the propensity-score matched analysis (1:3 matching).

Results: A total of 12,153 patients were included. Of those, 98 patients (0.8%) received REBOA and a 1:3 propensity-score matching generated a total of 392 study patients to be analyzed. The median time to REBOA was 0.73 hours (interquartile range: 0.43-1.47). Following REBOA, 63 patients (64.3%) underwent laparotomy and 40 patients (40.8%) underwent endovascular procedures for definitive hemorrhage control. The use of REBOA was associated with higher odds of 24-hour and in-hospital mortality (OR: 2.08, 95% CI: 1.21-3.55 and OR: 2.74, 95% CI: 1.74-4.31, respectively). REBOA was also associated with increased transfusion of PRBC, plasma, and platelets within 4 and 24 hours. The incidence of major complications including acute kidney injury was not significantly different between the REBOA and no-REBOA groups.

Conclusion: Our data suggest that the use of REBOA was associated with decreased survival, even in the patient who met the currently proposed injury criteria. In the matured trauma system, the in-hospital use of REBOA prior to definitive hemorrhage control procedures might be harmful. Continued search for the appropriate indications and settings (e.g. prehospital use) will be necessary.

Poster #42

AAST MULTI-CENTER PROSPECTIVE ANALYSIS OF PRE-HOSPITAL TOURNIQUET USE FOR EXTREMITY TRAUMA

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Background: Tourniquets have seen a resurgence of use in civilians. Retrospective studies demonstrated that tourniquets improved outcomes for extremity trauma. No prospective study has been conducted. The objective of this study was to evaluate outcomes in patients with major extremity injuries with a pre-hospital tourniquet. Our hypothesis was that pre-hospital tourniquets would decrease the incidence of patients arriving in shock.

Methods: Data were collected prospectively for adult patients with major extremity trauma at 28 Level 1 and Level 2 trauma centers from 2015-2020. Patients with pre-hospital tourniquets were included in the tourniquet group and limbs with major extremity trauma not receiving a pre-hospital tourniquet were enrolled in the control group.

Results: A total of 1392 injured extremities were enrolled with 1130 tourniquets, including 962 pre-hospital tourniquets. The control group consisted of 262 limbs without pre-hospital tourniquets and 88 tourniquets placed upon hospital arrival. Only 42 patients had improvised tourniquets placed pre-hospital. Tourniquets were effective at controlling bleeding in 88.2% of limbs. Tourniquet and control groups were similarly matched for demographics, ISS, and pre-hospital vital signs ($p > 0.05$). Despite higher limb injury severity patients in the tourniquet group, patients were less likely to arrive in shock compared to the control group (13.0% vs. 17.4%, $p = 0.04$). The incidence of limb complications was not significantly higher in the tourniquet group ($p > 0.05$).

Conclusions: This study is the first prospective analysis of tourniquet use for civilian trauma. We found widespread tourniquet use, with most pre-hospital tourniquets placed by emergency response personnel and a low number of improvised tourniquets. Pre-hospital tourniquet application was associated with decreased incidence of arrival in shock to the ED without increasing limb complications. This study provides evidence that tourniquets are being widely and safely adopted to improve outcomes in civilians with extremity injuries.

	Pre-hospital tourniquet N=962*	No Pre-hospital tourniquet N=350	p value
Injury characteristics			
ED SBP, mean (SEM)	124 (1)	118 (2)	**<0.01**
ED HR, mean (SEM)	95 (1)	91 (2)	0.051
ED arrival in shock (SBP≤90), n (%)	125 (13.0)	61 (17.4)	**0.04**
AIS injured extremity, mean (SEM)	2.4 (0.04)	2.2 (0.05)	**<0.01**
MESS injured extremity, mean (SEM)	4.4 (0.08)	3.9 (0.1)	**<0.01**
Blood vessel injured, n (%)	367 (38.1)	114 (32.6)	0.07
Outcomes			
Mortality, n (%)	58 (6.0)	26 (7.4)	0.37
PRBCs, mean (SEM)	1.9 (0.2)	1.4 (0.2)	0.16
FFP, mean (SEM)	1.2 (0.1)	0.8 (0.2)	0.051

*80 patients with unknown setting of tourniquet placement were excluded from analysis

Poster #43

IT IS NOT ALL IN YOUR GENES

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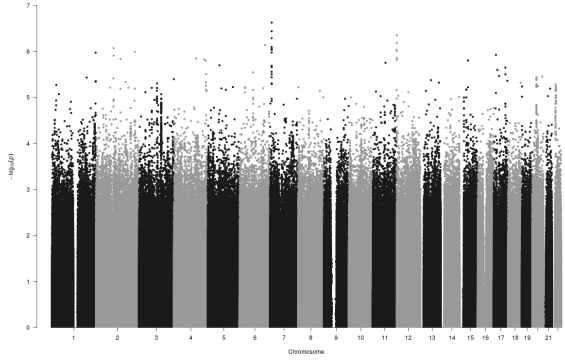
University of Michigan

Introduction: Patient specific factors are known to contribute to risk of post-operative complications after surgery. The contribution of genomic variants to risk of complication is not well studied. Identification of genomic variants that predispose to complications could lead to better insight into pathogenesis, as well as an opportunity to identify the patients that are at a higher risk for perioperative morbidity. We conducted a genome-wide association study (GWAS) to identify the genomic variants that are associated with postoperative complications within 30 days following abdominal operations.

Methods: Institutional genomic data from patient samples collected in the preoperative area was queried. Genotyping was performed using a customized Illumina human core exome array. 2,237 cases were identified as having developed a complication within 30 days after undergoing general surgery and gynecologic abdominal operations, and 9,137 controls developed no complication. Complications studied included infectious, shock, respiratory, cardiac and end organ failure related complications. Single nucleotide polymorphisms (SNPs) were tested for genome-wide significance for postoperative complications. In a separate analysis, candidate SNPs (rs552713895, rs183626656, rs78064607) from UK Biobank data were tested for validation in our institution's cohort.

Results: No SNPs that met the predetermined significance threshold of $5x10^{-8}$ were identified, as shown in the Manhattan plot (Figure). Validation analysis of previously identified SNPs from the UK Biobank cohort in our institution's cohort found these SNPs to be nonsignificant.

Conclusion: According to this GWAS, genomic contribution to the development of complications after abdominal operations is negligible. We should instead focus our attention on the modifiable patient-specific risk factors.



Poster #44

LESS IS MORE: A MULTIMODAL PAIN MANAGEMENT STRATEGY REDUCES OPIOID USE IN HOSPITALIZED TRAUMA PATIENTS

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Background: Adequate pain control is critical to the management and recovery of acutely injured patients. Opioids are associated with various adverse effects, and patients admitted with traumatic injuries have a greater than average risk of chronic dependence, abuse and overdose-related deaths. We hypothesized that a multimodal pain management protocol would reduce opioid use while still optimizing pain control.

Methods: We implemented a multimodal pain management strategy in hospitalized adult patients admitted to the Trauma Service at a single ACS-verified level 1 trauma center, and performed a retrospective analysis on patients PRE- (August 2017 through September 2018) and POST- (October 2018 through August 2019) protocol implementation. Patients were excluded from the analysis if they were less than 18 years of age, pregnant or imprisoned. Data collection included demographics, injury patterns and severity, pain medication use and hospital length of stay. The primary endpoint was opioid prescription on hospital discharge, measured in daily morphine milligram equivalent (MME). Secondary endpoints included daily inpatient MME, non-opioid adjunct utilization, inpatient naloxone administration, pain scores and opioid refill requests. A subgroup analysis evaluating opioid use was performed in patients grouped by injury severity score (ISS) (mild ≤ 15, moderate 16-24, severe ≥ 25), and by injury type (AIS body region scores).

Results: There were 1755 patients in the PRE group and 1723 patients in the POST group. Patient demographics were similar between PRE and POST groups, consisting of primarily middle aged males who were moderately injured from blunt trauma. Opioid MME prescribed on hospital discharge decreased from 24.3 in the PRE group to 13.7 in the POST group ($p < 0.001$). There was a significant decrease in the mean daily inpatient MME, from 32.4 to 21.7 ($p < 0.001$). More patients in the POST group were discharged without an opioid prescription (44% POST vs 37% PRE, $p < 0.001$). There was a significant increase in the use of all non-opioid pain medications, measured by both percentage of patients who received at least one inpatient dose and mean daily dose (all p-values < 0.001). There was no difference in opioid medication refill requests. ISS subgroup analysis revealed a significant decrease in discharge MME in all three groups (mild 25.4 to 14.66 $p < 0.001$; moderate 28.1 to 13.9 $p < 0.001$; severe 13.61 to 8.2 $p = 0.0043$). MME also decreased regardless of injury type, across all AIS body regions.

Conclusion: The successful implementation of a standardized multimodal pain management protocol targeting scheduled non-opioid medications and patient education reduces opioid amount prescribed on discharge in hospitalized trauma patients by nearly half, regardless of injury severity, and without an observed increase in refill requests.

Poster #45

COLD STORED WHOLE BLOOD TRANSFUSION IN TRAUMA - A MORE RAPID RESPONSE: EXPERIENCE OF A LEVEL 1 TRAUMA HOSPITAL

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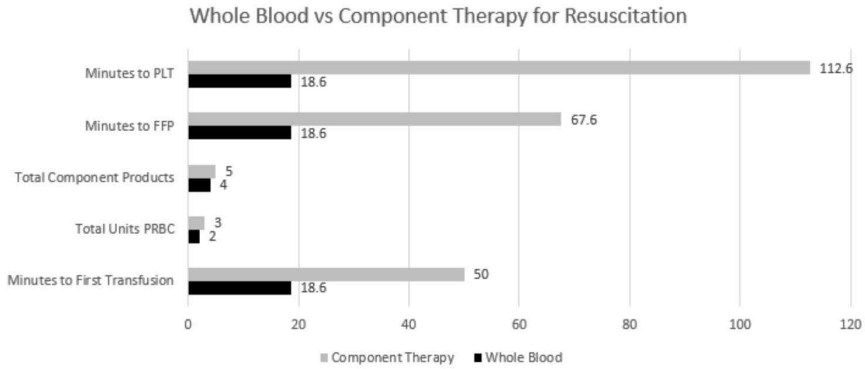
Scripps Mercy Hospital

Introduction: Use of cold stored whole blood (WB) in the civilian trauma system is a relatively new practice. Recent studies have demonstrated safety and some clinical benefit of WB for resuscitation, with decreased transfusion requirements and no additional adverse reactions when compared to component therapy (CT). We sought to analyze changes in resuscitation and time-critical events after initiation of a WB program.

Methods: We analyzed adult trauma patients with acute hemorrhage who received blood products from 2016 - 2019. We compared patients who received WB after it became available at our institution (4/2018 to 12/2019) versus patients who received only CT prior to WB availability (1/2016 – 3/2018). Demographics, injuries, physiologic response, and clinical data including time to key events were compared. Multivariable logistic regression analysis was used to evaluate independent factors for mortality.

Results: A total of 184 patients were identified during the study period. Of these, 59 (31%) received WB and 125 (69%) received CT. The groups did not differ with regard to demographics and injury severity characteristics. WB patients had a significantly shorter time to transfusion (median 18.6 minutes vs. 50.1 minutes; $p = 0.0005$), less requirement for subsequent packed red blood cell transfusion (median 2 units vs. 3 units; $p = 0.03$), and decreased total CT requirement (4 units vs. 5 units; $p = 0.02$) when compared to CT only patients. Times to first administration of plasma or platelets were significantly higher in the CT only group ($p < 0.0001$). In a multivariable logistic regression, only injury severity and systolic blood pressure < 100 mmHg on admission were significant predictors of mortality. Resuscitation grouping was not independently associated with in-hospital death.

Conclusion: The initial transfusion of WB may be superior to CT with quicker initiation of transfusion and immediate balanced ratios, and a decrease in subsequent transfusion requirements. Civilian trauma centers should consider adopting the use of WB as a first line resuscitation strategy.



Poster #46

TO SCAN OR NOT TO SCAN: DEVELOPMENT OF A CLINICAL DECISION SUPPORT TOOL TO DETERMINE IF IMAGING WOULD AID IN THE DIAGNOSIS OF APPENDICITIS

Rathnayaka K. Gunasingha MD, Scott Grey PhD, Beau Munoz MD, Seth Schobel PhD, Joseph Lee BS, Casey Erwin BS, Thomas Irons BS, Elizabeth McMillan BS, Desiree Unselt PhD, Vivek Khatri PhD, Jaspreet Seth PhD, Eric Elster MD, Matthew Bradley MD
Walter Reed National Military Medical Center

Introduction: Appendicitis is one of the most common surgically treated diseases in the world, with nearly 400,000 people diagnosed with the disease in 2015. Although scoring systems have helped improve the rate of diagnosis and lower the negative appendectomy rate, almost 13% of patients with appendicitis can be missed. CT scans are often over-utilized and usually ordered before a surgeon has evaluated the patient. Our aim was to develop a tool using machine learning (ML) algorithms that would help determine if there would be benefit in obtaining a CT scan prior to surgeon consultation.

Methods: Retrospective chart review of 100 randomly selected cases who underwent appendectomy and 100 randomly selected controls who presented to the ER with abdominal pain during fiscal year 2016-2017 was completed. Variables included components of the patient's history, laboratory values, Alvarado score, CT readings, operative findings, and pathology. Pathology was used as the gold standard of diagnosis in those that underwent appendectomies. Comparisons of the variables across the case and control samples were done to characterize differences between the two groups. All variables that have demonstrated to aid in appendicitis diagnosis were then used to build the ML algorithms. Next, Random Forest (RF), Support Vector Machine (SVM), and Bayesian Network Classifiers (BNC) models with and without CT scan results were trained and compared to CT scan results alone and the Alvarado score for accurately identifying pathology-confirmed appendicitis using area under the Receiver Operator Curve (ROC), sensitivity, and specificity measures from 500 bootstrapped resamples.

Results: Among the cases that underwent appendectomy, 87% had pathology-confirmed appendicitis. The negative appendectomy rate was 13% in this sample. Age, male sex, pain migration, anorexia, right lower quadrant tenderness, progression of pain, white blood cell count, and neutrophilia were significantly different ($p < 0.001$) between the groups. Similarly, CT findings of regional inflammatory changes, appendiceal wall thickening, a dilated appendix, and the presence of an appendicolith were also significantly found in the patients who had pathology-confirmed appendicitis. All the ML algorithms had better specificity and ROC than the Alvarado score. CT scan alone had the highest sensitivity and was equivalent in ROC to SVM (0.89), with only a minimal improvement over RF and BNC (ROC 0.88). The BNC model with CT results showed the highest ROC (0.94) and specificity (0.90). Figure 1 visually shows these results.

Conclusion: This study provides evidence that ML algorithms alone may be useful in determining if a CT scan is necessary compared to the Alvarado score. The BNC model is highly representative of a physician's decision making process and supports missing data and relationships among variables. ML algorithms can improve the diagnosis of appendicitis and may be particularly useful at lowering the negative appendectomy rate. Further model refinement and external validation are currently being pursued.

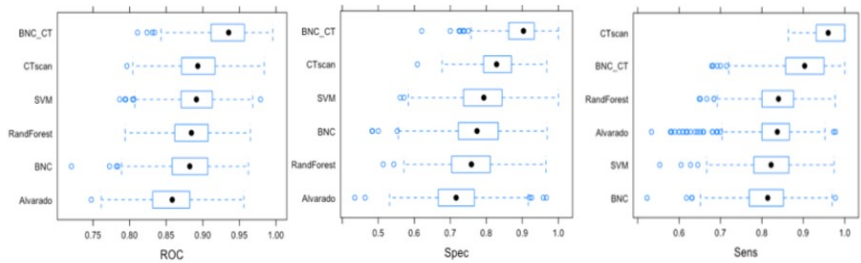


Figure 1: Comparison of ML algorithms with Alvarado score and CT scan for diagnosis of appendicitis
BNC_CT= Bayesian Network Classifier with CT scan data; **CT scan**= CT scan only; **SVM**= Support Vector Machine, no CT data; **RandForest**= Random Forest, no CT data; **BNC**= Bayesian Network Classifier, no CT data; **Alvarado**= Alvarado score, no CT data

Poster #47

A MULTICENTER STUDY OF PRECISION TRAUMA RESUSCITATION: TOLERANCE TO FIBRINOLYSIS DEPENDS ON DEPTH OF SHOCK AND INJURY SEVERITY

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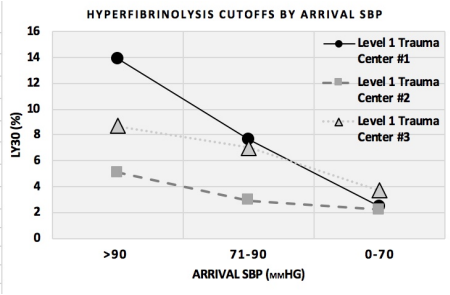
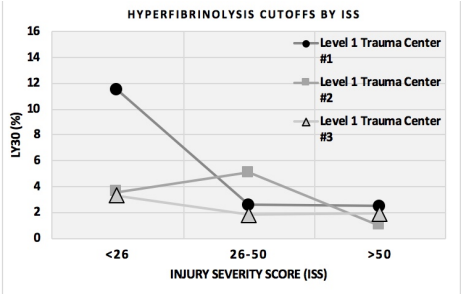
Introduction: Hyperfibrinolysis(HF) is associated with increased postinjury mortality and massive blood transfusion(MT). The critical level to define HF and initiate anti-fibrinolytic therapy has ranged from 3-7.5% LY30 by rapid-thromboelastography(rTEG). Recognizing the heterogeneity of injury, we hypothesize that LY30 cutoffs predictive of MT are dependent on depth of shock and severity of anatomic injury and that this trend is independent of institutional practice patterns.

Methods: Adults requiring trauma activation from 2010-2017 in three level 1 trauma centers(L1-TC) in three different states, who received >1 red blood cell unit were included. Cutoffs to define rTEG-measured HF were determined using ROC analysis and maximizing the Youden Index (sensitivity+specificity-1), with MT(>10 RBC/6hrs or death/24hrs) as the outcome.

Results: 332, 893 and 922 patients from three L1-TC were included. Median age was 35, 37 and 36 years, ISS was 14, 17 and 22, 52%, 53% and 77% suffered blunt injuries, mortality was 10%, 25% and 16% and MT administered in 8.6%, 16% and 26% respectively. Although specific cutoffs varied by center, similar trends were observed: the HF cutoff that was predictive of massive transfusion tended to decrease with worsening hypotension and increased injury severity (Figure).

Conclusion: LY30 cutoffs predictive of massive transfusion varied with trauma patient characteristics, suggesting that as anatomic injury or shock severity increase, the ability to tolerate even mild degrees of fibrinolysis is markedly reduced. This trend is independent of institutional practice patterns.





Poster #48

EMERGENCY DEPARTMENT THORACOTOMY REMAINS AN INTEGRAL RESUSCITATIVE ADJUNCT FOR BLUNT TRAUMA

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INTRODUCTION: Emergency department thoracotomy (EDT) is a potentially lifesaving procedure for patients in profound hemorrhagic shock after trauma. Despite agreement on EDT indications for patients suffering penetrating trauma, the role of EDT after blunt trauma remains controversial. We hypothesize that EDT after blunt trauma is associated with survival in the present day.

METHODS: Prospective observational study of 801 adult trauma patients undergoing EDT after blunt trauma over a 40-year period at a single institution. Patients were stratified by decades for analysis (n/decade = 224, 261, 153, 163). Demographics, prehospital CPR, return of spontaneous circulation (ROSC) after EDT, survival to OR, and overall survival were compared between groups. Continuous data are presented as median (interquartile range). Adjusted odds ratios (aOR) and 95% confidence intervals (CI) are reported. Regression models were controlled for prehospital CPR, age, decade, and injury pattern (multisystem vs. isolated head/chest/abdomen/extremity).

RESULTS: Most patients were male (73%) with median age 34 (24-49) years. CPR was performed in 76%, 29% ROSC after EDT, 21% survived to OR, and 3.4% survived overall. Overall survival was higher in the last decade (10%) vs. 3 prior decades (3%, 1%, 2%, $p<0.001$). Overall survival increased to 16% in those who survived to OR. Overall survival in those who survived to OR was also higher (29%) in the last decade vs. 3 prior decades (7%, 14%, 8%, $p=0.009$). After controlling for confounders, EDT in the final decade was associated with survival to OR (aOR 2.228, 95% CI 1.318-3.768, $p=0.003$) and overall survival (aOR 12.324, 95% CI 2.711-56.016, $p=0.001$).

CONCLUSIONS: EDT for blunt trauma in the era of modern trauma care is associated with survival, particularly in those who survive to OR. EDT for blunt trauma should not be abandoned. Multicenter studies are needed to inform modern-day EDT guidelines.

Poster #49

EVALUATION OF PREHOSPITAL BLOOD PRODUCT ADMINISTRATION BY AIR MEDICAL SERVICES IN PATIENTS WITH SUSPECTED TRAUMATIC HEMORRHAGE

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Introduction: There is conflicting evidence on the impact of prehospital transfusion of red cells and/or plasma on outcomes in severely injured trauma patients. The objective of this study was to determine if prehospital blood product administration was associated with presence of shock and coagulopathy on arrival to the hospital and short-term mortality in patients transported by air medical services to our Level 1 trauma center.

Methods: This was a retrospective cohort study of traumatically injured adults (≥18 years) transported by a university-affiliated air medical service to a single Level 1 trauma center with a 5-state catchment area. Cases received 1-4 of the 2 units of red cells and 2 units of plasma available on rotary wing and fixed wing aircraft from July 2015 to July 2019. Matched controls were transported on rotary wing or fixed wing aircraft with no blood products available from October 2011 to December 2017. Controls and cases were matched 2:1 using optimized nearest neighbour matching on age, highest in-flight shock index (SI=heart rate/systolic blood pressure [SBP]), lowest in-flight SBP, prehospital intubation status, blunt vs. penetrating injury, scene vs. transfer transport, injury severity score (ISS), new injury severity score, maximum head abbreviated injury scale, and time from flight team arrival at the patient to arrival at the trauma center. The primary outcomes were evidence of shock on arrival (composite endpoint of SBP < 90, SI > 0.9, lactate ≥ 2.5 mmol/L, or base deficit ≥ 6 mEq/L) and coagulopathy on arrival (International Normalized Ratio [INR] > 1.5, platelet count < 100 x 109/L, partial thromboplastin time [PTT] > 60s, or fibrinogen < 100 mg/dL). Secondary outcomes included 6h mortality and vital signs and laboratory values on arrival in the emergency department. Multivariable logistic and linear regression analyses were used to determine if prehospital administration of blood products was associated with each outcome. Models were adjusted for all variables used in matching.

Results: The 202 cases were well matched with 404 controls on all matching variables. Median age was 51 years (IQR: 31-65), 70.5% were male, 84.8% had blunt injury, and 52.2% were transported from the scene of injury and the remainder were interfacility transports. The median maximum in-flight SI was 1.2 (IQR: 0.9-1.5) and median ISS was 29 (IQR: 20-43). Median prehospital transport time was 52 minutes (IQR: 33-70). Prehospital administration of blood products was associated with lower odds of coagulopathy on arrival (23.4% vs. 31.7%, aOR: 0.52, 95%CI: 0.33-0.80), but no significant difference in shock on arrival (78.9%vs. 78.0%, aOR:0.94, 95%CI: 0.58-1.51). Patients receiving prehospital blood products had higher mean hematocrit and fibrinogen levels and lower INR. There was no significant difference in 6h mortality (2.5% vs. 2.0%, aOR: 1.18, 95%CI: 0.37-3.84), arrival SBP, heart rate, SI, lactate, base deficit, pH, hemoglobin, platelet count, or PTT (Table).

	Cases n=202	Controls n=404	Adjusted mean difference (95% CI)
Arrival Vital Signs, mean (SD)			
SBP, mmHg	116 (32)	118 (30)	0 (-5 to 5)
Heart rate, beats per minute	100 (27)	99 (28)	-1 (-5 to 2)
Shock Index	0.91 (0.32)	0.90 (0.37)	-0.03 (-0.08 to 0.02)
Arrival Laboratory values, mean (SD)			
pH	7.28 (0.12)	7.29 (0.11)	-0.01 (-0.02 to 0.01)
Lactate, mmol/L	3.7 (2.8)	3.5 (2.7)	0.0 (-0.4 to 0.4)
Base deficit, mEq/L	6.6 (5.0)	6.5 (4.5)	0.1 (-0.7 to 0.9)
Hemoglobin, g/dL	11.6 (2.1)	11.5 (2.4)	0.3 (-0.1 to 0.7)
Hematocrit, %	36.0 (6.3)	34.6 (7.2)	1.7 (0.6 to 2.8)
INR	1.3 (0.3)	1.5 (0.7)	-0.2 (-0.3 to -0.1)
PTT, seconds	33 (12)	34 (17)	-2 (-4 to 1)
Platelet count, $x10^9$ /L	188 (73)	184 (87)	5 (-8 to 18)
Fibrinogen, mg/dL	212 (86)	191 (91)	22 (5 to 39)

Conclusion: In our cohort of severely injured adults transported by air medical services, prehospital administration of blood products was not associated with improvement in parameters of shock or reduction in short-term mortality. However, prehospital administration of blood products was associated with a lower risk of coagulopathy, likely due to replacement of clotting factors with plasma administration and decreased hemodilution with decreased prehospital crystalloid administration.

Poster #50

PRELIMINARY CHARACTERIZATION OF PERITONEAL MESOTHELIAL CELLS EXPOSED TO REACTIVE ASCITES COLLECTED IN ACUTE APPENDICITIS OR SMALL BOWEL OBSTRUCTION

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Injury Outcomes Network

Introduction: Pathological adhesions in the abdomen can cause bowel obstructions, female infertility, pain, and surgical complications. Mesothelial cells (MCs) covering the surfaces of abdominal organs and the peritoneum regulate abdominal adhesions. Under normal conditions, a monolayer of MCs secrets a surfactant-like glycocalyx and actively prevents adhesions. Inflammation, e.g., acute appendicitis (AA), initiates transition of the monolayer to proliferating hypertrophic fibroblastoid cells that increase extracellular matrix (ECM) and fibrin deposition to form physiologic adhesions that degrade as the reparative process completes. Pathological adhesions result when this process is dysregulated. Here, we describe preliminary data exploring the response of human MCs in culture to reactive ascites (rA) collected during appendectomy or fibrinolysis for small bowel obstruction (SBO). Our goal is to better understand signaling between rA and MCs so that we may devise pathogenic adhesion prevention and treatment strategies.

Methods: This is a non-randomized, prospective observational IRB-approved study. Patients with non-perforated AA or SBO are being recruited from four Level 1 trauma centers in the United States. To date, 29 AA and 4 SBO rA samples have been collected. To recapitulate in vivo resting MCs, we utilized a cell culture model consisting of a monolayer of quiescent cuboid-like mesothelial cells (cMCs). Tissue culture media 24h post-treatment was analyzed with bead-based quantification of cytokines and chemokines (HDF13; EVE Technologies), and relative gene expression changes after 48h were quantified via quantitative PCR. Cells fixed to microscope slides were stained with phalloidin to visualize cell shape via the f-actin cytoskeleton.

Results: For a preliminary experiment, 3 AA and 1 SBO rA were chosen at random. cMCs treated for 24h with either 10% AA or SBO rA undergo drastic morphological changes, appearing hypertrophic with increased cell-to-cell contact. One of the AA rA also induced a portion of the cells to become fibroblastoid but did not produce a gel-like substance that was observed in the other 2 AA rA-treated cMCs. No gel-like substance was observed in SBO-treated cMCs. AA and SBO rA treatment for 24h increased the media concentration of the proinflammatory cytokine IL-6 between 2- and 16-fold (0.4 ng/ml to 3.47 ng/ml) over untreated cMCs (0.2 ng/ml). 24h treatment of cMCs with either 1 or 10 ng/ml interleukin (IL)-6 or IL-8 did not recapitulate the morphologic changes observed in rA-treated cells. Gene expression analysis of cMCs showed that after 48h, tissue-type plasminogen activator (tPA) mRNA was 3.3- or 2.0-fold increased over untreated cMCs in AA- or SBO-treated cells, respectively, whereas, urokinase-type plasminogen activator (uPA) was decreased by 72% and 7.3% in AA and SBO-treated cells, respectively.

Conclusion: Although additional experimentation is required for this active study, both AA and SBO rA elicited substantial phenotypic changes in cMCs that were not reproduced with IL-6 or IL-8 treatment.

Poster #51

OPTIMIZING TRAUMA TRANSFER THROUGH THE DEVELOPMENT OF AN INTERNAL CALL CENTER STAFFED BY TRIAGE NURSES

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University of Kansas Medical Center

Introduction: Interfacility transfers are critical in the care of trauma patients, particularly in rural states with long transport times, and a standardized approach to interfacility transfers is required to optimize efficiency and improve patient outcomes. To streamline the transfer process, our trauma center transitioned from an off-site third-party call center to an in-house call center staffed by trained nursing personnel. This study examined the changes in the trauma transfer process to determine whether a reduction in transfer time had occurred.

Methods: We reviewed interfacility transfers to our ACS verified Level I Trauma Center from May 2015 to May 2019. Patient characteristics, transfer time intervals, transfer mode, and distances were compared and analyzed for three call center models used during the study period: the third-party call center, a hybrid period during which in-house triage nurses took calls during the day and the external call center took calls at night, and a fully staffed in-house call center.

Results: There were 1,343 trauma transfers with complete data during the study period: 234 in the third-party system, 575 in the hybrid system, and 534 in the in-house system. Patients were similar in terms of demographics and injury severity (Table 1). When examining total transfer time from request to completion, we identified a 27-minute decrease following transition from the third-party call center to the in-house call center (171 versus 148 minutes, $p < 0.0001$) despite a greater distance traveled (35 versus 47 miles, $p < 0.030$).

Conclusion: The transition from an off-site call center to an in-house system staffed by triage nurses has saved valuable time in the transfer of trauma patients to our center. The significant decrease in time despite longer distance traveled is critical given the large rural catchment area surrounding our center and provides a starting point for future efforts to optimize our trauma system as well as a model for other centers serving regions with long transport distances and times.

Table 1. Characteristics of Patients Undergoing Interfacility Transfer by Call Center Model

	n	Male	Age		ISS		Transfer Time (min)		Distance (miles)	
		Freq	Median	IQR	Median	IQR	Median	IQR	Median	IQR
Third Party	234	68%	51	29-70	10 ·	5-17	175	141-225	35	18-84
Hybrid	575	64%	53	33-70	9	5-17	188	150-252	45	11-74
In-House	534	62%	58	38-73	9	5-14	148	117-208	47	27-85

Poster #52

UTILITY OF REPEAT HEAD CT IN DETECTING DELAYED INTRACRANIAL HEMORRHAGE IN FALLS ON NOVEL ORAL ANTICOAGULANTS

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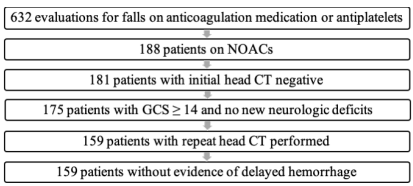
Introduction: One of most common traumatic presentations in the elderly is a ground level fall, which is often complicated by the use of anticoagulation and antiplatelet agents. One of the most feared complications of falls in this population is intracranial hemorrhage (ICH). Delayed ICH (dICH) is defined as the appearance of ICH on a repeat head CT after a negative initial head CT and has been reported at a rate of 0.6-6% in patients taking anticoagulants or antiplatelet agents. Studies have shown that patients on warfarin therapy have a small but persistent rate of dICH. This led to the development of our head injury protocol for patients on warfarin, which requires a head CT 6 hours after presentation. When we first reported our data in 2011, we had a 2.5% rate of dICH for patients on warfarin. As patients on novel oral anticoagulants (NOACs) – dabigatran, rivaroxaban, and apixaban -became more prevalent, we followed the same protocol as data regarding dICH in this population was lacking. In a second review of our data in 2015, the first 50 patients on NOACs had no dICH. The purpose of this study is to determine incidence of dICH in a larger group of patients and to determine if a change to our current protocol would be feasible.

Methods: After IRB approval was obtained, a retrospective review of trauma evaluations for falls on NOACs at a Level II Trauma Center from January 2016-December 2018 was conducted. All charts meeting these criteria were reviewed for Glasgow Coma Score (GCS) on arrival, presence of new neurologic deficit as noted in initial trauma note, NOAC use, result of initial head CT and findings on delayed head CT, if one was performed. Patients were excluded if their initial GCS was less than 14 or if they presented with new neurologic deficits, if there was evidence of traumatic intracranial pathology on initial head CT, if they were taking antiplatelet agents or other anticoagulants in addition to NOACs, or if a repeat head CT was not performed.

Results: We identified 632 patients evaluated by the trauma team from January 2016-December 2018 for falls on anticoagulation or antiplatelet therapy. As seen below, 159 (25%) of patients were included in the retrospective review. Ages ranged from 19-98 years old, with 151 patients over the age of 60. There were 99 females and 60 males included in the sample. Eighty patients were taking apixaban, 29 were taking dabigatran, and 50 were taking rivaroxaban. Ten patients presented with GCS of 14 and the remaining 149 patients had an initial GCS of 15. Twelve patients presented to the emergency room > 6 hours after their fall, and as such only had one head CT. No delayed hemorrhages were detected in this population.



Conclusion: The necessity of a repeat head CT in patients who experience blunt head trauma secondary to fall while taking NOACs is not currently well defined in the literature. Review of the trauma database at a level II trauma center failed to demonstrate any delayed hemorrhage in 159 neurologically intact patients after head strike on NOAC, suggesting that there is no indication for follow-up imaging if the GCS remains above 13. This data, in combination with our previous reviews, allows us to feel confident in eliminating mandatory repeat head CTs in patient on NOACs from our protocol.

Poster #53

THE IMPACT OF FORMAL TRAUMA DESIGNATION AND CIVILIAN PATIENT INCORPORATION ON A RURAL MILITARY MEDICAL CENTER: INCREASING READINESS WHILE BOLSTERING A REGIONAL TRAUMA SYSTEM.

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Introduction: Trauma remains one of the leading causes of morbidity and mortality around the world. Studies have shown that the institution of regionalized trauma systems improves the evaluation, stabilization and transport of critically ill or severely injured patients. With sparse civilian trauma assets and inconsistent prehospital capabilities in Southeast North Carolina, the prospect of incorporating a longstanding military medical center into the Regional Trauma System (RTS) showed great potential in aiding the region. In addition, the opportunity for military members to potentiate skills maintenance by treating civilian trauma also showed potential benefit toward increasing deployment readiness.

Methods: Here we examine the effects of our rural military trauma center on both an RTS and on readiness of the military medical force. We performed a retrospective review of all trauma activations at our level III center from May 1, 2017 to December 31, 2018. We examined changes in injury severity score (ISS) as the program grew, transfer rates to higher level centers, RTS development, and knowledge, skills, and abilities (KSAs) of providers.

Results: 1,740 patients were included during the evaluation period (106 pre-trauma designation and 1,634 post); 39% were unaffiliated with the military (8.5% pre, 41% post). Trauma transfer rates decreased from 19% to 15% post designation. Transfer average ISS scores significantly increased from 15 pre-to 26 post designation. KSAs increased among those evaluating trauma patients from roughly 50% meeting requirements to almost 75% currently.

Conclusion: Formal Trauma designation and civilian integration in a rural military medical center has greatly enhanced the developing RTS. We have been effective in serving as a site for the earlier resuscitation/stabilization of injured patients, have decreased transfer burdens on surrounding trauma centers and improved the KSA levels of military practitioners in our facility.

Poster #54

UNDERTRIAGE OF GERIATRIC TRAUMA PATIENTS IN FLORIDA

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Introduction: Elderly undertriage rates have been estimated to be as high as 55% percent in the US. This study examined risk factors for undertriage among hospitalized trauma patients in a state with high volumes of geriatric trauma patients.

Methods: This is a population based retrospective cohort study based on the State of Florida using Agency for Healthcare Administration (AHCA) database. Severely injured trauma patients were defined by ACS definitions and an ICD injury severity score (ICISS)

Results: Undertriaged patients were more likely to have isolated TBIs, lower ICISS scores, multiple comorbidities and older age. Specifically, trauma patients aged 65 and older were more than twice as likely to be undertriaged (34% versus 15.7%, $p < 0.0001$). Undertriaged patients of all ages were also more likely to suffer from pneumonia, UTI, arrhythmias, and sepsis. After risk adjustment, severely injured trauma patients admitted to non-TC were also more likely to be at risk for mortality (adjusted OR 1.27, 95% CI 1.17-1.38).

Conclusion: Age and multiple comorbidities are significant predictors for undertriage of trauma patients. As a result, trauma triage guidelines should account for high-risk geriatric trauma patients that would benefit from definitive treatment at designated trauma centers.

Poster #55

AND MILES TO GO BEFORE WE SLEEP: EAST DIVERSITY AND INCLUSIVITY PROGRESS AND REMAINING CHALLENGES

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Introduction
In 2019, the Eastern Association for the Surgery of Trauma (EAST) surveyed its members on topics of equity and inclusion and performed an assessment of leadership representation. It is unclear how survey responses reflect other available sources of data on diversity. We hypothesized that females and surgeons of color (SOC) are underrepresented as EAST members and leaders.

Methods
Responses from the 2019 #EAST4ALL Survey were analyzed post-hoc for representation of females and SOC in current academic appointments (clinical instructor, assistant professor, associate professor, or professor), past or current academic leadership roles (division chief, department chair, or program director), EAST committee membership, and EAST board membership, and compared to the overall #EAST4ALL respondent cohort using chi-square goodness-of-fit tests. EAST membership and board demographics were compared to diversity data from the AAMC using chi-square goodness-of-fit and Fisher's exact tests.

Results
Of 306 respondents, 37.4% self-identified as females and 23.5% as SOC. In the survey responses, there were no statistically significant differences in female and SOC representation in current academic appointments and EAST committee participation ($p > 0.05$) compared to their male and white self-identified counterparts. For academic leadership roles, females were underrepresented ($p < 0.0001$) while SOC were not ($p = 0.08$). Both female and SOC survey participants were underrepresented in EAST board membership ($p = 0.002$ and $p = 0.043$, respectively). As of February 2020, EAST has 2666 members, with 1241 self-identified males, 537 females, and the remaining 888 unknown. Of EAST's 33 presidents, three have been white women (9%), two have been Black, non-African American men (6%), and 28 (85%) have been white men. When compared to the 2017 AAMC data on active US general surgeons [19865 (79%) males, 5157 (21%) females], females are over-represented in EAST's 2020 membership ($p < 0.0001$) and proportionally represented in EAST's 2019-2020 board members ($p > 0.05$). We were unable to assess representation of racial and ethnic groups in EAST due to inability to accurately compare to AAMC data.

Conclusions
Examining the diversity in surgical academia is the first step to addressing potential gaps. Respondents to the #EAST4ALL survey suggested that women and SOC may be underrepresented as leaders in academic trauma surgery and the leadership of EAST. However, within EAST women appear to be over-represented as members and proportionally represented as board members. A lack of high quality granular demographic data in areas such as race/ethnicity or non-binary gender makes it challenging to evaluate whether structurally marginalized groups such as African American men are adequately represented. Our national trauma organizations should encourage self-reported diversity data from their respective members in an effort to re-assess and further promote the diversity landscape in trauma surgery.

Poster #56

DEVELOPMENT AND VALIDATION OF A RISK ASSESSMENT MODEL FOR CONCOMITANT FACIAL FRACTURES IN PATIENTS WITH BLUNT HEAD TRAUMA

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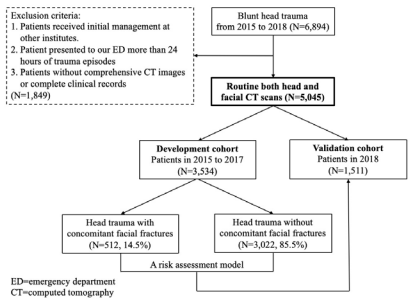
Introduction: Patients with head trauma may have concomitant facial fractures, which were usually under detected by routine head computed tomography (CT) alone. The objective of this study was to identify clinical indicators of concomitant facial fractures in head trauma. We tried to develop a risk assessment model to guide a discriminative use of an additional facial CT in patients with blunt head trauma.

Methods: A retrospective review of head trauma patients receiving simultaneous head and facial CT at a level II trauma center for years 2015-2018 was conducted. The multivariate logistic regression analysis was used to evaluate independent factors of concomitant facial fractures in head trauma patients using data of patients in the year 2015-2017, and a risk assessment model was created accordingly. Regression coefficients from the logistic regression analyses were used to compute a linear predictor (LP). The predicted risk of concomitant facial fractures in patients with blunt head trauma (R) was calculated using the equation: $R = 1 / (1+ \exp(-LP))$. The discrimination, calibration, and precision of this model were validated by patients in the year 2018.

Result: In total, 5,045 blunt head patients (3,534 patients in year 2015-2017 as development cohort and 1,511 patients in year 2018 as validation cohort) were enrolled. Concomitant facial fractures occurred in 723 head-trauma patients (14.3%). Ten clinical and head CT variables were identified as predictors, including younger age, male sex, a fall from elevation, a motorcycle collision, Glasgow coma scale (GCS) $\leq$ 14, epistaxis, tooth rupture, facial lesion, intracranial hemorrhage and skull fracture. The final linear predictor (LP) = - 4.721 - 0.01 x (age in years) + 0.43 x (male) + 0.834 x (a fall from elevation) + 0.545 x (a motorcycle collision) + 1.048 x (GCS≤14) + 2.13 x (epistaxis) + 1.148 x (tooth rupture) + 3.412 x (facial lesion) + 0.527 (intracranial hemorrhage) + 1.295 x (skull fracture) (1 = risk factor is present, 0 = risk factor is absent)

In the development cohort, the model showed good discrimination (area under the receiver operating characteristic curve, AUC = 0.891), good calibration (Hosmer-Lemeshow $\hat{C}$-test, p = 0.691) and good precision (Brier score = 0.066). The model performance in the validation cohort also demonstrated excellent discrimination (AUC = 0.907), good calibration (Hosmer-Lemeshow $\hat{C}$-test, p = 0.652) and good precision (Brier score = 0.083). Using the developed model, 77.1% of unnecessary facial CT could be avoided.

Conclusion: The risk assessment model may guide a discriminative use of additional facial CT to detect concomitant facial fractures in head-trauma patients.



Diagnostic Performance of the Risk Assessment Model for Concomitant Facial Fractures in the Development and Validation Cohorts.

Variables	Development Cohort (N =3,534)	Validation Cohort (N =1,511)
Year of diagnosis	2015-2017	2018
Cases with facial fracture (N, %)	512 (14.5%)	211 (14.0%)
Discrimination, AUC (95% CI)	0.891 (0.878-0.904)	0.907 (0.892-0.923)
Calibration, H-L *p*-value[$]	0.691	0.652
Precision, Brier score[#]	0.066	0.083
Sensitivity (%)	84.6	91.9
Specificity (%)	77.0	77.4
Positive predictive value (%)	38.4	39.8
Negative predictive value (%)	96.7	98.3

Abbreviations: AUC, area under receiver operating characteristic curve; CI, confidence interval; H-L, Hosmer-Lemeshow $\hat{C}$-test.

[$] $p > 0.05$ indicating no significant difference between the predicted and observed outcome.

[#] Mean square difference between the observed and predicted outcome; range from 0 to 1, the lower the better.

Poster #57

REDEFINING GERIATRIC TRAUMA: 55 IS THE NEW 65

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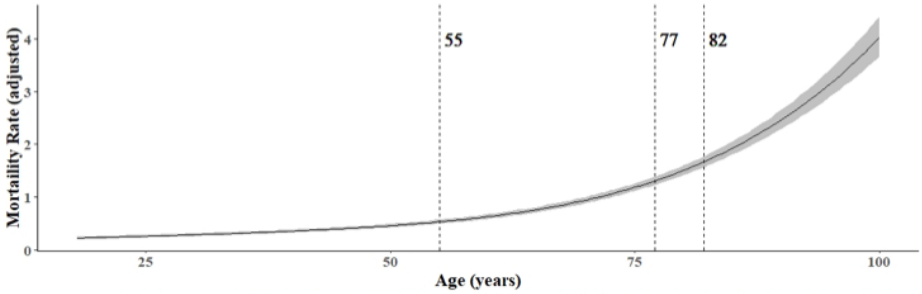
Introduction: As the prevalence of geriatric trauma patients has increased, protocols are being developed to address the unique requirements of this demographic. However, categorical definitions for geriatric patients vary, potentially creating confusion as to which patients should be cared for according to geriatric-specific standards. The aim of this study was to statistically identify cut-points for mortality based on age to support implementation of age-driven guidelines.

Methods: Adults aged 18–100 with blunt or penetrating injury were selected from 95 hospitals' trauma registries. Change point analysis techniques (cumulative sum binary segmentation) were used to detect inflection points in the proportion of deaths at each age. Based on these calculated points, patients were allocated into age groups and their characteristics and outcomes compared. Logistic regression was used to estimate risk-adjusted in-hospital mortality controlling for gender, race, ISS, GCS, and number of comorbidities.

Results: A total of 255,099 patients were identified (45.7% female, mean age 59.3, mean ISS 8.69, 92.6% blunt). Statistically significant increases in the mortality rate were noted at ages 55, 77, and 82 (figure). Compared to the referent group (Age <55), patients were more likely to die if they were Age 55–76 (Adj odds ratio [AOR]: 2.42), Age 77–81 (AOR: 4.70), or Age 82+ (AOR: 6.43). There was also a significant jump in NTDS-defined comorbidities once age passed 55, as the rate more than doubled for the older groups (0.88 vs. 1.87, 2.18 & 2.21, see table). As age increased, each group was more likely to be female, have dementia, sustain a ground level fall (GLF), and be discharged to a SNF (p<0.001).

Conclusions: This large multicenter study suggests the age threshold for geriatric patients in trauma is lower than previous studies indicated. We recommend trauma centers consider including patients age >55 in geriatric trauma protocols. The other age inflection points identified (77, 82) may also warrant additional specialized care considerations.



	N (%)	Adj. Mortality	AOR (95% CI)	# Comorbid	% Female	% Dementia	% GLF	% SNF
<55	113,519 (41.0)	0.35	--	0.88	29.1	0.1	9.7	8.0
55-76	88,506 (32.0)	0.85	2.42 (2.24, 2.62)	1.87	49.6	4.9	46.1	34.6
77-81	23,658 (8.5)	1.66	4.7 (4.19, 5.27)	2.18	61.9	17.5	65.5	53.1
82+	51,281 (18.5)	2.27	6.43 (5.85, 7.07)	2.21	68.0	28.0	72.1	59.9

Poster #58

NBATS-2, IS IT READY FOR PRIMETIME? A NATURAL EXPERIMENT TESTING ITS RELIABILITY

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Introduction: The American College of Surgeons' Needs based Assessment Tool (NBATS) was developed to quantify the optimal number of trauma centers needed in a geographic region. NBATS-2 attempts to predict the impact on patient volume and travel time for patients when a new (candidate) trauma center (TC) is added to the system. Although states are starting to use the new tool for strategic planning, predictive accuracy of the tool has not been thoroughly studied. Trauma Service Area (TSA) 2 provided a unique opportunity for tool evaluation as patient data was available before and after designation of the region's only trauma center. The purpose of this study was to examine NBATS-2 predictive accuracy regarding expected volume and travel times of trauma patients at a newly designated TC when compared to actual data.

Methods: The NBATS predictive model for volume of trauma patients (International Classification of Injury Severity Scores < 0.85 and Injury Severity Score >15) at the new candidate TC was run based on 25th, 50th, & 75th percentiles of both state (local) and National Trauma Data Bank (NTDB) patients per 100 TC beds. This was compared to the actual number of trauma patients from the State Discharge Data set before (2011-2012) and after (2016-2017) designation of the TC. The analysis was then augmented using ArcGIS spatial modeling to characterize median travel times for actual trauma patients, before and after designation of the TC.

Results: Both state and NTDB 25th, 50th, & 75th percentiles for trauma patients per 100 beds resulted in significant over estimation of volume at the new TC in 2016. After another year of TC maturation (2017), over estimation decreased but was still present. The 25th percentile from state and NTDB data sets provided the most accurate predictions (Table A). ArcGIS accurately showed patients traveling < 30 min. to a TC nearly doubled after designation (Table B) of the new TC.

Table A: Predicted number of trauma patient volume for candidate hospital in TSA 2

Target or expected volume percentile	Predicted volume based on Target	Difference (expected–actual) using actual 2016 volume of 150	Difference (expected – actual) using actual 2017 volume of 175
State 25th	193	43 (29%)	18 (10%)
State 50th	310	160 (107%)	135 (77%)
State 75th	355	205 (137%)	180 (103%)
Measures below are based on NTDB patients/100 beds distribution*			
NTDB 25th	417	267 (178%)	242 (138%)
NTDB 50th	604	454 (303%)	429 (245%)
NTDB 75th	939	789 (526%)	764 (436%)

*The ICISS < 0.85 values are estimates based on the NTDB ISS > 15 distribution and state specific conversion factor of 1.13.

Conclusions: NBATS-2 provides an excellent template for state strategic planning to evaluate the impact of adding an additional TC to the system; however, it over estimates candidate TC volume. State trauma patient percentiles per 100 beds resulted in better predictions than NTDB percentiles. The 25th state percentiles resulted in the most accurate predictions. ArcGIS appropriately showed a decrease in trauma patient travel times after TC designation.

Table B: Actual patients served within travel times for TSA 1,2,3, and 10

	Model 1: Pre-TC		Model 2: Post-TC
Travel time zones	2011 and 2012		2016 and 2017
< 10 minutes	93		145
11-20 minutes	178		401
21-30 minutes	232		395
31-40 minutes	90		140
41-50 minutes	81		79
51-60 minutes	49		33
Total	723		1193

Poster #59

ALBUMIN FOR SHOCK RESUSCITATION REVISITED: A TRANSLATIONAL STUDY

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Introduction: Studies have suggested a beneficial effect of early plasma based resuscitation following trauma/hemorrhagic shock (T/HS). A plausible mechanism is preventing the development of the endotheliopathy of trauma (EOT) and the acute coagulopathy of trauma. The protective effects of plasma may be associated with other components other than coagulation factors; our previously published work suggests a role for sphingosine 1-phosphate (S1-P). Albumin is the major protein in plasma and is an important carrier of S1-P. Different albumin manufacturing processes are used for clinical and laboratory purposes. We hypothesized that this processing may result in variable concentrations of S1-P and may impact the development of the EOT.

Methods: Human umbilical vein endothelial cell (HUVEC) monolayers were subjected to control or shock (hypoxia/reoxygenation + epinephrine) flow conditions followed by perfusion with 5% plasma or albumin. Albumin solutions included commercial albumin (HSA, purified by Cohn process), bovine serum albumin (BSA) or recombinant human albumin (r-Albumin). Glycocalyx (EG) degradation was measured by syndecan-1 shedding and measurement of EG thickness. Endothelial activation was detected by soluble thrombomodulin (sTM), tissue plasminogen activator (tPA) and plasminogen activator inhibitor-1 (PAI-1). Vascular permeability was indexed by angiopoietin-2 (Ang-2). HUVEC ADAM metallopeptidase domain 17 (ADAM-17) expression and mitochondrial integrity (JC-1 dye, fluorescent intensity) were also determined. S1-P concentration was determined in plasma and the various albumin preparations. Additional microfluidic studies were also conducted with added exogenous S1-P.

Results: Mean ± SD, N = 6 for each group

HUVEC Group	S1-P (ng/ml)	Syn-1 (ng/ml)	EG thickness (fluor intensity)	sTM (pg/ml)	Ang-2 (pg/ml)
Control	------	24.3 ± 2.5	236.4 ± 5.6	29.8 ± 2.8	147 ± 1.8
HR + epi	------	90.5 ± 7.2*	131.4 ± 4.2*#	98.9 ± 7.1*	378 ± 4.5*
HR + epi + Plasma	58.4 ± 3.8	27.1 ± 2.9	227.2 ± 10.6	30.3 ± 5.9	159 ± 5.2
HR + epi + Commercial HSA	4.1 ± 1.4*	89.8 ± 3.8*	154.9 ± 4.8*	99.6 ± 5.5*	370 ± 5.2*
HR + epi + BSA	27.9 ± 4.2*#	74.1 ± 4.6*#	193.2 ± 7.6*#	79.8 ± 5.6*#	303 ± 6.1*#
HR + epi + r-Albumin	0*#	91.3 ± 6.9*	143.8 ± 4.2*#	101.3 ± 8.2*#	378 ± 7.2*

*p<0.05 vs. plasma, #p<0.05 vs. commercial HSA.

Biomimetic shock resulted in increased tPA and reduced PAI-1 concentrations; these were returned to control values in all groups except commercial HSA. Addition of exogenous S1-P to physiological levels protected against shock related EG and EC injury in all groups. ADAM-17 activity and JC-1 fluorescent ratio were positively affected by S1-P content in the various albumin groups.

Conclusion: The protective effect of albumin on EOT is dependent on S1-P concentration. Commercially available albumin solutions have relatively low concentrations of Si-P, which may account for some of the differences in the the reulsts of albumin administration in clinical vs animal T/HS studies. Exogenously S1-P enriched HSA may be a useful solution for early T/HS resuscitation.

Poster #60

THE SEVERITY OF E-SCOOTER INJURIES: A COMPARISON WITH OTHER MODES OF TRANSPORTATION

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Introduction: The introduction of electric Scooters (e-Scooters) worldwide has created a novel mode for transportation and a new mechanism of injury. Preliminary reports about injuries sustained riding e-Scooters have raised concern about the incidence and severity of this problem. Previous work has focused on describing these injuries without comparison groups of other similar modes of transportation. We evaluated patients injured riding e-Scooters and compared them to patients injured riding bicycles and motorcycles.

Methods: Data (July 2018-September 2019) were collected from the electronic medical record at an urban level 1 trauma center. Inclusion criteria were adult patients (≥16 years) with an injury mechanism due to riding an e-Scooter, bicycle or motorcycle. Patients were excluded if they were not using one of these modes as a form of transportation, e.g. organized racing. We examined the differences of patient demographics, helmet use and injury presentation factors between the three groups. A Chi-square test with Bonferroni correction and an ANOVA with a Tukey's honestly significant difference (HSD) post hoc test were performed to evaluate these cohorts, including between group comparisons.

Results: Forty-four patients presented with injuries involving e-Scooters, 44 due to bicycles and 57 due to motorcycles. Scooter riders were significantly younger than bicycle riders (34.9±15.3 vs. 43.6±16.0, p=0.02) and were more likely to be female (50%) than those riding either a motorcycle (19%) or a bicycle (18%) (p=0.001). Scooter riders also never wore a helmet (0%) compared to bicycle riders (7%) and motorcycle riders (56%) ($p < 0.001$). The groups did not differ in their use of alcohol (p=0.27) or marijuana (0.49). Scooter patients were also injured with similar severity compared to bicycles and motorcycles and did not differ in AIS Head/Neck ≥ 2 (p=0.16), AIS Extremity ≥ 2 (p=0.29) or ISS > 15 (p=0.13).

Conclusion: Patients injured from riding an e-Scooter were more likely to be younger, female and not wearing a helmet when compared to those riding other modes of transportation. The use of alcohol and marijuana was similar between all groups. Scooter riders sustained an injury burden similar to other two-wheel options, especially motorcycles. This largely unregulated mode of transportation represents a new mechanism of substantial injury and further investigation is warranted to lessen this impact on society.

	e-Scooter, n=44	Bicycle, n=44	Motorcycle, n=57	p value
Age, mean ± SD	34.9 ± 15.3	43.6 ± 16.0	38.4 ± 12.9	0.02
Male Gender, n (%)	22 (50)	36 (82)	46 (81)	0.001
Helmet Use, n (%)	0 (0)	3 (7)	32 (56)	<0.001
Positive EtOH, n (%)	9 (20)	13 (30)	20 (35)	0.27
Positive Marijuana, n (%)	9 (20)	6 (13)	13 (23)	0.49
AIS Head/Neck ≥ 2, n (%)	5 (11)	5 (11)	13 (23)	0.16
AIS Extremity ≥ 2, n (%)	26 (59)	22 (50)	36 (63)	0.29
ISS > 15	4 (9)	8 (18)	14 (24)	0.13

Poster #61

NEED FOR SURGEON PRESENCE AND NEED FOR TRAUMA INTERVENTION BOTH OUTPERFORM ISS IN PREDICTING RESOURCE UTILIZATION IN PEDIATRIC TRAUMA

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University of Oklahoma Health Sciences Center

Introduction: Injury severity score (ISS) was developed to quantify injury severity retrospectively. It has also been used to assess the appropriateness of trauma triage and predict resource utilization in pediatric trauma. Recently, Need for Surgeon Presence (NSP) and Need for Trauma Intervention (NFTI) have been utilized for determining appropriate triage. We sought to compare NSP and NFTI to ISS in predicting resource utilization and triage in pediatric trauma patients.

Methods: The 2016 and 2017 Trauma Quality Improvement Program (TQIP) datasets were combined for this study. Patient who were < 18 years of age were included. Patients transferred in or out, those discharged home from the ED, those with a primary injury type not blunt/penetrating, and those not treated at a tertiary (Level I/II) center were excluded. NSP and NFTI have previously been described. Outcomes of interest were mortality, length of stay (LOS), disposition from ED, and discharge disposition. Prognostic values of NSP and NFTI versus ISS were contrasted in multivariable logistic regression models of mortality adjusted for age, sex, injury type, and transport mode. Lastly, agreement between NSP and NFTI was assessed with the Kappa statistic.

Results: A total of 52,592 patients were included in the analysis. Both NSP+ and NFTI+ outperformed ISS in predicting LOS, hospital discharge home, and deaths in the ED ($p < 0.01$). Additionally, in comparing NSP to NFTI, NSP+ patient had a longer LOS (NSP+ mean days=9.6 vs NFTI+ mean days = 8.2, $p < 0.0001$), fewer discharges home (NSP+ = 62.0% vs NFTI+ = 69.7%, $p < 0.001$), and more discharges to inpatient rehab (NSP+ = 16.4% vs NFTI + = 13.3% $p < .001$). Crude mortality was 14.0% and 10.6% for NSP+ and NFTI+ patients respectively ($p < 0.001$). The area-under-curve (AUC) values for NSP (AUC = 0.946 95%CI 0.942-0.950) and NFTI (AUC = 0.931 95%CI 0.926-0.937) differed by just 1.5%. The Kappa for NSP and NFTI was 0.73 (95%CI 0.71-0.73) indicating substantial agreement, with the most discordant pair being NFTI+/NSP-.

Conclusion: NSP and NFTI consistently outperformed the ISS system in multiple outcomes of interest including LOS, hospital discharge home, and deaths in the ED. Though the prognostic value of NSP and NFTI were equivocal in models of mortality, NSP+ patients had increased LOS, fewer discharges home, and more discharges to inpatient rehabilitation centers. NSP may have an advantage in that can be calculated upon the patient leaving the ED, whereas NFTI sometimes is not calculated for at least 3 days after the patient arrival. We conclude that NSP and NFTI are both useful tools in calculating resource utilization in pediatric trauma. Both outperform ISS when predicting resource utilization, however, NSP may offer some advantages over NFTI.

Poster #62

DISPARATE EFFECTS OF SEX HORMONES ON ENDOTHELIOPATHY OF TRAUMA: AN IN VITRO STUDY

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Introduction: Clinical studies have shown a protective effect of the female gender on outcomes following trauma hemorrhagic shock (T/HS). This is most apparent in pre-menopausal women and has been attributed to serum estrogen (E2) concentration. Protection of hemodynamic parameters have been demonstrated in females and studies suggest a protective effect of E2 on the microcirculation following T/HS. However, the physiologic impact on the microvasculature endothelium (ET) and the glycocalyx (GC) layer are unknown.

Methods: Human umbilical vein endothelial cell (HUVEC) monolayers were established in a microfluidic device. Monolayers were pretreated with either E2 at premenopausal or post-menopausal concentrations (400 pg/ml and 20 pg/ml respectively), dihydrotestosterone (DHT, 10 ng/ml) or media alone for 24 hours. Monolayers were then exposed to hypoxia-reoxygenation (HR) and epinephrine (Epi) under flow conditions. GC integrity was indexed by shedding of syndecan-1 (syn-1), hyaluronic acid (HLA) and glycocalyx thickness. Endothelial injury/activation was detected by soluble thrombomodulin (sTM). ET coagulative phenotype was indexed by tissue plasminogen activator (tPA) and plasminogen activator inhibitor-1 (PAI-1) activities.

Results: Mean ± SD, N = 6 for each group

HUVEC Group	HLA (pg/ml)	Syn-1 (pg/ml)	GC Thickness (nm)	sTM (pg/ml)	tPA (pg/ml)	PAI-1 (pg/ml)
Control	16.2 ± 2.4	24.2 ± 2.9	33.6 ± 4.1	21.6 ± 3.2	4.6 ± 1.2	2540 ± 170
HR/Epi only	85.6 ± 9.4*#	79.1 ± 7.3*#	12.4 ± 1.4*#	124.7 ± 10.8*#	283 ± 23.9*#	265 ± 35*#
HR/Epi + DHT (10 ng/ml)	55.2 ± 2.6*#	82.3 ± 8.9*#	13.9 ± 2.6*#	126.7 ± 18.8*#	257 ± 19.4*#	335 ± 35*#
HR/Epi + E2 (20 pg/ml)	67.3 ± 8.5*#	56.9 ± 7.5*#	16.6 ± 3.8*#	103.4 ± 9.1*#	248 ± 22.6*#	355 ± 115*#
HR/Epi + E2 (400 pg/ml)	23.2 ± 3.1	30.6 ± 2.8	31.8 ± 3.6	27.9 ± 3.1	10.4 ± 2.6*	2065 ± 145*

*p<0.05 vs. Control, #p<0.05 vs. 400 pg/ml E2

Conclusions: Premenopausal but not postmenopausal E2 or DHT mitigated against GC and ET derangement following biomimetic T/HS conditions. This was associated with a pro-thrombotic endothelial phenotype which may be protective against the development of the acute coagulopathy of trauma in the clinical setting.

Poster #63

BEDSIDE USE OF ARTIFICIAL INTELLIGENCE GUIDED IDENTIFICATION OF MISPLACED ENDOTRACHEAL TUBES IN THE ICU

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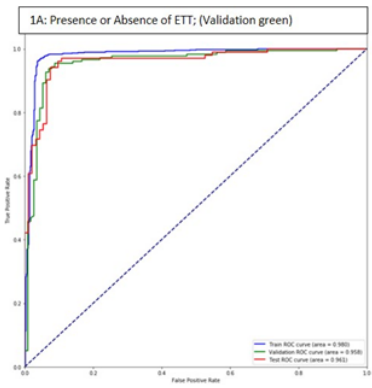
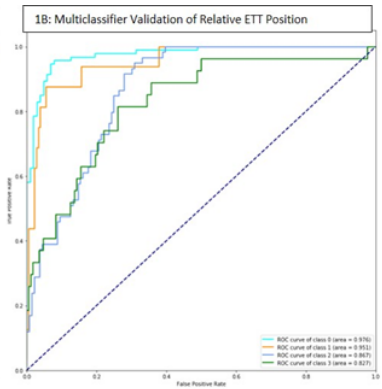
Introduction: Intubated patients in the ICU routinely undergo chest radiographs (CXRs) daily to verify positioning of endotracheal tubes (ETT). However, it has been shown there is significant delays to radiologists reading and identifying ETT malposition. The aim of this study was to create a first of its kind artificial intelligence (AI) algorithm that can automatically detect ETT presence, relative position of the ETT (too high, too low, ideal), and calculate distance above the carina at the bedside of the patient on a portable CXR.

Methods: Real world CXRs were taken from two institutional radiology PACS archives and de-identified. Ground truth was determined by independent, blinded review of each CXR by two radiologists. Each CXR was classified as presence/absence of ETT, a qualitative measure of relative position, and pixel level annotation completed indicating the carina/ETT coordinates. The annotated CXR data was then divided into a training set (n=5528 images) and a validation set (n=1368). A Deep learning (UNET) pipeline was trained to determine the presence/absence and relative position. An additional DenseNet neural network was created for an automated classifier of ETT tip to carina distance. Inter-rater reliability was determined using a double blind investigation for the human annotators and was compared to the AI algorithm.

Results: The algorithm had excellent ability to detect a binary ETT presence/absence classifier (AUC 0.96). The relative position of the ETT being too low/right main stem had an AUC 0.95 (Figure 1A) and optimal position AUC 0.87 (Figure 1B, optimal purple, too high orange, too low green). The AI algorithm instantaneously produces a distance measurement with an error

Conclusion: This novel application of AI based decision support has significant potential to improve time to recognition of important radiographic findings at the bedside of the patient in the ICU.





Poster #64

ALTERED PROTEIN AND MICRO RNA EXPRESSION PROFILES OF INTESTINAL EPITHELIAL CELL-DERIVED EXOSOMES DUE TO HYPOXIA/REOXYGENATION INJURY

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Introduction: Exosomes are small extracellular vesicles carrying diverse payloads, such as proteins, lipids, and microRNAs (miRNAs). Intestinal exosomes have been identified as mediators that trigger systemic inflammation after a severe injury. However, their cellular origin and specific payload to activate inflammation remain to be characterized. We hypothesized that an ischemia/reperfusion (I/R) injury would change exosome phenotypes secreted from intestinal epithelial cells (IECs) identified by proteomic and miRNA analyses.

Methods: Human IECs were cultured to 80% confluence and exposed to hypoxia/reoxygenation (H/R) (1% O_2 for 6 h, followed by 24 h normoxia) in order to mimic intestinal I/R injury in vitro. Exosomes secreted from IECs (IEC exosomes) were isolated from the culture media of the control (normoxia) and H/R groups using commercially available kits. A monocyte nuclear factor kappa B (NF-kB) activity assay was used to evaluate the biological activity of IEC exosomes. Proteomics analysis of IEC exosomes was performed using a nanoscale liquid chromatography with tandem mass spectrometry (nano LC-MS/MS) analysis, and bioinformatics analysis was then conducted to identify potential pathways modulated by exosomal proteins. A pathway-focused miRNA PCR array was also performed to characterize miRNA expression differences in exosomes during H/R injury.

Results: H/R exposure induced phenotypic changes in IEC exosomes and caused a 1.62-fold increase in NF-κB activation compared to control ($p < 0.05$; $N = 3$ in each group). A total of 3,324 and 3,068 exosomal proteins were identified in the control and H/R groups, respectively. Differences were found in IEC exosome profiles harvested from the H/R group, with a significant increase in 346 proteins as well as a decrease in 253 proteins compared to the control (Figure). Bioinformatics analysis revealed enriched pathways associated with cell signaling and inflammatory response. Several differentially expressed miRNAs were also found in IEC exosomes of the H/R group, including miR-155-5p, miR-100-5p, and let-7e-5p upregulation (fold changes = 3.38, 4.27, and 5.33, respectively). Remarkably, these miRNAs have been shown to be involved in proinflammatory signaling including the TLR/NF-κB pathway.

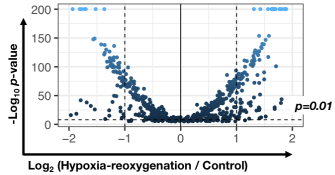

Figure. **Volcano plot** highlighting the differentially characterized proteins in IEC exosomes.
The x-axis: log 2 (fold change for H/R group/control)
The y-axis: negative log 10 transformed p-values from the t test

Conclusion: H/R exposure could induce proinflammatory phenotype changes in IEC exosomes, and these exosomes carry distinct protein and miRNA payloads.

Poster #65

PRE-HOSPITAL SIMPLE THORACOSTOMY DOES NOT IMPROVE PATIENT OUTCOMES COMPARED TO NEEDLE THORACOSTOMY IN SEVERELY INJURED TRAUMA PATIENTS

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Introduction: ATLS 10th edition recommends simple (finger) thoracostomy (ST) over needle thoracostomy (NT) in the pre-hospital setting for suspected tension pneumothorax (tPTX) or traumatic arrest. Some emergency medical services (EMS) have adopted ST into their pre-hospital (PH) practice, thus we sought to examine outcomes of ST vs NT in our local EMS services. We hypothesized that pre-hospital (PH) ST would reduce failure rates and improve outcomes compared to NT.

Methods: This was a retrospective review of adult (18+ years) trauma patients from 2017 - 2020 who received ST or NT by EMS in the PH setting. Subset analysis was carried out in blunt and penetrating patient subgroups.

Results: There were 48 patients with 64 pleural decompression (PD) procedures included. The cohort was mostly male (83.7%), injured by penetrating mechanism (65.3%) and of median (IQR) age of 31 (25 – 46) years. Of the 64 PD attempts, 28 (43.8%) were NT and 36 (56.3%) ST. ST was significantly more likely to be employed bilaterally compared to NT (22.2% vs 3.6%; $P < 0.001$) and at mid-axillary rather than mid-clavicular (58.3% vs 30.6%, respectively; $P < 0.001$). Rates of improved patient response post-PD ($p=0.15$) or noted return of blood/air ($p=0.19$) did not differ between the techniques. Return of spontaneous circulation (ROSC) was achieved in 10% of ST vs 14.3% of NT attempts ($P = 0.62$). Median on scene times were higher for ST (16.8 vs 11.5 minutes; $P < 0.02$). Overall mortality did not statistically differ between ST and NT (68.2% vs 46.4%, respectively; $P = 0.125$). For patients that survived beyond the ED, PD-related complication rates were 2 of 21 patients (9.5%) in ST and 1 of 12 (8.3%) in NT. In penetrating trauma, ST had longer on scene time and total PH time (table).

Conclusion: FT did not improve success rates of ROSC and was associated with prolonged pre-hospital times, especially in penetrating trauma patients. Given the benefit of "scoop and run" in urban penetrating trauma, consideration should be given to direct transport in lieu of FT. Use of ST in blunt trauma should be evaluated prospectively.

Blunt mechanism	Total patients (n = 17)	Needle thoracostomy (n = 7)	Simple thoracostomy (n = 10)	P
On scene time	16.8 (12.0 – 23.5)	15.5 (11.4 – 22.9)	18 (12.5 – 24.3)	0.776
Transport time	11.0 (7.0 – 14.8)	14.0 (11.0 – 15.5)	7.0 (6.8 – 12.3)	0.071
Total PH time	37.0 (31.0 – 42.0)	39.0 (32.0 – 54.0)	36.0 (24.0 – 40.5)	0.252
ED mortality	7 (41.2)	1 (14.3)	6 (60.0)	0.059
In-hospital mortality	11 (64.7)	1 (14.3)	10 (100)	<0.001
Penetrating mechanism	**Total patients (n = 31)**	**Needle thoracostomy (n = 19)**	**Simple thoracostomy (n = 12)**	**P**
On scene time	11.5 (8.0 – 18.0)	10.0 (7.5 – 13.0)	16.5 (9.0 – 22.8)	0.035
Transport time	12.0 (9.0 – 14.0)	12.0 (9.0 – 13.5)	12.5 (9.3 – 14.0)	0.617
Total PH time	30.0 (26.0 – 38.0)	28.5 (26.0 – 33.0)	35.0 (29.3 – 40.3)	0.035
ED mortality	8 (25.8)	5 (21.1)	4 (33.3)	0.447
In-hospital mortality	16 (51.6)	11 (57.9)	5 (41.7)	0.379

Poster #66

POPLITEAL SCORING ASSESSMENT FOR VASCULAR EXTREMITY INJURIES IN TRAUMA (POPSAVEIT) STUDY

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Introduction: Traumatic popliteal artery injuries are associated with the highest risk of limb loss of all peripheral vascular injuries, with amputation rates of 10-15%. Previous scoring systems have been developed to predict limb salvage in patients with traumatic lower extremity injuries, but these largely focus on mangled extremities. Additionally, these scoring systems are fairly complex, often requiring extensive evaluation by multiple specialties, limiting their clinical utility. The aim of this study was to provide a simplified scoring system to predict limb salvage rates in patients with traumatic popliteal artery injuries.

Methods: A multi-insitutional retrospective review of all patients sustaining traumatic popliteal artery injuries from 2007-2018 was performed. Demographics, clinical, operative, and outcome data were collected. Patients undergoing lower extremity amputation (trans-tibial or trans-femoral) were compared to those with successful limb salvage at last follow-up. Significant predictors ($p < 0.05$) for amputation on univariate analysis were included in a multivariable logistic regression. The POPSAVEIT score was created by assigning points based on relative odds ratios of the variables in the most predictive model.

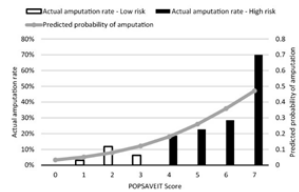
Results: A total of 355 patients from 9 institutions were included in the analysis. The median patient age was 31 years and 80% were male. Median follow-up was 69 days [IQR: 19-343 days]. Overall major amputation rate was 16%. The POPSAVEIT score was created using the significant predictors for major amputation, which consisted of blunt mechanism of injury [1 point], associated orthopedic injury (fracture or dislocation) [1 point], initial systolic blood pressure < 90 mm Hg [2 points], and absence of pedal Doppler signals at presentation [3 points], Table I. Using a threshold of < 4 to define low-risk and > =4 to define high-risk, 15 of 189 (8%) low-risk and 42 of 166 (25%) high-risk patients required amputation ($p < 0.001$), resulting in a sensitivity of 72%, specificity of 58%, with positive and negative predictive values of 25% and 92%, Figure 1.

Conclusions: Traumatic popliteal arterial injuries carry significant risk for major amputation. The POPSAVEIT score provides a simple and practical way to effectively stratify patients into low- and high-risk categories for major amputation. While high scores do not preclude limb salvage, this can be used to effectively communicate risk stratification between institutions, providers, and patients. Futher studies should be performed to validate this scoring system.

Table I. Risk factors associated with amputation in patients with traumatic popliteal artery injuries

	No amputation (n=298)	Amputation (n=57)	Univariate P Value	Multivariate Odds Ratio	Point Value Assigned
Blunt injury	187 (63%)	46 (81%)	0.009	2.0	1
Associated orthopedic injury	233 (78%)	53 (93%)	0.010	2.9	1
Initial SBP < 90	21 (7%)	10 (18%)	0.010	4.0	2
Absence of Pedal Doppler signals	150 (50%)	42 (74%)	<0.001	6.9	3

Figure 1. Rate and predicted probability of amputation by POPSAVEIT Score



Poster #67

HIGH TIDAL VOLUMES DURING CRITICAL CARE TRANSPORT OF THE INJURED PATIENT: OPPORTUNITIES FOR IMPROVEMENT

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Introduction: High tidal volumes are associated with increased rates of respiratory complications and acute respiratory distress syndrome. Data on the influence of high tidal volumes during critical care transport on civilian trauma patients is scarce. We aimed to identify how often patients receive high tidal volumes, associated factors, and their influence on subsequent management to identify opportunities for improvement.

Methods: We analyzed a retrospective cohort of traumatically injured, mechanically ventilated, adult patients transported to a single rural academic medical center by a hospital based critical care transport program between January 2018 and April 2019. We defined low tidal volumes as ≤ 8 ml/kg predicted body weight.

Results: Of 78 patients, 17 (22%) received high tidal volumes during transport, with no difference between interfacility vs. scene calls (p = 0.6). Females were more than twice as likely as males to receive high tidal volumes, even after 6 hours. Compared to those receiving low tidal volumes, patients receiving high tidal volumes during transport were nearly 4 times as likely to receive high tidal volumes in the ICU after handoff (71% vs 18%, p < 0.001), and 3 times as likely after 6 hours (67% vs 20%, p = 0.002). All but 9 (1.2%) patients had their tidal volume changed within 6 hours of handoff. Overall in-hospital mortality for the cohort was 23% (n = 18).

Table: Characteristics of Patients During and After Transport

	Low Tidal Vol $V_T \leq 8$ ml/kg[1]	**High Tidal Vol** $V_T > 8$ ml/kg[1]	
Transport	n = 61	n = 17	p
Female	9 (15%)	7 (41%)	0.02
Tidal volume	7.0 (0.7)	8.7 (0.7)	< 0.001
Transfer Time	67.8 (27.3)	61.5 (16.2)	0.4
Blunt trauma	56 (92%)	15 (88%)	0.6
Scene call	18 (30%)	6 (35%)	0.6
After Handoff	n = 54	n = 23	p
Female	6 (11%)	10 (43%)	0.001
Tidal volume	7.2 (0.9)	9.0 (0.7)	< 0.001
After 6 Hours	n = 37	n = 16	p
Female	4 (11%)	8 (50%)	0.002
Tidal volume	7.3 (0.9)	8.9 (0.7)	< 0.001

All values n (%) or mean (SD) [1]Per kilogram predicted body weight

Conclusion: Despite evidence of the hazards, one in five trauma patients transported to our center received high tidal volumes, with female patients being at particular risk. Improved education and standardization could aid early optimization of tidal volume during the transport, evaluation, and stabilization of the mechanically ventilated injured patient.

Poster #68

IMPACT OF INTERMITTENT REBOA USE ON ISCHEMIA REPERFUSION INJURY; A TRANSLATIONAL ANALYSIS

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Tulane School of Medicine

Introduction: The impact of ischemia/reperfusion injury (IRI) has been shown at the cellular level to cause endothelial glycocalyx damage with worsening coagulopathy. Intermittent resuscitative endovascular balloon occlusion of the aorta (iREBOA) involves scheduled inflations and deflations of the occlusive balloon as an alternative to reduce IRI. This is the first study comparing standard full occlusion vs iREBOA regarding IRI and clinical outcomes.

Methods: This was an international, multicenter retrospective review of all patients managed with REBOA from July 2014 – June 2018 in the ABOTrauma Registry. iREBOA characteristics and outcomes were compared to those of standard occlusion. Significance was set at $P < 0.05$.

Results: The cohort included 162 patients, primarily male (74%), blunt injured (70%). Nearly 30% received iREBOA. No differences existed between groups in demographics, receipt of CPR, systolic blood pressure before or after aortic occlusion (AO), 24 hour or 30 day mortality, femoral access method, or zone of AO. iREBOA patients had better ED survival but received significantly more blood products than full occlusion REBOA patients with significantly more likelihood of coagulopathy, higher lactate and renal failure. (**Table**)

Conclusion: Although iREBOA had a lower ED mortality, these patients demonstrated higher incidence of coagulopathy, higher lactate and blood product utilization, potentially due to repeated IRI events. Further prospective studies are needed to determine whether full occlusion vs. iREBOA should be implemented in hemorrhaging patients. This is the first clinical analysis to suggests that iREBOA could potentially play a key role in exacerbating endothelial damage with worsening coagulopathy through repeated IRI.

Table. Comparison of clinical factors and outcomes between full occlusion and iREBOA

	Total (n = 162)	Full occlusion (n = 114, 70.4%)	iREBOA (n = 48, 29.6%)	P
ED aPTT	38 (29 – 56)	32 (27 – 50)	48.5 (36 – 77)	0.007
ED INR	1.0 (1.0 – 2.0)	1.0 (1.0 – 2.0)	2.0 (1.0 – 2.0)	0.05
ED Lactate	7.0 (4.6 – 13)	6.8 (4.3 – 11)	9 (4.9 – 18)	0.04
PRBC after REBOA 24hrs	8 (4 – 14)	6 (3 – 12)	14 (8 – 20)	< 0.001
FFP after REBOA 24hrs	7.5 (4 – 14)	6 (2 – 10)	11 (6.5 – 20)	0.001
Platelets after REBOA 24 hrs	2 (0 – 5)	1 (0 – 2)	3 (2 – 9.5)	< 0.001
ED mortality	20 (12.3)	18 (15.8)	2 (4.2)	0.040
Renal failure	17 (10.6)	8 (7.1)	9 (18.8)	0.028
Extremity ischemia	10 (6.3)	6 (5.3)	4 (8.5)	0.446

ED - emergency department; PTT - partial thromboplastin time; INR - international normalized ratio; PRBC - packed red blood cells; FFP - fresh frozen plasma; hrs - hours

Poster #69

A TALE OF TWO CENTERS: IS LOW-MOLECULAR-WEIGHT HEPARIN REALLY SUPERIOR FOR PREVENTION OF POST-TRAUMATIC VTE?

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Scripps Mercy Hospital Trauma Service

Introduction: Although low-molecular-weight heparin (LMWH) is widely used for venous thromboembolism (VTE) chemoprophylaxis, it is more expensive than unfractionated heparin (UFH). We compared the clinical effectiveness of LMWH and UFH for the prevention of post-traumatic DVT and PE between two neighboring centers with similar patient populations and similar DVT screening, but different VTE prophylaxis approaches.

Methods: We conducted a retrospective review of trauma patients age ≥ 15 years receiving VTE chemoprophylaxis at two urban Level I trauma centers with similar DVT screening protocols. One center primarily uses anti-factor Xa adjusted LMWH every 12 hours and the other utilizes UFH every eight hours. Patient demographics, chemoprophylaxis, and clinical characteristics were evaluated in a two-level hierarchical logistic regression model. Primary outcome was incidence of DVT and PE.

Results: A total of 3,654 patients were included. The DVT rate was significantly lower at the UFH center (3.5% vs. 5%; p=0.04) prior to adjusting for other variables. PE rates did not significantly differ between the LMWH vs. UFH centers (0.6% vs. 0.4%, p=0.64, respectively). Patients at the LMWH center were older (50.3 vs. 47.3, $p < 0.01$), more severely injured (ISS 10 (5-17) vs. 9 (5-16), $p < 0.01$), spent more time in the ICU (3.0 vs. 1.3 days, $p < 0.01$), and had longer hospital stays (9.4 vs. 7.0 days, $p < 0.01$) than those at the UFH center, although the magnitude of these differences was small. Patients at the UFH center received the first dose of chemoprophylaxis earlier (1.0 vs. 1.7 days, $p < 0.01$). After adjusting for center effects and clinical covariates, there was no difference in DVT or PE rates between the LMWH versus UFH approach (OR: 1.01, 95%CI: 0.69–1.48, p=0.949).

Conclusions: Primary utilization of LMWH versus UFH for VTE prophylaxis was not a significant predictor of DVT and the rate of PE was equivalent between the two centers. Given the lower cost of UFH, choice of chemoprophylaxis agent may have economic implications for managing post-traumatic DVT and PE prophylaxis.

Table 1. Clinical characteristics, center characteristics, DVT rate, and PE rate for the LMWH versus UFH Center.

Clinical or Center Characteristic	LMWH Center n = 2,499	UFH Center n= 1,155	p value
Age, years (mean)	50.3	47.3	**<0.01**
ISS, median (IQR)	10 (5-17)	9 (5-16)	**<0.01**
Blunt Mechanism	92%	90%	0.14
Hospital LOS, days (mean)	9.4	7.0	**<0.01**
ICU Days, (mean)	3.0	1.3	**<0.01**
Days to First Chemoprophylaxis Dose, median (IQR)	1.7 (1.0-2.8)	1.0 (0.5-1.9)	**<0.01**
DVT Rate	5.0%	3.5%	**0.04**
PE Rate	0.6%	0.4%	0.64

Poster #70

INAPPROPRIATE RESTRAINT USE IN PEDIATRIC PATIENTS INVOLVED IN MOTOR VEHICLE COLLISIONS

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Introduction: Motor vehicle collisions (MVC) have long been the leading cause of unintentional death among children and adolescents. Although improved outcomes from the use of restraints has been well established, public awareness and use of the appropriate restraint recommendations are perceived to be deficient in the pediatric population. This study aims to identify the prevalence of inappropriate pediatric restraint use in our catchment area.

Methods: After obtaining IRB approval, we retrospectively queried the registry of an urban Level 1 trauma center for pediatric (0-18yrs) patients involved in MVC from October 2013 to December 2018. Demographic and clinical variables were recorded. Data regarding appropriate restraint use by age group, including seatbelt, car seat, booster, and seating position, were examined.

Results: 303 cases of pediatric MVC were identified from the registry. Overall, 52% (158/303) of children were inappropriately restrained at the time of MVC. 60% (35/58) of toddlers/infants of car seat age and 57% of booster size were either inappropriately restrained or unrestrained altogether. 45% of seatbelt age children were unrestrained, with 3% being restrained but inappropriately riding in the front seat. African-American children were more likely to be inappropriately restrained than White and Hispanic children (62% vs 41% and 47%, respectively; p=.012). Mortality was 2%, with 21% of patients requiring surgery. Inappropriate restraint was significantly associated with orthopedic injury (p=.011) but not with surgical interventions or mortality (p=0.12 and 0.47).

Conclusions: While efforts to improve adherence to vehicle restraint regulations have greatly increased in the last decade, more than half of the children involved in MVC are still inappropriately restrained in our community. Close collaboration with our injury prevention colleagues and community outreach is essential to educate the most vulnerable populations, especially infants and toddlers, on adequate motor vehicle safety measures.

	Car seat		Booster		Seatbelt	
	N=58		N=68		N=177	
	n	%	n	%	n	%
Appropriately restrained	23	40%	29	43%	91	51%
Inappropriately restrained	9	16%	1	1%	6	3%
Unrestrained	26	45%	38	56%	80	45%

*American Academy of Pediatrics (AAP) recommends (1) rear-facing car seat until age 2 yrs, (2) forward-facing car seat with harness until ~65 lbs, (3) booster until appropriate age [~8-12 yrs] and height [4'9"], (4) children < 13 yrs should be back-seat occupants, and (5) lap belt for all others

Poster #71

RECIDIVISM FOLLOWING PEDIATRIC FIREARM INJURIES AND CORRELATES FOR FUTURE INCARCERATION

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Introduction: Firearm injuries (GSW) continue to be a leading cause of mortality among children. Identifying causes of recidivism is essential for preventing subsequent injuries. Furthermore, the effect of this violence on future incarceration remains poorly examined in children. This study aims to recognize the correlates of recidivism for future injury and incarceration after GSW among children within our county.

Methods: After obtaining IRB approval, we retrospectively queried the registry of an urban Level 1 trauma center for pediatric (0-18yrs) GSW, from September 2013 to January 2019. Demographic and clinical variables were recorded. Data regarding prior and future incarceration as well as prior and future admissions for GSW were examined.

Results: 393 cases of pediatric GSW were identified from the registry. Mortality was 11%, with 59% of deaths occurring in the resuscitation unit. 87% of patients were African American, 10% Hispanic, and 2% Caucasian. Males accounted for 89% of patients. Prior encounter for GSW occurred in 4% of patients. Of the 348 patients who survived the initial injury, 12% sustained future GSW within the study period and 39% were subsequently incarcerated. Factors associated with mortality, future GSW and incarceration are shown in Table 1. Those not attending school and prior/future GSW encounters had a trend towards future incarceration. On multivariable analysis, the only significant predictor of future GSW was a prior GSW [OR 6.2 (1.8-21.6), p=0.004] while the predictor of future incarceration was age >15 years at the time of injury [OR 2.3 (1.8-21.8), p=0.003].

Conclusions: Over one in every ten children subjected to gun violence in our community falls victim to repeat injury, and over a third were eventually incarcerated. Trauma centers should be empowered to develop targeted strategies for halting the cycle of violence and crime that continues to devastate our most vulnerable population.

Characteristic	Total		Mortality		Future GSW			Future Incarceration		
	n	%	n	%	n	%	p-value	n	%	p-value
Total	393	100%	45	11.5%	43	12.4%	-	136	39%	-
Age (years) ≤15	126	32.1%	14	11.1%	11	25.6%	0.752	26	19.1%	<.001
Prior GSW	16	4.1%	2	12.5%	6	14.0%	0.004	9	6.6%	0.807
Prior Incarceration	31	7.9%	2	6.5%	5	11.6%	0.404	19	14.0%	0.055
Future GSW	43	10.9%	-	-	-	-	-	25	18.4%	0.052
Future Incarceration	136	34.6%	-	-	25	58.1%	0.801	-	-	-
Not in School	114	29.0%	28	62.2%	12	27.9%	0.319	47	34.6%	0.057

Table 1: Frequency of recidivism based on encounters for GSW and incarceration

Poster #72

OVERDOSE IN TRAUMA PATIENTS: HOW DO WE ADDRESS THE EPIDEMIC?

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Introduction: Deaths from drug overdose continue to rise, and in fact doubled in the region of study over the past year. According to the CDC, death from overdose is now the leading cause of injury-related death in the United States. However, outcomes after traumatic injury has typically been limited to determination at time of discharge or brief follow-up. Overall, it has been found that long term survival is worse than predicted actuarial survival, suggesting that the mortality of injury does not end at discharge, but the prevalence of death from overdose after a traumatic incident is unknown. Due to the significant injuries often acquired during trauma, trauma patients have historically received substantial opioid regimens to alleviate their pain. Further, the rate of preexisting substance use is significantly higher among trauma patients compared with the general population, making these patients even more vulnerable. This study aims to determine the prevalence of and characterize the population of trauma patients suffering death by acute drug poisoning after presentation for a traumatic incident. Further, we aim to identify risk factors in this group.

Methods: We analyzed all activated and admitted trauma patients, 18 years or older at the only level 1 trauma center in our region over the years 2012-2018. We then partnered with the Department of Public Health to match this cohort with unintentional or undetermined acute drug poisoning fatalities from the death registry. All out of county patients were excluded. Known suicides were not included in the 'acute drug poisoning fatality' group, nor were patients who died of acute drug poisoning during their index trauma hospitalization. Overall descriptive characteristics of the group who died by acute drug poisoning were analyzed. Then, estimation and comparison of survival curves were conducted using the Kaplan-Meier method and the difference in survival curves were examined using the log-rank test. To examine factors associated with death from acute drug poisoning, Cox proportional hazards regression was conducted. First, univariate regression for each independent variable was conducted and variables with $p<0.05$ were then included in the multivariate model.

Results: From 2012-2018, there were 25,158 adult trauma activations and admissions, representing 23,751 unique patients, with 12,322 reportedly living outside of the study county. Of the remaining 11,429 patients, 2,304 were recorded as having died in the county being studied, 102 of these from unintentional acute poisoning involved cocaine, heroin, fentanyl, methamphetamine, opioids, benzodiazepines and alcohol. Overdose decedents were 86% male, 55% white, 93% English-speaking, of a mean age of 47 years at the time of presentation, and the majority (76%) publicly-insured.

Of all patients who died of an overdose, 55% were screened for a blood alcohol level and 33% underwent a urine drug screen, 21% of which were positive. The average blood alcohol level, among all those screened, was 166 (BAC 1.60). The median injury severity score (ISS) was 5, IQR 1-11. The average Glasgow Coma Score in the ED was 13. The median time from trauma activation to death was 497 days (IQR 130-1,036), however 20% had overdosed within the first 3 months. Forty percent of these patients died from a prescriptionopioid overdose, as opposed to illicit drugs such as heroin or fentanyl. On univariate analysis in the unadjusted cox models, patients who died from an acute drug poisoning were more likely than other patients admitted for a traumatic injury to be male ($p<0.002$), white vs all others ($p=0.04$) or black vs all others ($p=0.05$), be a younger age at the time of admission ($p=0.009$), have a higher ISS on admission ($p=0.018$), lower GCS in the emergency department ($p<0.02$), higher blood alcohol level on admission ($p<0.005$). Neither having a urine toxicology checked, nor having that urine toxicology be positive were associated with an increased risk of death from overdose compared to all other trauma patients. Asian race was protective ($p=0.001$). On multivariate analysis, only a higher blood alcohol level was statistically significant associated with death from overdose.

Conclusion: In conclusion, patients who have suffered a traumatic injury may be at risk of death from overdose, especially those with an elevated blood alcohol level, a test that is easy to perform in the emergency department. As overdose deaths continue to rise, identifying patients at risk for this important cause of mortality is increasingly important. Though the outcome in the community of interest was small, it represents significant mortality after trauma. More work should be done to better understand those at risk for unintentional overdose after injury. Trauma hospitalization may confer opportunities to increase screening and initiate harm reduction and prevention strategies.

Poster #73

FEWER LEVELS OF TRAUMA CARE LEAD TO BETTER OUTCOMES FOR PATIENTS

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Introduction: Data has shown that dedicated trauma intensive care units (ICUs) staffed by surgical intensivists leads to better outcomes for trauma patients. Increased length of stay (LOS) has been linked to worse outcomes. Very little research has focused on the effect of a dedicated trauma floor or a dedicated ICU/floor system. In 2018, our Level 1 trauma center transitioned from three levels of care (mixed ICU/stepdown unit/floor) to two dedicated levels of trauma care (ICU/floor). The biggest changes were a loss of stepdown units and both available units now dedicated to trauma. Our objective was to look at patient outcomes pre- and post-intervention.

Methods: Retrospective analysis of trauma registry data was performed on all adult patients (age ≥18) admitted to the trauma service at a Level 1 rural trauma center over a 46-month period. In the pre-intervention group, stepdown unit and floor patients were combined as "non-ICU" for data comparison. Student's t-test and multivariate regression analysis were used to determine the effect of intervention on primary outcomes, including mortality, length of stay, and complications.

Results: A total of 5,986 patients were analyzed. The two groups had similar demographics with the pre-intervention having more patients with ISS >15 (28.8% vs 23.2%) but fewer patients with 3+ comorbidities (56.5% vs 66.7%). Median LOS decreased from 5 to 4 days for ICU patients and 3 to 2 days for non-ICU patients ($p<0.0001$). ICU patient index admission mortality dropped from 9.0% to 5.5% ($p=0.0009$), while for non-ICU patients it went from 1.7% to 0.26% ($p=0.0013$). Overall patient mortality was level at 3.7%. Inpatient complications dropped from 9.9% to 8.5% ($p=0.07$). Unplanned readmissions to the ICU were unchanged ($p=0.4169$). For all patients with 3+ comorbidities, overall LOS dropped by 2 days ($p<0.0001$) and home discharge increased from 42.8% to 51% ($p<0.0001$).

Conclusion: Implementation of two levels of dedicated care has decreased LOS for all trauma patients without increasing mortality and complications. Patients with extensive comorbidities saw the biggest improvements. Further work is being completed to determine which other populations are seeing benefit and if this intervention has changed long-term outcomes.

Poster #74

EVALUATION OF STATEWIDE UTILIZATION OF HELICOPTER EMERGENCY MEDICAL SERVICESFOR INTERFACILITY TRANSFER

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Introduction: Helicopter emergency medical services (HEMS) have been utilized with increasing frequency for the transportation of injured patients both from the scene and from medical treatment facilities to higher levels of care. Improved outcomes in HEMS have been difficult to establish and reports of overutilization and patient financial harm have been recently published. Our study was conducted to evaluate statewide HEMS utilization of inter facility transfers (IFT) to assess for overutilization and identify opportunities for performance improvement (PI).

Methods: A statewide registry was used to evaluate patients admitted to trauma centers 2013-2017. Descriptive and inferential statistics were used to analyze the data. Patients were compared based on mode of IFT. Ground emergency medical service (GEMS) and HEMS patients' annual volume and mortality rates were evaluated for change. Further analyses were performed to compare outcomes, possible overutilization based on a previously validated risk profile, and change in vital signs between prehospital (PH) and referring facility (RF).

Results: Overall 33,924 patients underwent IFT during the study period of whom 14.89% were transported by HEMS. HEMS patients were more likely to be male (69.8%), younger (48.0 vs 56.2 years), had higher injury severity sores (ISS) (14.6 vs 9.0), and had a higher mortality (10.5% vs 2.8%). All PH, RH and emergency department vital signs (VS), total Glasgow Coma Score (GCS) and GCS-motor component (GCS-m) were worse in overall HEMS transfer group. Overall HEMS utilization for IFT fell from 17.0% to 13.3% over the study period. Patients with normal PH VS/GCS-m constituted 86.9% of subsequent HEMS transfers with a mortality rate of 2.11% which was not different from GEMS mortality rates for patients in low or high risk categories. Abnormal PH VS/GCS-m were associated with an 11.8% hospital mortality rate. Normal RF VS/GCS-m did not confer similar protection (mortality 10.0% vs 16.2%).

Conclusion: In a statewide trauma system IFT occurred most frequently with GEMS and HEMS transfers fell slightly over the study period. Mortality rates and ISS in HEMS patients were consistently higher and while normal PH VS/GCS-m identified a group with favorable outcomes normal RF facility VS/GCS-m did not confer a similar survival advantage. Based on our study HEMS overutilization in IFT cannot be identified with PH and RF VS/GCS-m data.

GEMS and HEMS Utilization by Year

	GEMS	HEMS	Total
2013	4256 (83.0%)	874 (17%)	5130
2014	5231 (83.5%)	1031(16.5%)	6262
2015	6100 (83.9%)	1162(16.1%)	7262
2016	6862 (87.3%)	999 (12.7%)	7861
2017	6424 (86.7%)	985 (13.3%)	7409

Poster #75

EGS QUALITY IMPROVEMENT EFFORTS: WHAT IS NEEDED AND WHERE?

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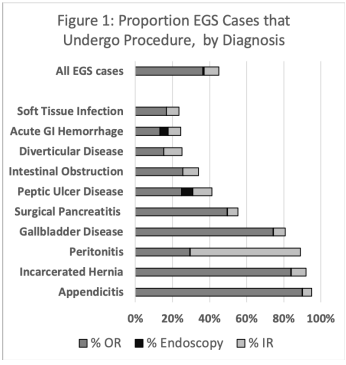
Introduction: The AAST and the ACS are developing a new Quality Improvement Program for Emergency General Surgery (EGS). To inform those efforts, it is important to understand the resource requirements for EGS patients and hospitals. We hypothesized that requirements would be variable, suggesting opportunities to fine-tune metrics.

Methods: The Nationwide Inpatient Sample (NIS), 2016, was used for the analysis. Patients were included if they were >18 years of age. EGS conditions and procedures were identified using ICD-10-CM codes. Hospitals were divided into quartiles based on the proportion of EGS patients. Results were weighted to produce national estimates. Adjusted and unadjusted analyses were performed.

Results: A total of 22,892,266 patients were included, of which 7.3% (1,675,714) had an EGS diagnosis. EGS patients were on average 59 years of age, and 52% were female. The top 3 most common EGS conditions were soft tissue infection (30%), gallbladder disease (19%), and intestinal obstruction (16%). The need for operations, interventional radiology (IR) procedures, and endoscopy varied by condition. (Figure 1) Mortality was overall low (0.8%) but varied based on condition (range 0.2% to 2.6%). Hospitals with the largest proportion of EGS patients (>10%) were more often small, rural non-teaching hospitals. Mortality was also lower for these hospitals (0.6% vs. lowest quartile 0.9%, $p < 0.001$), suggesting a volume-outcome relationship. With regards to transfers out, EGS patients were transferred out less frequently compared to the average overall hospital population (11% vs. 21%, $p < 0.001$).

Conclusion: This study identified variability in procedure type and frequency by condition, raising the question of the relative needs for these requirements at all hospitals. We also found that high-volume EGS hospitals were more often small and rural, reflecting the importance of the rural hospital system to EGS quality improvement efforts. Finally, transfers were overall low in the EGS population, suggesting that future efforts could include guidance on transfers.



Poster #76

A CONTEMPORARY ANALYSIS OF DAMAGE CONTROL ORTHOPEDICS (DCO) AND EARLY TOTAL CARE (ETC): THE PENDULUM HAS SWUNG BACK!

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Introduction: Controversy exists regarding the best management and timing of femoral shaft fracture fixation in polytrauma patients. The aims of the current study are: 1) to define the current practice related to femoral shat fracture fixation ; 2) to analyze timing of ETC (Early Total Care) vs. definitive fixation after DCO ; 3) to describe risk factors for mortality and complications in each treatment strategy.

Methods: NTDB data from 2007-2016 were used. Patients with blunt mechanism of injury and an ISS > 15 were included. Patients were divided into 2 groups: ETC (internal fixation only), and DCO. Outcome measures included 30-d mortality, hospital length of stay (HLOS), days on mechanical ventilation (DMV), ICU LOS, and complications. An analysis was performed in the DCO group to define timing of definitive (internal) fixation. Multiple imputation was used for missing data. Logistic regression was used to identify risk factors associated with measured outcomes. A $p < 0.05$ was considered statistically significant.

Results: A total of 21,710 patients were included. 591 patients (2.7%) received only external fixation and were excluded. Compared to the DCO (n= 1,922; 8.9%), the ETC group (n=19,197; 88.4%) had shorter HLOS (19 vs. 10 d), DMV (8 vs. 5 d), ICU LOS (10 vs. 5 d) and mortality (1.7% vs. 1.1%); (All differences $p < 0.05$). In the ETC group, internal fixation occurred at a median of 14.3 h. In the DCO group, external fixation was performed at a median time of 5 h and internal fixation at median of 101 h. 52% of DCO patients underwent definitive internal fixation < 96 h. The incidence of AKI, ARDS, DVT, pneumonia, and severe sepsis was higher in those receiving definitive treatment >96h ($p < 0.05$), although there was no difference in mortality. ETC was associated with decreased AKI and ARDS rates, while ETC and DCO were not independent risk factors for mortality.

Conclusions: Use of DCO has recently decreased to < 10%. DCO is a risk factor for AKI and ARDS. Internal fixation in DCO > 96h carries high complication rates, thus ideal time for fixation should be < 96h. Further prospective studies are needed.

Poster #77

EARLY CHEMICAL PROPHYLAXIS IS SAFE FOR ISOLATED BLUNT SPLENIC INJURIES UNDERGOING NONOPERATIVE MANAGEMENT REGARDLESS OF GRADE

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Introduction: Recent studies have indicated that it may be safe to start early (≤48 hours after admission) chemical prophylaxis in patients with blunt solid organ injury (SOI) without an increase in failure rate of nonoperative management (NOM). However, these studies commonly combined the organs (liver, spleen and kidney) and their various grades (I-V) into one analysis making conclusions limited. High grade blunt splenic injuries (IV-V) have a much higher failure rate for NOM than low grade (I-III) injuries. We compared early (≤48 hours after admission) vs. late (>48 hours) chemical prophylaxis for patients with isolated blunt splenic trauma to determine if early chemical prophylaxis is safe regardless of injury grade.

Methods: All hemodynamically stable adult (age ≥ 16 years) trauma patients with isolated blunt splenic trauma undergoing NOM over a four-year time period were retrospectively reviewed. Patients with penetrating injuries, hemodynamic instability on admission, dead on arrival, underwent immediate operative intervention or angioembolization, traumatic brain injury, brain death or withdrawal within 24 hours of admission, burns, and those with incomplete data were excluded. The remaining patients were divided into two groups based on timing of chemical prophylaxis initiation: Early group (EG) (≤48 hours after admission) vs. late group (LG) (>48 hours). Failure rates of NOM were compared for the two groups for each grade and analyzed using Mann-Whitney U and Fisher's Exact test. Data were reported as median with interquartile range (IQR) and total number with percentage.

Results: 151 patients met the above criteria with 49 (32%) in the EG and 102 (68%) in the LG. Breakdown by grade for the two groups was as follows (EG vs. LG): Grade I (15 [31%] vs. 25 [25%], p=0.6), Grade II (19 [39%] vs. 35 [34%], p=0.7), Grade III (10 [20%] vs. (29 [28%], p=0.4), Grade IV (4 [8%] vs. 9 [9%], p=1), and Grade V (1 [2%] vs. 4 [4%], p=1). The groups were well matched with no significant differences in demographics or mechanism of injury. The median time in hours from admission to first dose of chemical prophylaxis was as follows (EG vs. LG): (30 [21-41] vs. 68 [56-84], p=0.00001). Very few doses were held or missed as shown by the percent of scheduled doses that were delivered in the first five days after initiation (93% [232/250] vs. 98% [106/108], p=0.7). There was no difference in the failure rate of NOM between the two groups regardless of grade with zero failures in the EG and one failure (grade V) in the LG. There was no difference between the two groups for hospital length of stay in days (4 [2 – 6] vs. 4 [3-8], p=0.5), rate of venous thromboembolic events (1 [2%] vs. 2 [2%], p=0.7), or lowest hemoglobin in the first five days (11 [10-13] vs. 11 [9-12], p=0.4).

Conclusions: Early (≤48 hours after admission) chemical prophylaxis is safe after blunt splenic trauma regardless of grade of injury.

Poster #78

THERAPEUTIC INTERVENTIONS AND OUTCOMES IN CIVILIAN AND MILITARY ISOLATED GUNSHOT WOUNDS TO THE HEAD: A DOD TRAUMA REGISTRY AND ACS TQIP MATCHED STUDY

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Introduction: Recent military conflicts introduced new concepts in trauma care, including aggressive surgical intervention in severe head trauma. The purpose of this study was to compare therapeutic strategies and outcomes, following isolated gunshot wounds of the head, between military and civilian populations.

Methods: Patients from the DoD Trauma Registry (DoDTR) 2013-2016 with isolated GSW to the head were propensity score matched 1:3 with similarly injured patients (age, gender, year of injury, head abbreviated injury scale) from the American College of Surgeons TQIP database. Analysis from the DoDTR was based on first hospital entry and transfer patients were excluded from the civilian population.

Results: 136 military patients were matched for age, gender, year of injury, and head abbreviated injury scale with 408 patients from TQIP. Utilization of blood products was significantly higher in the military population (mean units/24hrs: PRBC 10 vs 0, FFP 8 vs 0, Plt 2 vs 0, Cryo 5 vs 0; $p < 0.001$) as was management with craniotomy or craniectomy (34% vs 13%, $p < 0.001$). Mortality in the military population was significantly lower than in the civilian population (27% vs 38%, $p = 0.013$).

Conclusions: Military patients are more likely to receive blood product transfusion and undergo craniectomy or craniotomy than their civilian counterparts after isolated head GSW. Mortality is significantly lower in the military population.

	DoDTR (n=136)	**TQIP (n=408)**	**p value**
Transfusion			
PRBC	10 (4-21)	0 (0-2)	< 0.0001
FFP	8 (2-21)	0 (0-0)	< 0.0001
Platelet	2 (0-5)	0 (0-0)	< 0.0001
Cryo	5 (0-10)	0 (0-0)	< 0.0001
Craniotomy/ectomy	46 (34%)	52 (13%)	< 0.0001
Mortality	36 (27%)	156 (38%)	0.013

Poster #79

BOWEL DISCONTINUITY DURING DAMAGE CONTROL LAPAROTOMY IS ASSOCIATED WITH INCREASED RISK OF ANASTOMOTIC DEHISCENCE: RESULTS OF AN AAST PROSPECTIVE MULTI-INSTITUTIONAL STUDY

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Introduction: The management of destructive intestinal injuries in patients undergoing damage control laparotomy (DCL) remains controversial. Some surgeons recommend leaving the bowel in discontinuity while others support definitive bowel anastomosis at the initial operation. The aim of this study was to evaluate and compare outcomes between these operative strategies.

Methods: This was an AAST multi-institutional prospective, observational study, from 2015-2019, including adult trauma patients with destructive gastrointestinal requiring resection that underwent DCL. The study population was stratified into a primary anastomosis (PA) and bowel discontinuity (BD) groups. Demographics, clinical characteristics, injury severity, operative findings, peritoneal contamination, intraoperative blood products, crystalloids and vasopressor utilization and management of the intestinal injury (PA vs BD) at the initial operation were collected. Outcomes included bowel ischemia or necrosis at reoperation, anastomotic leaks, intra-abdominal abscess, organ failure, time to fascia closure, and hospital and ICU length of stay.

Results:16 centers contributed a total of 244 patients. The most common mechanism of injury was firearm (64.3%) followed by motor vehicle (20.9%) and motorcycle collision (4.1%). In 178 (73%) patients, the bowel was managed with BD and in 66 (27%), with PA at the initial operation. Mean injury severity score (ISS) was higher in the BD group (22 vs 17, p=0.015) as was use of intraoperative blood product (PRBC BD 5u vs 2u, p=0.025). On univariate analysis, intra-abdominal abscess (31.5% vs 13.6%, p=0.005) and anastomotic dehiscence (11.2% vs 1.5%, p=0.009) was significantly higher in the BD group. On multivariable analysis, (correcting for age, ISS, PRBC, urine output, and body mass index) discontinuity at the index operation was an independent predictor for anastomotic dehiscence (OR 8.3, p=0.049) and intra-abdominal abscess (OR 2.8, p=0.021).

Conclusions: Bowel discontinuity during index damage control laparotomy is associated with increased risk of intra-abdominal abscess and anastomotic dehiscence. Anastomosis should be strongly considered in damage control laparotomy.

Poster #80

PROPHYLACTIC ANGIOGRAPHY OF GRADE III-V SPLENIC INJURY: CHARACTERIZING FAILURES OF NONOPERATIVE MANAGEMENT

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Introduction: Angiography and embolization (AE) are often used as adjuncts to observation in nonoperative management of blunt splenic injury (BSI). Use of angiography is variable, and characteristics of failure of NOM after prophylactic splenic AE are not well described. Our study was designed to better characterize failures of this treatment.

Methods: We performed prophylactic AE over 9 years per our institution's protocol in which all patients with grades III-V splenic injury with and without vascular abnormalities on imaging undergo AE at the time of admission. A retrospective evaluation of this cohort was performed to evaluate injury characteristics, adherence to protocol, and outcomes. Characteristics of NOM failures after AE were evaluated.

Results: From 1/2010-2/2019, 571 patients were admitted with grade III-V BSI. NOM was attempted in 360 (63%), with 28/360 failures (7.8%). Failure rates by grade are illustrated in the table. Of patients failing NOM, failure occurred at a median of 1 day (IQR 1-2). Two NOM patients (7.1%) died; one death was attributable to failed NOM. Of all patients admitted for NOM under the protocol, 306/360 (85%) successfully underwent AE. Fifteen patients failed NOM after embolization (4.9% of all AE NOM). In patients with AE, median time to failure following AE was 1 day (IQR 1-1.25). Common reasons for NOM failure after AE were hemodynamic instability and decreasing hemoglobin.

Grade	Failure of NOM	Failure of NOM after AE
III	3.1% (7/224 patients)	1.5% (3/188 patients)
IV	11.6% (14/121 patients)	8.3% (9/108 patients)
V	46% (7/15 patients)	33.3% (3/10 patients)

Failure Reason after AE	Percent (patients)
Hemodynamic instability	33.3% (5)
Hemoglobin decrease	46.7% (7)
Pain/peritonitis	13.3% (2)
Infection	6.7% (1)

Conclusions: Failure of NOM following prophylactic AE of grade III-V splenic injuries is less frequent than described in the previous literature, with higher grade injuries having greater failure risk, even with successful AE. If patients remain stable to prophylactic angiography, failure is less common and occurs early after AE.

Poster #81

MANAGEMENT OF VASCULAR TRAUMA ACROSS CANADA: A COHORT STUDY WITH IMPLICATIONS FOR PRACTICE

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Introduction: The aim of this study was to provide a description of vascular trauma and its management at centers across Canada.

Methods: This was a retrospective cohort study evaluating patients from 8 Canadian level 1 trauma centers (2011-2015). Medical records were queried to identify all adult patients who survived to hospital with major vascular injury (defined using ICD -10 codes). Major vascular injury was defined as injury to named arterial or venous vessels in the legs, arms torso, or neck. Data were collected using the Research Electronic Data Capture (REDCap) secure data platform, and included patient demographics, injury mechanism, injury details, management and clinical outcomes.

Results: A total of 1330 patients were included from eight centres across Canada (n = 90 – 306 patients/site). Patients were 76% male with a mean age of 43 years (SD 18.8 years). Reported injuries were 63% blunt, 36 % penetrating, and the remainder mixed. The most common specific mechanisms of injury were motor vehicle collision (36%), stabbing (26%), and falls (16%), with gunshot injuries accounting for less than 5%. Pre-hospital tourniquets were applied in only 27 patients (2%). The mean Injury Severity Score (ISS) was 24 (SD 14.5), and 70% had an ISS of greater than 15. A minority presented in shock (initial systolic BP < 90 mmHg in 13.6%). The injuries were most commonly identified by computed tomography (60%) and operative exploration (37%). We identified injuries to named vessels of the neck (32%), thorax (23%), abdomen and pelvis (27%), upper extremity (14%) and lower extremity (10%). Specific vascular injuries included transection (50%), complete occlusion (11%), partial occlusion (39%), and pseudoaneurysm formation (11%). Injuries were managed non-operatively in 29%, with definitive open surgical management (22%), endovascular management (9%) and with damage control techniques in the operating room (3%). Amputation occurred in 10% of lower extremity vascular injuries and 4% of upper extremity injuries. Responsibility for vascular injury management was undertaken by a wide variety of specialists (n=16), the most common of which were vascular surgeons (31%), trauma surgeons (19%), and interventional radiologists (15%). Overall, in-hospital mortality was 12%, and 4% of patients died before definitive management of the vascular injury.

Conclusion: This study describes the nature and management of vascular injuries across Canada. The variability in injury mechanisms, management strategies, specialty responsible for management, and outcomes have important implications for practice change and knowledge translation.

Poster #82

FACTORS INFLUENCING CHANGE IN RESIDENCE IN GERIATRIC PATIENTS WITH MILD TRAUMATIC BRAIN INJURY (TBI)

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Background: Little is known about discharge disposition of older adults with mild TBI post hospitalization. The aim of this study was to identify independent predictors of a negative change in residence for patients ≥65 years who presented with a mild TBI.

Methods: Data was obtained from the AAST MITC Geri-TBI study conducted from 2017-2019. Inclusion criteria were age ≥40 and computed tomography verified TBI. Exclusion criteria were injury to any other body region with an Abbreviated Injury Scale score >2 and presentation >24 hours after injury. Mild TBI was defined as Glasgow Coma Scale (GCS) 13-15. The primary outcome was change in residence (CR) from admission to discharge. This variable ranged from 0 to -4, indicating discharge to preinjury residence, subacute care, assisted living, nursing home, and death or hospice. We modeled the binary change score, recoded as discharge to preinjury residence vs. all other locations as a function of variables associated with it in bivariate analysis using logistic regression and retained independent predictors whose p-value was

Results: Of 2,490 patients presenting with mild TBI, 1705(68%) were ≥65. Of these, 681/1705 (40%) were not discharged to preinjury residence. Decreased GCS, increasing age, (91/681) warfarin use, (44/681) history of liver disease, (63/681) intraventricular hemorrhage (IVH), (221/681) CT worsening, and (78/681) neurosurgical intervention (NSI) were independent risk factors for a negative CR at discharge.

Conclusion: Sixty percent of older adults who present with an intracranial lesion and a GCS of 13-15 return to preinjury residence at discharge. Those with IVH, CT worsening and NSI have a higher risk of experiencing a negative CR at discharge. Taking these risk factors into account will allow for the early identification of those who are less likely to be discharged to preinjury residence and early establishment of goals of care and utilization of resources to facilitate placement.

Independent Predictors of Negative Residence Change in Older Adults with Mild TBI

	Odds Ratio (95%) CI
GCS	0.55 (0.45, 0.67)
Age	1.03 (1.02, 1.05)
Warfarin Use	1.48 (1.06,2.07)
Liver Disease	1.78 (1.09,2.91)
CT worsening	2.18 (1.39,3.41)
Intraventricular Hemorrhage	2.36 (1.80,3.08)
Neurosurgical Intervention	5.21 (3.06,8.85)

Poster #83

READMISSION AFTER SPLENIC SALVAGE: HOW REAL IS THE RISK?

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Introduction: Hemorrhage due to delayed splenic rupture is a potentially fatal complication of non-operative management of splenic injuries. Sub-optimal post-discharge follow-up at has made measuring the incidence of failed splenic salvage challenging. We hypothesized that readmission after splenic salvage is rare; however, readmissions for splenic conditions would be associated with a high rate of splenectomy.

Methods: The National Readmission Database for 2016 & 2017 was queried for trauma admissions with ICD-10 codes for splenic injury. Patients with missing discharge disposition, discharge to a short-term hospital, death during index admission or admitted in December were excluded. The primary endpoint was non-elective 30-day readmission for splenic diagnoses after non-operative management including splenic embolization during the index admission. Outcomes collected included transfusions, complications, interventions at readmission and mortality.

Results: There were 22,366 patients admitted for a traumatic splenic injury; 15,596 (69.7%) underwent no intervention, 2,261 (10.1%) were treated with embolization only and 4,509 (20.2%) underwent splenectomy. For those treated with embolization or no intervention, the spleen-related 30-day readmission rate was 2.4% (Table), with the majority (69.4%) occurring within 7 days of discharge. There were 21 patients (4.8%) readmitted with shock related to their trauma. The most common complications were pleural effusion (23.0%), sepsis (4.4%), splenic abscess (3.9%) and splenic infarct (3.0%). Those undergoing splenic salvage during the index admission had a 22.3% rate of splenectomy and mortality of 1.6% on readmission for spleen related diagnosis.

Conclusion: Readmission after splenic salvage is rare with the majority presenting within 1 week of discharge. However, of those readmitted for spleen injury related diagnoses there was a high rate of splenectomy. Patients managed with splenic salvage should be counseled on the risk of potential failure and need for readmission and operation after discharge.

Comparison of Splenic Salvage Patients

	Initial Management				
	No Intervention		Embolization Only		p
Total Population	n=15596		n=2261		
All 30-day Readmissions	1142	7.3%	260	11.5%	<0.001
Spleen-related Readmissions*	341	2.2%	94	4.2%	<0.001
Transfusion at readmission	59	17.3%	7	7.4%	0.008
Interventions during readmission					
No Intervention	223	65.4%	68	72.3%	<0.001
Embolization Only	46	13.5%	1	1.1%	<0.001
Splenectomy	72	21.1%	25	26.6%	<0.001
Mortality at readmission	6	1.8%	1	1.1%	0.897

** 30-day readmissions associated with splenic injury related diagnoses*

Poster #84

IMPLEMENTING A DISCHARGE OPIOID BUNDLE IN ADULT TRAUMA PATIENTS DECREASED OPIOIDS PRESCRIBED AT DISCHARGE

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Introduction: Overdose related mortalities now exceed other leading causes of unintentional injuries, including gun violence and motor vehicle accidents. One third of adults receiving long term opioid therapy report that their first opioid prescription came from a surgeon, indicating that post-surgical prescribing is an important point of intervention. The lack of evidence driving "right dose" prescribing of opioids creates a challenging situation for providers to ensure adequate pain control, but avoid excessive prescription of opioids. The purpose of this study was to implement a Trauma Discharge Opioid Bundle (TDOB) to optimize discharge prescribing of opioids in trauma patients, using twenty four hour opioid use prior to discharge and injury severity to provide a patient centered approach for "right dose" prescribing.

Methods: This was a pre-post study of adult trauma patients (> 18 years old) before and after implementation of the TDOB at a level one trauma center. The pre-group (n = 151) and post-group (n = 226) included consecutively discharged patients from September through November in 2018 and 2019, respectively. The primary outcome variable was the total MME prescribed at discharge. Secondary outcomes included functional pain scores at/after discharge, refills within fourteen days of discharge, number of non-opioid adjuncts prescribed, incidence of pain management education at discharge, and number of patients discharged with Naloxone. Data is reported in Mean (SEM) or Median [IQR]. Categorical data was analyzed using the Fisher's Exact Test or Chi Squared, Mann Whitney U Test or the Student's T-test were used for continuous data.

Results: There was no difference in injury severity score (10, [5-14] vs 10**,** [5-16], p = 0.657), age (40.75 ± 1.296 vs 43.46 ± 1.069, p = 0.109), or hospital length of stay (4, [2-7] vs 4**,** [3-7], p = 0.616) between groups. The total MME prescribed at discharge (225, [150-300] pre vs 200**,** [100-225] post, $p < 0.001$) and maximum MME/day (45, [30-45] pre vs 30**,** [20-45] post, p = 0.004) were significantly less in the post-group. Patient education regarding pain management was distributed more following implementation (23.2% pre vs 88.5% post $p < 0.001$) and the incidence of outpatient refills within fourteen days were unchanged (49.7% pre vs 41.6% post, p = 0.139). In the post group, the PEG functional pain scores were 24, [17-28] at discharge (n = 221) vs 12**,** [7-23] five to seven days following discharge (n = 91), $p < 0.001$, indicating that patient's pain improved following discharge. Fifty patients were prescribed Naloxone that received > 50 MME/day at discharge or had a qualifying risk index for overdose or serious opioid-induced respiratory depression score in the post-group.

Conclusion: The implementation of a comprehensive Trauma Discharge Opioid Bundle reduced the total number of MME prescribed at discharge without compromising patient comfort or increasing the frequency of opioid refills following discharge.

Poster #85

ASSOCIATION OF SYSTOLIC BLOOD PRESSURE AND BODY TEMPERATURE WITH MORTALITY IN U.S. SERVICE MEMBERS WITH TRAUMATIC BRAIN INJURY

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Introduction: Traumatic Brain Injury (TBI) is a significant cause of mortality in combat and civilian trauma. TBI is considered a "signature injury" of conflicts in Iraq and Afghanistan due to the increased use of explosive devices. Physiological parameters such as systolic blood pressure (SBP) and hypothermia can reflect either severity of injury or decompensation from inadequate resuscitation and are associated with worse outcomes. Further elucidation of the combine effects of SBP and temperature (T°) regulation in brain injury has the potential to improve prehospital, transport interventions, and improve TBI outcomes. This study, therefore, aimed to better characterize the differential impact of admission SBP and To on in-hospital mortality or died of wounds in military TBI. **Methods:** Data were extracted from the Department of Defense Data Registry for U.S. service members who sustained TBI and arrived at U.S. military treatment facilities in Iraq and Afghanistan from 01/ 2003 to 12/ 2014. Patients were identified with moderate and severe TBI cases (msTBI), defined as an Abbreviated Injury Scale (AIS) score of the head ≥2. TBI patients were further stratified as isolated TBI (iTBI; AIS-head ≥ 2 and AIS-other < 2) or polytrauma -TBI (pTBI; AIS-head ≥ 2 and AIS-other ≥2). Values for SBP, T° and injury severity score were obtained from the earliest record following injury. Only patients with T° and SBP data available were included. SBP and T° were stratified as hypo- (SBP < 90 mg Hg; T°o ≤ 100°F; Hg), hyper- (SBP >140 mg Hg; T°> 100°F), and their combinations. The primary outcome is in-hospital mortality. Chi-square, Fisher's exact test, t-test, or Mann-Whitney test was used for descriptive analysis where appropriate. Logistic regression was used to calculate the likelihood of mortality by SBP and T° levels (P **Results:** Of the 27213 patients retrospectively reviewed, we identified 5753 TBI patients who met inclusion criteria for analysis. Most patients were males (97.9%) with a median (IQR) age of 24 (21-29) years. Most patients were U.S Army (73.7%) injured in Iraq (62.6%). A logistic model with Firth correction (mortality ~ 3%) was applied (Outcome ~ SBP + T° + Total GCS scores + TBI type). The model performed well (AUROC = 0.95) consistent with previously published models revealing high concordance between GCS scores, extra-cranial injuries, and outcomes. SBP, T° and TBI type all significantly affected survivability (p180 mmHg was associated with a lower odds of survival. In our cohort, while hypothermia was associated with lowering the odds of survival by ~50% (OR: 0.49; 95% CI: 0.26- 0.80), the presence of polytrauma can be linked to two-fold higher survivability (OR: 2.68; 95% CI: 1.73-3.97) as compared to iTBI. **Conclusion:** The findings from this study indicate that higher mortality in TBI was associated with hypothermia and hypotension as well as hypertension (SBP>180 mmHg). The presence of polytrauma was associated with higher survivability of TBI in this population compared to iTBI. Furthermore, SBP lower than 100 mmHg was also associated with higher odds of mortality and consistent with previous reports that 90 mmHg may be too low a threshold for hypotension in TBI patients.

Poster #86

FIELD AND ED PHYSIOLOGIC TRENDS IMPROVE PERFORMANCE OF MODIFIED REVISED TRAUMA SCORE

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Introduction: A modified Revised Trauma Score (MRTS) in which systolic blood pressure (SBP) and respiratory rate (RR) were replaced with age-adjusted shock index (SI) and peripheral oxygen saturation (SpO_2) and added temperature (T) was shown to be more accurate in predicting mortality in general trauma population. We hypothesized the addition of the difference (Δ) between the field (EMS) and Emergency Department (ED) values of Glasgow Coma Scale (GCS), age-adjusted SI and SpO_2 would further increase the prediction accuracy for mortality.

Methods: Retrospective database analysis using children and adults from TQIP database year 2017. EMT and ED values for GCS, SBP, heart rate (HR), SpO_2, T and SI (calculated as HR/SBP) were collected for each patient and used as continuous variables in stepwise logistic models with survival as primary outcome. Presence/absence of physiologic and anatomic field trauma triage criteria were used as categorical variables. To adjust for age, SI was expressed as a Z-Score (ZSI). Patients aged 1-89, with ISS≥2) were calculated by subtracting EMS readings from ED readings. Area under the curve (AUC) was used to compare the performance of ED-MRTS (GCS+ZSI+SpO_2 +T) and Δ-MRTS (ED-MRTS+ΔGCS+ΔZSI+ΔSpO_2+field trauma triage criteria).

Area Under the Curve

Variable(s)	Area	Std. Error	Sig.	95% CI	
				Lower	Upper
EMS-RTS	.767	.004	.000	.760	.774
EMS-RTS+FTTC*	.777	.003	.000	.770	.784
EMS-MRTS	.822	.003	.000	.816	.827
EMS-MRTS+FTTC	.822	.003	.000	.816	.827
ED-RTS	.811	.003	.000	.805	.818
ED-RTS+FTTC	.811	.003	.000	.805	.817
ED-MRTS	.853	.002	.000	.848	.858
ED-MRTS+Δ**	.863	.002	.000	.859	.868
ED-MRTS+Δ+FTTC	.863	.002	.000	.858	.868

** FTTC – field trauma triage criteria*
*** Δ = ΔGCS+ ΔZSI+ ΔSpO2*

Results– 29,562 pediatric and 360,012 adult patients were included. Overall mortality was 1.1% and 2.8% respectively. Δ-MRTS outperformed ED-MRTS (AUC 0.863 95%CI [0.858, 0.868] vs 0.853 95%CI [0.848, 0.858], P<0.001). Of the 3 Δ variables, only ΔGCS and ΔSpO2 were significant in predicting mortality (P<0.001). Non-survivors had higher ΔZSI (0.17 ±3.3 vs -0.1±2.8, P<0.001) higher ΔSpO2 (2.9 ±12.7 vs 0.6±6.5, P<0.001), lower ΔGCS (-0.67 ±2.9 vs 0.04±1.58, P<0.001), and more likely to require supplemental oxygen during transport (OR-7.88 95%CI [7.57, 8.23], P<0.001) than the survivors. Prehospital cardiac arrest (P<0.001), prehospital hypotension (P<0.001), crushed extremity (P=0.015), pelvic instability (P=0.013), skull fractures (P<0.001) and paralysis (P<0.001), although significant, did not meaningfully improve the classification performance of Δ-MRTS.

Conclusions– Physiologic trends of GCS, SI and SpO_2 in the field and ED better characterize the acute physiologic response to traumatic injury and are more accurate in predicting mortality. Lack of improvement in neurologic status, persistent hemodynamic instability and supplemental oxygen requirement during transport from the field are strong mortality predictors.

Poster #87

PEDIATRIC EVIDENCE-BASED IMAGING GUIDELINES FOR ADULT TRAUMA PROVIDERS SIGNIFICANTLY REDUCES RADIATION EXPOSURE TO CHILDREN

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Introduction: Evidence suggests that stand-alone pediatric trauma centers outperform adult and combined adult/pediatric trauma centers by limiting unnecessary radiation exposure to injured children. This likely represents improved compliance with evidence-based imaging guidelines for children and increased comfort with clinical observation in lieu of imaging. We sought to determine the impact of implementing evidence based guidelines for pediatric imaging at a combined adult (level 1) and pediatric (level 2) center. The initiative focused on trauma/critical care surgeons as the pediatric surgeons did not participate in the resuscitation and initial evaluation of injured children.

Methods: In 2018, evidence based guidelines were developed from existing clinical studies. After 3 months of education, guidelines were implemented, and regular feedback given to providers regarding compliance. Data was collected from the trauma registry for all pediatric patients (aged less than 15 years), in calendar years 2017 (pre-guideline) and 2019 (post-guideline). All pediatric trauma admissions were analyzed, as well as the subgroup of children with multisystem trauma specifically admitted to the trauma surgery service.

Results: Total number of trauma admissions (304 vs 349), ISS, and length of stay did not signficantly change between the two periods. However, following implementation of guidelines, the mean number of CT scans per injured child fell by over 50% (.93 vs .45). For patients admitted to the trauma service, the mean fell by 58% (1.82 vs. 0.76). The number of patients receiving more than 1 CT significantly decreased for all children (26% vs 10%), and particularly those admitted to the trauma service (52% vs 17%). During this time there was only one injury missed at the initial admission, which was clinically insignficant (non-displaced skull fracture).

Conclusions: Implementation of evidence based guidelines regarding pediatric imaging in trauma eliminates disparity in imaging practices between a combined adult/pediatric trauma center and stand alone pediatric trauma centers. An educational initiative focusing on trauma surgeons has a profound positive effect on all injured children presenting to a trauma center.

Poster #88

BURDEN OF SURGICAL SITE INFECTIONS ON TRAUMA PATIENTS

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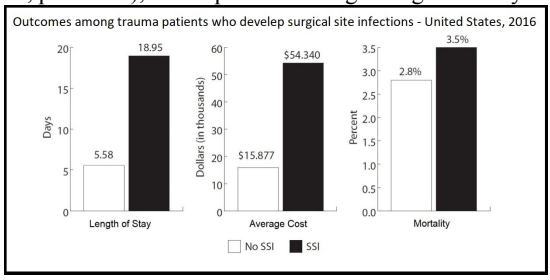
Introduction: Surgical site infections (SSIs) are a common and costly healthcare-associated infection in the United States. We described the epidemiology and healthcare utilization of trauma patients with SSIs, hypothesizing concomitant SSI results in greater healthcare costs, increased length of stay, and increased mortality.

Methods: We queried the 2010-2015 Nationwide Inpatient Sample (NIS) for adult patients ($\geq$ 18 years) with a diagnosis of trauma defined by ICD-9-CM. A surgical site infection was defined as ICD-9-CM code 998.59. Major operative procedures were abstracted using ICD-9-CM codes and sub-categorized by the organ system. Outcomes assessed included mortality, cost of treatment, and inpatient length of stay. Statistical analyses accounted for survey methodology.

Results: Among the 10 million (n=10,886,309) trauma patients over the 6-year time period, 42,494 (0.4%) had a co-diagnosis of SSI. Compared to patients without an SSI, patients with an SSI were younger (56.0 vs 63.6 years, $p < 0.001$), commonly male (58.9% vs 48.4%, $p < 0.001$) and more likely to have Medicare or Medicaid (56.9% vs 36.2%, $p < 0.001$) as their primary payer source. Trauma patients with an SSI were more likely to be transferred to rehabilitation facilities (41.1% vs 38.0%, $p < 0.001$), and experienced longer lengths of stay (18.9 vs 5.6 days, $p < 0.001$) than those patients who did not have an SSI. The average cost of treatment was higher in trauma patients who developed an SSI compared to those who did not ($54,341 vs $16,028, $p < 0.001$). Urban teaching hospitals treated more trauma patients with SSIs (66.6% vs 56.0%, $p < 0.001$). In adjusted analysis, any trauma patient who had an SSI had 1.5 higher odds of mortality (aOR 1.5, $p < 0.0001$). Trauma patients with a major operative procedure who developed an SSI had 2.2 higher odds of mortality (aOR=2.2, $p < 0.001$).



Conclusion: While uncommon among trauma patients as a whole, the development of an SSI after a minor or major procedure results in increased morbidity, length of stay, cost, and mortality.

Poster #89

THE CURRENT STATE OF TRAUMA SURGEONS WORKFORCE IN THE UNITED STATES: A MISDISTRIBUTION OR FAILED MEDICAL SYSTEM?

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Background: The United States (U.S.) is facing a shortage of trauma surgeons (TSs). No research has been published comparing the density of TSs temporally and geographically in the U.S. The goal of this study is to fill this gap by determining how TS density has evolved over time by state and region.

Methods: Retrospective cohort analysis using data from the American Medical Association (AMA) physician master file (2007-2020), the National Trauma Data Bank (NTDB) 2016 trauma admissions data, and the US 2016 Census Bureau to determine TS density was determined per 1,000,000 population at State and region level. Statistical significance was defined as $p< 0.05$.

Results: 26% of States have a TS density of 6-10, 44% have a density of 10-15, 24% have 15-20, and only 12% have a density greater than 20. In 2016, the Northeast region had the greatest density of TSs at 17.29 while the West region had the least at 12.08. The U.S. as a whole has 13.46 TSs per 1,000,000 people in 2016. From 2007 to 2014, the U.S. saw an increase of 3,384 TSs. Interestingly, the density of TSs did not significantly change between 2014 to 2020.

Conclusion: The density of trauma surgeons has not increased to meet the demands of population growth and the rise in traumatic injuries. Interventions should be considered to understand the causes for trauma surgeon shortage and implement strategies to increase interest in the field.

Keywords: Trauma Surgeons; Physicians Shortage; Healthcare System; American Medical Association; Traumatic Injuries

Poster #90

TRAUMA CENTER DESIGNATION IMPACTS OUTCOMES IN GERIATRIC TRAUMA

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Introduction: Trauma in the elderly is increasing in prevalence, due to the aging population. They often do not meet trauma center criteria and are thus under-triaged to hospitals that are not designated as trauma centers. The aim of this study was to examine the outcome of geriatric trauma patients when they are not initially treated at a designated trauma center (DTC).

Methods: ACS-TQIP database from years 2015-2016 was analyzed and elderly (age ≥ 65) trauma patients were studied. Outcome variables included TQIP complications, resource utilization and mortality, and the main independent variable tested with multivariable regression analysis was DTC (I, II) or non-designated (NDTC). Patients undergoing inter-facility transfer were excluded, and for all patients the modified frailty index (mFI) was calculated.

Results: There were 128,845 patients that met inclusion criteria for this study. Patients treated at DTC I and II were more frail, had higher ISS and lower GCS than NDCT ($p<0.01$). Age and mechanism was similar.

Despite being more severely injured, elderly trauma patients admitted to Level I or II TC had a significantly lower mortality (5.6% versus 7.1%) when compared to non-designated TC (p .

Conclusion: Elderly trauma patients have better outcome when taken to a designated trauma center compared to a non-designated hospital. Triage criteria may need to be adjusted for the elderly to avoid undertriage which may result in the patients being taken to a non-designated trauma center.

N=128,845	DCT I (34%)	DTCII (31.4%)	NDTC (34.5%)
Age	77	78	77.1
Mechanism (MVC)	61.4%	62%	61.8%
ISS	15.4	12.3	12
GCS	11	12	12
SHOCK INDEX	0.75	0.62	0.52
FRAILTY (mFI)	1.4	1.2	1.2
COMPICATIONS	9.4%	7.3%	10.3%
MORTALITY	6%	5.3%	7.1%

Poster #91

A NATIONWIDE ANALYSIS OF POPLITEAL VASCULAR INJURIES AND OUTCOMES: DOES HOSPITAL TEACHING STATUS MATTER?

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Background: Popliteal artery injuries are the second most common arterial injuries below the inguinal ligament. We aimed to compare outcomes in patients with popliteal injuries by hospital teaching status utilizing the National Trauma Data Bank Research Data Set (NTDB-RDS) 2013-2016.

Methods: Four-year retrospective study using the NTDB-RDS, evaluating popliteal vascular injuries. Patients were divided by popliteal injury type and teaching status into; non-teaching hospital (NTH), community teaching (CTH), or University teaching (UTH). Demographics and outcome measures were compared between groups. Risk-adjusted mortality odds ratios (ORs) were calculated. Significance was defined as p

Results: 3,577,168 patients were in the NTDB-RDS, with 1,120 having a popliteal injury, (incidence=0.03%). There was no significant difference in the amputation rate between patients treated in NTHs, CTHs, or UTHs (p>0.05). There was no significant difference in the raw mortality rate between patients treated in NTHs, CTHs, or UTHs. After adjusting for confounders; compared to NTH, the odds ratio for mortality for popliteal artery injuries in the CTH group was significantly higher (OR:15.95, 95% CI:1.19-213.84), and for the UTH group the morality was also significantly higher (OR:5.74, 95% CI:0.45-72.95).

Conclusion: The incidence of popliteal vascular injuries was 0.03% for 2013-2016. Patients with popliteal artery injuries treated at community teaching hospitals have a 16 times higher risk of mortality and at university teaching hospitals have a 5.7 times higher risk of mortality than patients treated at non-teaching hospitals.

Poster #92

PREDICTING THE NEED FOR VOLUME EXPANSION IN INFANTS EXPERIENCING SIGNIFICANT ACUTE BLOOD LOSS

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Introduction: In infants, predicting the need for volume expansion in the setting of acute blood loss is challenging. Vital signs are often used to assess intravascular volume status and guide resuscitation. To mimic hemorrhagic shock in infants, we studied those undergoing cranial vault reconstructive surgery as these are otherwise healthy infants, the procedure results in significant blood loss, and confounding variables are minimized. Our aim was to evaluate the performance of bedside indices, including vital signs, to distinguish fluid responders from non-responders.

Methods: We performed a prospective observational pilot study of infants undergoing cranial vault reconstructive surgery for craniosynostosis between May 2019 and January 2020. To distinguish fluid responders from non-responders, a CardioQ-Esophageal Doppler Monitor (EDM) was placed in the esophagus, adjacent to the proximal descending aorta, which measures changes in peak aortic velocity – a value that directly correlates with cardiac output and stroke volume. We defined fluid responders as those who demonstrated an increase in their peak aortic velocity by $\geq$ 15% following a crystalloid bolus ($\geq$ 20 mL/kg). Pre-bolus vital signs analyzed included heart rate, systolic blood pressure, mean arterial pressure, shock index (heart rate/systolic blood pressure), pulse pressure variability, and end-tidal carbon dioxide level. Infants were also monitored with a CipherOx®-Compensatory Reserve Index (CRI) M1 device, a non-invasive finger probe, to continuously estimate central volume status from normovolemia (CRI=1) to decompensation (CRI=0). The performance for each variable was compared using area under the receiver operator curves, adjusting for age and volume of bolus (mL/kg).

Results: Seventeen crystalloid boluses were administered during the study period. Seven boluses were given to responders and ten to non-responders. There were no statistically significant differences in demographics, bolus volume and bolus duration between responders and non-responders. Although it did not reach statistical significance, more blood loss was observed in the fluid responder group (**Table 1**). After adjusting for age and bolus volume, CRI outperformed all other predictors, with an AUC of 0.825 (95% CI = 0.574, 0.991, **Table 2**).

Conclusion: Distinguishing infants who are fluid responders from those who are not can be challenging. CRI is a continuous, noninvasive measure that may be used to accurately predict the need for additional volume expansion in infants experiencing acute blood loss.

Table 1: Demographics and Intraoperative Details

	Fluid Responders (n=7)	Fluid Non-Responders (n=10)	P-Value
Weight (kg)	7.07 ± 8.29	7.75 ± 1.66	0.92
Height (cm)	69.4 ± 7.89	62.2 ± 18.7	0.36
Female	2 (29)	4 (40)	1.00
Race			1.00
White	7 (100)	9 (90)	
Not reported	0 (0)	1 (10)	
Ethnicity			1.00
Hispanic	0 (0)	1 (10)	
Not Hispanic or Latino	7 (100)	9 (90)	
Estimated Blood Loss (mL/kg)	30.4 ± 14.8	18.5 ± 9.1	0.06
Blood transfusion	6 (86)	10 (100)	0.41
Bolus Volume (mL/Kg)	22.2 ± 6.67	22.9 ± 4.88	0.84
Bolus Duration (min)	4.71 ± 2.87	3.80 ± 2.10	0.46

Data represents mean ± SD or n (%).

Table 2: Performance of Indices to Distinguish Fluid Responder from Non-Responders

	Adjusted AUC (95% CI)
CRI	0.825 (0.574, 0.991)
Pulse pressure variability	0.495 (0.157, 0.853)
Heart rate	0.553 (0.227, 0.819)
Systolic blood pressure	0.542 (0.242, 0.875)
Mean arterial pressure	0.733 (0.403, 0.968)
Shock index	0.771 (0.422, 0.986)
End tidal CO^2	0.669 (0.364, 0.928)

Shock index was calculated by dividing the heart rate by systolic blood pressure. AUC, area under the curve; CI, confidence interval; CRI, compensatory reserve index; CO^2, carbon dioxide.

Poster #93

A PROSPECTIVE ANALYSIS OF PRE-EXISTING DEPRESSION AND PSYCHOLOGICAL OUTCOMES AFTER TRAUMA

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Introduction: The prevalence of depression after a traumatic injury is estimated to be as high as 6% in the first year and is often associated with worse functional outcomes and quality of life. There is limited data on how pre-existing mental illness affects post trauma care recovery and what risk factors contribute to worse psychological outcomes after traumatic injury. This study aims to evaluate potential risk factors for depression after hospitalization for non-neurologically injured older adults. We hypothesize that patients with pre-existing depression will have worse depression symptoms at the time of discharge regardless of injury mechanism or severity, defining them as a uniquely vulnerable population.

Methods: This is an analysis of 196 patients admitted from October 2017 to present to one of three level one trauma centers in Indianapolis, Indiana. Patients were enrolled in the Trauma Medical Home (TMH), a randomized controlled trial evaluating a collaborative care intervention for patients 50 years old and greater, with an Injury Severity Score (ISS) of 9 or greater. Upon enrollment, patients complete several self-reported outcome measures including the PHQ-9 to screen for depression symptoms. Pregnant patients and prisoners were excluded, as well as those with neurodegenerative disease, moderate to severe cognitive impairments, severe psychological illness, traumatic brain injury, spinal cord injuries, or recent substance abuse. Patients with pre-existing depression were identified by ICD-9 codes or current antidepressant medication use. The primary outcome was depression symptoms using PHQ-9 depression scale scores at the time of hospital discharge. Multivariate logistic regression analysis was used to identify relationships between pre-existing depression and self-reported depression symptoms at discharge. Analyses were performed by SAS software.

Results: Over half of the participants had pre-existing depression (51.5%, n=101). 88.8% of the patients were white and 54.1% were female. After examining age, race, injury mechanism, ISS, and Charlson Comorbidity Score, the factor *most* predictive of depression symptoms at discharge was pre-existing depression [OR(95%CI) 2.97 (1.44, 6.14), p 0.003]. The Charlson Comorbidity Index also correlated with depression symptoms at discharge, but to a lesser degree [OR(95%CI) 1.40 (1.07, 1.83), p 0.015].

Conclusion: Older trauma patients with pre-existing depression are almost three times as likely to have depression symptoms at the time of discharge from the hospital, even when controlling for ISS and mechanism of injury. The high validity of the PHQ-9 depression screening tool make these patient-reported outcomes all the more striking. In light of these results, we recommend early screening and intervention for pre-existing depression in older injured adults to help mitigate post-traumatic injury morbidity.

Poster #94

WHICH HOSPITAL ACQUIRED CONDITIONS MATTER THE MOST? AN EVIDENCE-BASED METHOD FOR PRIORITIZING TRAUMA PROGRAM IMPROVEMENT

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Introduction: Prevention of hospital-acquired conditions (HAC) is a primary focus of trauma center quality improvement. Although the incidences and severities of various HACs has been described extensively in the literature, the relative contributions of these conditions to post-injury hospital outcomes is unknown. The objective of our study was to quantify and compare the impacts of six HACs on early clinical outcome and resource utilization in a large cohort of hospitalized trauma patients.

Methods: Adult patients from the 2013-2016 American College of Surgeons Trauma Quality Improvement Program Participant Use Data Files with an ISS ≥ 9 and hospitalized for ≥ 5 days were included for analysis. Population attributable fractions (PAFs) were estimated in order to determine the contribution of 6 different HACs on early clinical outcomes and resource utilization for the study cohort, after adjusting for patient and injury characteristics. The PAF incorporates information about both the HAC frequency and severity, thereby allowing direct comparison of low-frequency/high-severity conditions to high-frequency/low-severity conditions. In this context, the PAF represents the estimated percentage decrease in adverse outcome that would be expected in the study cohort if exposure to the HAC had been fully prevented.

Results: A total of 529,670 patients requiring ≥ 5 days of hospitalization were included for analysis. Pneumonia demonstrated the strongest association with in-hospital clinical outcome and resource utilization (see Table). Complete prevention of this condition in our study cohort would have resulted in an estimated 22.7% reduction in end-organ dysfunction, 7.8% reduction in mortality, 8.7% reduction in prolonged hospitalization, 7.1% reduction in prolonged ICU stay, and a 6.8% reduction in need for mechanical ventilation. The size and breadth of impact of the remaining 5 HACs was comparatively small.

Conclusion: In an era of value-based health care delivery, HAC prevention efforts should ideally target those conditions which matter the most. Using an innovative method for comparing the contributions of different HACs to hospitalized trauma patients, we have found pneumonia to have far and away the largest overall impact on this patient population. Finite quality improvement resources should preferentially be devoted towards the prevention of this condition, as opposed to other commonly targeted but much lower-yield HACs.

Table. Risk-Adjust Population Attributable Fractions[a] for Each Hospital Acquired Condition-Outcome Pair.

EOD (Incidence = 5.9%)	In-hospital Mortality (Incidence = 3.5%)	Prolonged Hospitalization (Incidence = 26.6%)	Prolonged ICU Stay (Incidence = 26.6%)	Need for Mechanical Ventilation (Incidence = 26.9%)
1. Pneumonia 22.1 (21.6,22.7)[b]	1. Pneumonia 7.8 (7.1,8.4)[b]	1. Pneumonia 8.7 (8.6,8.8)[b]	1. Pneumonia 7.1 (7.0,7.2)[b]	1. Pneumonia 6.8 (6.6,6.9)[b]
2. VTE 7.8 (7.4,8.1)[b]	2. VTE 1.0 (0.6,1.4)[b]	2. UTI 4.3 (4.2,4.4)[b]	2. VTE 2.7 (2.6,2.8)[b]	2. VTE 2.2 (2.1,2.3)[b]
3. UTI 7.5 (7.1,7.8)[b]	3. Pressure Ulcer 0.9 (0.6,1.1)[b]	3. VTE 4.2 (4.2,4.3)[b]	3. UTI 2.5 (2.5,2.6)[b]	3. UTI 1.9 (1.8,2.0)[b]
4. Pressure Ulcer 5.2 (5.0,5.5)[b]	4. CLABSI 0.4 (0.3,0.5)[b]	4. SSI 2.3 (2.2,2.3)[b]	4. Pressure Ulcer 1.3 (1.3,1.4)[b]	4. Pressure Ulcer 1.2 (1.1,1.3)[b]
5. SSI 3.5 (3.3,3.7)[b]	5. UTI 0.1 (-0.3,0.4)[c]	5. Pressure Ulcer 2.1 (2.0,2.1)[b]	5. SSI 1.0 (1.0,1.1)[b]	5. SSI 0.9 (0.8,0.9)[b]
6. CLABSI 1.6 (1.4,1.7)[b]	6. SSI -0.3 (-0.5,-0.2)[b]	6. CLABSI 0.4 (0.4,0.4)[b]	6. CLABSI 0.3 (0.3,0.3)[b]	6. CLABSI 0.2 (0.2,0.3)[b]

[a] PAF for an HAC-Outcome pair describes the percentage reduction in the adverse outcome in the study population had exposure to the HAC been completely prevented; Estimates adjusted for patient-, hospital-, and injury-related factors.
[b] P < .001
[c] P = ns
Abbreviations: EOD, end-organ dysfunction; ICU, intensive care unit; VTE, venous thromboembolism; UTI, urinary tract infection; SSI, surgical site infection; CLABSI, central line associated blood stream infection.

Poster #95

LIQUID COLD-STORED WHOLE BLOOD IN THE CIVILIAN POPULATION: A MIXED PICTURE

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Background: Fresh whole blood has been associated with decreased mortality and coagulopathy in the military setting, though minimal data are available on liquid cold-stored low-titer O-positive or –negative whole blood (LTOWB) and are limited to small case series.

Methods: This single-center, retrospective cohort analysis compares civilian trauma patients resuscitated with whole blood (WB) to those who received component therapy alone (COMP). COMP includes of patients who presented from 1/2017-6/2018. WB comprises patients who presented from 7/2018-12/2019, after LTOWB became available at our institution. Adult patients were included if they presented as a trauma activation, had either a massive transfusion protocol or emergency blood ordered, and received at least one unit LTOWB or packed red blood cells (pRBC). For analysis, one unit LTOWB equals one unit pRBC, one unit plasma, and 1/6 unit apheresis platelets. Bivariate analyses were performed. Survival was compared with Kaplan-Meier survival curves.

Results: 161 patients received WB and 83 COMP. Baseline characteristics were similar, except WB had a lower mean ISS (22.2 vs 29.2; *p*p=0.006). 4 transfusion reactions were reported with WB (vs 0 in COMP; *p*=0.15). There were no differences in thromboembolic complications. Thromboelastography (TEG) was similar on admission. WB had a shorter R time and stronger clot index at one hour. 24-hour and 30-day survival was similar between groups (Log Rank *p*=0.20 and 0.134, respectively).

Conclusion: To our knowledge, this is the largest case series of cold-stored whole blood transfusion in the civilian trauma population. LTOWB is logistically superior, improves clot formation as demonstrated by TEG and is not associated with increased thromboembolic phenomena but may be associated with increased incidence of AKI and transfusion reactions.

Table 1. Transfusion quantities

	WB		COMP		
	Stat	95% CI or IQR	Stat	95% CI or IQR	*p* value
Bags of blood product					
Whole Blood*	3	(1, 7)	0	(0, 0)	-
pRBC*	0	(0, 3)	6	(3, 12)	**<0.001**
Plasma*	0	(0, 2)	5	(2, 10)	**<0.001**
Platelets*	0	(0, 1)	0	(0, 2)	0.30
Cryo*	0	(0, 0)	0	(0, 0)	0.14
Total Bags*	5	(2, 14)	12	(5, 24)	**<0.001**
Component-equivalent units					
pRBC*	4	(2, 10)	6	(3, 12)	**0.048**
Plasma*	4	(1, 9.5)	5.5	(2.25, 10)	0.13
Platelets*	0.67	(0.17, 2.42)	2	(1, 2)	0.24
Total Component-Equivalent Units*	8.67	(4.33, 22.17)	12	(5, 24)	0.20
Plasma:RBC ratio**	0.947	(0.91, 0.98)	0.797	(0.742, 0.851)	**<0.001**
Crystalloid (mL)*	1000	(0, 2375)	2700	(1000, 5000)	**<0.001**

Note: *median, **mean; Interquartile range (IQR) reported with medians, 95% confidence interval (CI) reported with means. Packed red blood cells (pRBC)

Poster #96

A SOUTHERN SYNDEMIC: CONNECTING HIV TO FIREARM INJURY

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Introduction: The southern U.S. has the highest rates of firearm fatalities and related injuries. The South also accounts for 43.9% of the total U.S. population living with HIV and 51.5% of the new HIV diagnoses. In our state, areas with greater rates of new HIV diagnoses parallel zip codes with greater concentrations of poverty and unemployment, which are known risk factors for firearm injury. Using deductive reasoning, we hypothesized that zip codes with greater rates of HIV would geographically cluster with firearm injuries.

Methods: We retrospectively reviewed our trauma registry for patients who sustained a GSW between 2012 and 2016 in our city. Zip code of home address was collected for each patient. We queried rates of HIV incidence and prevalence for 2016 from a regional database. To assess for a correlation between HIV and GSW rates, we used a multivariable Poisson regression, which also included 15 validated socioeconomic variables used in the CDC's Social Vulnerability Index. To assess for geospatial correlation, we used a mixed model regression with a spatial anisotropic power structure including the same 15 variables. Last, we performed a multivariate analysis to identify zip codes that were high outliers for new HIV diagnosis rates. All depicted rates are annual, per zip code, and per 100,000 people unless otherwise specified.

Results: There were 1,218 patients with GSWs from 33 different zip codes in our city. The median age was 26.8 (21.8-35.4) years, percent male 91.5% (n = 1114), and mean annual GSW rate 35.6 (±46). The mean prevalence of HIV in these 33 zip codes was significantly higher than the mean for our city (2695.8 vs 857.4, $p < .0001$). The mean new HIV diagnosis rate was also higher for these locations compared to the mean for our city (110.3 vs 36.9, $p < .0001$). On multivariable Poisson regression, HIV prevalence (β 3.2, 95% CI 2.5-3.9, $p < .0001$) positively correlated with GSW rates. On a separate regression, new HIV diagnosis rates (β 2.4, 95% CI 1.9-3.0, $p < .0001$) also correlated with GSW rates. Furthermore, locations with elevated HIV prevalence (β 0.02, 95% CI 0.01-0.03, $p = 0.0004$) geospatially correlated with areas of greater GSW rates. A separate geospatial analysis demonstrated the same trend for new HIV diagnoses (β 0.5, 95% CI 0.3-0.6, $p < .0001$). Based on multivariate analysis, 8 zip codes were found to be outliers for new HIV diagnosis rates (mean, 231.2), which corresponded to a 90.2 GSW rate using our geospatial model.

Conclusion: A syndemic relationship exists between HIV and GSWs in our southern city. HIV is an independent predictor of GSWs and additionally, it geographically clusters with GSWs. While we advocate for universal HIV testing, the greatest impact would be to screen GSW patients who live in zip codes with GSW rates $\geq$ 90 per 100,000 people. In these communities, the HIV risk is 6.3-times the average risk for our city, which emphasizes the need for enhanced and concurrent HIV screening and violence prevention.

Poster #97

IS IT SAFE? COMPARING OUTCOMES IN SEVERELY INJURED PATIENTS UNDERGOING DIRECT ADMISSION OR TRAUMA ACTIVATION FOLLOWING INTERFACILITY TRANSFER

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Introduction: Appropriate interfacility transfer is a crucial component of a highly functioning trauma system; when transfers occur, the accepting facility must determine disposition, to include trauma activation or direct admission to an intensive care unit (ICU) or ward bed, often in the setting of incomplete information; guidance on best practice in this setting is limited. Activations are thorough but resource intensive while direct admissions potentially risk harm due to inappropriate triage or delays in assessment, diagnosis, and management. We hypothesized that severely injured patients undergoing formal trauma activation prior to triage to the ward or ICU would have improved outcomes relative to those undergoing direct admission.

Methods: We utilized prospectively collected data to perform a retrospective review examining patients transferred to our ACS Verified Level I Trauma Center between January 2017 and June 2019, focusing on patient disposition (trauma activation, ICU, ward). We included patients that were 18 years of age and above with an Injury Severity Score > 15. Our primary outcomes were new injuries (those not diagnosed at the referring hospital but detected on initial assessment at our facility) and delayed diagnoses (those injuries not identified during initial assessment at our facility) requiring intervention.

Results: There were 1,241 patients transferred to our facility during the study period, with 493 meeting study criteria. The median age was 58 years while median injury severity score was 21. Most transferred patients underwent direct admission to the ICU (n = 371) with an additional 67 being admitted directly to the ward. 161 patients had a new injury discovered or a delay in diagnosis, with 91 requiring intervention based on these findings. The majority of intervention-requiring new injuries (n = 87) were discovered in patients admitted to the ICU and ward (70 %), but relative to the number of patients admitted to each location, were more commonly detected in trauma activations ($p < 0.001$). Delayed diagnosis was relatively rare in our series (n = 6), and only two patients required intervention; notably, though, all were admitted directly to the ICU.

Conclusion: New injuries are discovered in nearly one-third of severely injured patients undergoing interfacility transfer. While most do not require intervention, detection is greater in patients undergoing trauma activation. Delayed diagnoses are uncommon but, in our series, occurred exclusively in patients admitted directly to the ICU. These findings suggest that trauma activation is likely the safest and most comprehensive means of evaluating severely injured patients undergoing transfer; given the low risk of need for intervention, though, a cost-benefit analysis is warranted to further define the role of direct admission in this setting.

Poster #98

PATIENT CHARACTERISTICS WHO BENEFIT FROM EARLY CONTACT OF PHYSICIAN

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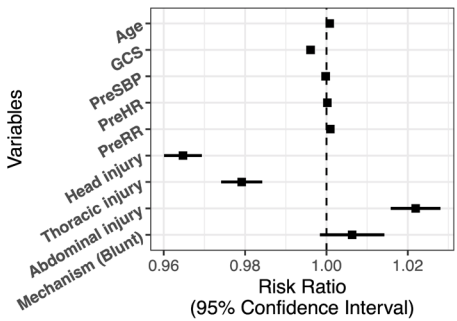
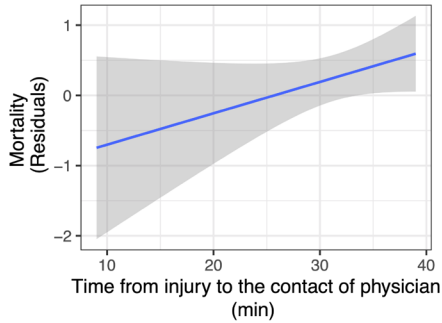
Introduction: Longer prehospital time is known to increase mortality, and thus early intervention for traumatic patients have expanded. A previous study in Scotland showed that prehospital care provided by a physician-led critical care team increased the chances of survival. However, this was not the case in a study held in Japan. We considered these contraindicating results to derive from the difference between the baseline characteristics of patients in these two studies. The aim of this study is to identify the characteristics of trauma patients who benefit from the presence of a physician in a prehospital setting.

Methods: The Japan Trauma Data Bank (JTDB) is a nationwide trauma registry consisting of prehospital and clinical data from tertiary care hospitals which includes moderate-severe (AIS >=3) trauma injuries. Using data of this database between 2003-2013, we included all adults (>=16y) transported directly from the scene, we excluded patients with no signs of life. To identify the patient characteristics who benefit from early intervention we evaluated two models:(1) Generalized linear model (GLM) (2) Generalized additive model (GAM). We used mortality as an objective variable and the following was explanatory variables; age, sex, Glasgow Coma Scale (GCS), mechanism of injury, site of injury and AIS. In model (1) we added an interaction term between each explanatory variable and time needed from onset to physician contact and evaluated this value. In model (2) we first performed GLM, and GAM was then performed between time to the contact of physician and the residue of GLM.

Results: A total of 23,581 patients met inclusion criteria. Mean age was 56.0 years (SD 22.2), and 65.7% were male. The population of patients who benefited from early contact with the physician was: patient with higher age, high respiratory rate and patients with abdominal injury. On the contrary, patients with higher GCS, patients with head injury or thoracic injury, the benefit of early contact with the physician was limited. The result of GAM supported the early contact of physician to the abdominal patients.

Conclusion: Early contact with the physician may be beneficial to patient with abdominal injury.





Poster #99

ELECTRICAL VAGAL NERVE STIMULATION MODULATES BALANCE BETWEEN OMEGA 3 AND OMEGA 6 POLYUNSATURATED FATTY ACIDS AFTER INTESTINAL ISCHEMIA REPERFUSION INJURY

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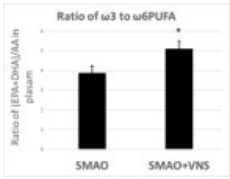
Introduction: Intestinal ischemia-reperfusion (I/R) leads to gut barrier failure that initiates a systemic inflammatory response, which results in multiple organ dysfunction syndrome (MODS). Inflammatory Omega-6 (ω6) and anti-inflammatory omega-3 (ω3) polyunsaturated fatty acids (PUFAs) are substrates for the production of various eicosanoids and docosanoids. A recent report showed that ω3 PUFA could suppress inflammation induced MODS. Furthermore, the balance ω3 PUFAs and ω6 PUFA plays a crucial role in the regulation of inflammation. Electrical vagal nerve stimulation (VNS) is known to alter the inflammatory response; however, the effect of VNS on the production of ω3 PUFAs and ω6 PUFAs in the acute injury model is unknown. We hypothesized that VNS would modulate the production of ω3 PUFAs (eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA)) and ω6 PUFA (arachidonic acid (AA)) in the plasma after intestinal ischemia reperfusion (IR).

Methods: Male Sprague Dawley rats were subjected to 60 minutes of superior mesenteric artery (SMA) clamping followed by 120 minutes of de-clamping to induce intestinal IR injury. Plasma was collected before and after the intestinal IR phase. A separate cohort of animals underwent electrical cervical VNS (5 V, 0.5 Hz, 1 ms for 20 minutes: 10minutes before SMA de-clamping and 10 minutes after SMA de-clamping). The lipids in the plasma were extracted using the method of Bligh and Dyer under acidic conditions and liquid chromatography electrospray ionization mass spectrometry.

Results: A lipid analysis of the plasma showed no significant difference in the ratios of ω3 PUFAs (DHA and EPA) to ω6 PUFA (AA) after intestinal IR compared with befire intestinal IR (n = 3). Performing VNS induced a 1.3-fold increase in the ratios of ω3 PUFAs to ω6 PUFA in plasma (n = 3, $p < 0.05$, see figure).



Conclusion: VNS may attenuate the systemic inflammation that occurs after intestinal IR by altering the balance between anti-inflammatory ω3 PUFAs and inflammatory ω6 PUFA in plasma.

Poster #100

ASSOCIATION OF MASSIVE TRANSFUSION PROTOCOLS WITH OVERTRANSFUSION: WHERE TO DRAW THE LINE?

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Introduction: The use of massive transfusion protocols (MTP) for exsanguinating trauma patients is associated with increased survival. However, the use of readily available blood products may occasionally result in overtransfusion. The purpose of this study was to characterize the incidence of overtransfusion in patients requiring MTP at a level I trauma center and identify potential predictors.

Methods: Trauma patients requiring MTP activation over a 42-month period ending in 12/2019 were selected. The time interval from initiation to conclusion of MTP was recorded, as was the amount of blood products administered. Patient demographics and injury characteristics were abstracted. Laboratory values including hemoglobin (Hg), platelet count (PLTs), lactate, creatinine (Cr), pH, base deficit (BD), and INR were obtained at admission, at 24 hours after conclusion of the MTP and at discharge. Overtransfusion was defined as achieving a Hg $\geq$ 10 mg/dL at 24 hours after the conclusion of MTP and at discharge. A linear regression model was utilized to identify correlations between overtransfusion and amount of packed red blood cells (pRBCs) transfused and duration of MTP.

Results: During the study period, 240 trauma patients required MTP activation. The median age was 36 years, with the majority (76%) being male, and suffering a blunt mechanism of injury (60%). The median ISS was 24. A total of 28 patients (12%) did not receive any blood transfusions. The remaining 212 required 10±11 [median 6] pRBCs, 6±9 [median 3] FFPs, 1 ±2 [median 1] platelets and 1±1 [median 0] cryoprecipitate during the duration of MTP activation (median of 5 hours). Of patients surviving to discharge (n=132), 69 (52%) at 24 hours after the conclusion of MTP and 52 (39%) at the time of discharge had a Hg level $\geq$ 10 mg/dL. There was no correlation between overtransfusion at 24 hours or at discharge with the number of pRBCs transfused during the MTP (linear regression: p=0.54 and p=0.73 respectively), nor with the duration of MTP activation (p=0.38 and p=0.23 respectively). In a forward logistic regression model including age, gender, mechanism of injury, admission vital signs, ISS, admission labs (Hg, PLTs, lactate, Cr, pH, BD) and duration of MTP, only penetrating mechanism and admission Hg predicted overtransfusion (AOR: 3.3 and 1.3 respectively).

Conclusion: Overtransfusion of blood products with massive transfusion protocols is common and may reflect the challenge with defining end points of resuscitation in massively transfused trauma patients.

Poster #101

PELVIC FRACTURE IMPAIRS SEXUAL FUNCTIONS AND QUALITY OF LIFE IN TRAUMA PATIENTS.

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Introduction: Pelvic fractures (PFs) form a distinctive group of injuries as they affect the physical, social and economic well-being of the patient. They are associated with myriads of complication that hampers the effective integration of patient into useful productive life. Pain, infertility, poor quality of life (QoL) and sexual dysfunction are the common complications. However, even though PFs have a major impact on overall quality of life, there remains a paucity of studies for assessing the impact of pelvic trauma on sexual functions and quality of life. It is especially important in developing countries, where rehabilitation services are still in infancy. We studied the sexual functions and quality of life in patients with PFs.

Methods: This was an prospective study**.** Patients with pelvic trauma who were managed between January 2014 and December 2018 were recruited. Infertility, gait disturbances, sexual dysfunction and QoL were assessed. Sexual dysfunction was assessed in males by Brief Sexual Function Inventory and in Females by Female Sexual Function Index. QoL analysis was assessed using WHO-BREF questionnaire.

Results: A total of 586 patients were managed during the study period. 71 patients did not meet the inclusion criteria and 79 patients died during the course of hospital stay. Of the 133 patients available for follow up, 54 patients were from a retrospective cohort and 79 patients were from a prospective cohort. 106 patients were males and 27 were females with a mean age of 34+/- 10.8 years. Sexual dysfunction in the form of premature or retrograde ejaculation was a major problem in males with an incidence of 36.5%. Four out of 14 females in the retrospective group (premenopausal and sexually active) had infertility. The poorest domain in WHO-BREF was psychological domain (70.8±20.1), while the best one was physical domain (81.7±20.4). The BSFI and FSFI scores were low at 1 month follow up which gradually improved over a period of 6 months.

Conclusion: PFs remain a major cause of morbidity. They directly affect the sexual activity and QoL of patients. Hence, there is a need for development of extensive rehabilitation protocols consisting of psychological and physical rehabilitation measures for ensuring better QoL in these patients.

Poster #102

MEASURING THE FIBRIN DEGRADATION PRODUCTS IN PEDIATRIC TRAUMA PATIENTS MAY REDUCE UNNECESSARY HEAD CT SCANS

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Introduction: The Pediatric Emergency Care Applied Research Network (PECARN) rule, a clinical decision algorithm for head CT scans in children, is widely used in the clinical practice of pediatric trauma. This rule is evaluated on clinical findings, which do not include fibrinolytic biomarkers. Traumatic brain injuries (TBI) are known to cause coagulopathy and the fibrin degradation product (FDP) is the biomarker for predicting TBI in adults. We aimed to clarify whether adding quantitative FDP measurement to the PECARN rule would reduce head CT scans for pediatric patients with head injury.

Methods: A retrospective study of pediatric trauma patients suspected of TBI was conducted from 2012 to 2017 in a Japanese tertiary teaching hospital. Trauma patients younger than 16 years of age with a Glasgow Coma Scale score of 14_15 and who satisfied at least one item of the PECARN rule were enrolled. They were divided into TBI (n=34) and non-TBI groups (n=291) and compared. TBI was defined as a head Abbreviated Injury Scale ≥ 3. FDP was measured at arrival in all patients using a CS2500/CA1500 (Sysmex®). The area under the curve was calculated according to the receiver operating characteristic (ROC) curve, and the FDP cut-off value and negative predictive value (NPV) for TBI was determined.

Results: Of 325 patients who satisfied the inclusion criteria, 232 (71%) were male with a median age of 10 years, and 217 (67%) had an isolated head injury. The mechanisms of injury were pedestrian (49.8%), fall (23.6%), motor vehicle collision (13.2%), motorcycle collision (1.5%), tumble (3.3%), tumble on the bicycle (3.3%), and others (4.6%). The median FDP in TBI group was higher than that in non-TBI group (18.7 vs. 6.2 μg/dL, $P < 0.001$). The ROC curve showed a cut-off value of FDP for TBI at 10.0 μg/dL and the sensitivity, specificity, and NPV were 0.76, 0.62 and 0.96, respectively. In cases of isolated head injury, the cut-off value of FDP for TBI was 6.6 μg/dL and the sensitivity, specificity and NPV were 0.80, 0.70 and 0.97 respectively. Using these cut-offs for patients who met the PECARN rule and potentially needed a head CT scan, 180 (55.4%) of all cases and 133 (61.3%) of isolated head injury patients would not have needed the head CT scan.

Conclusion: The fibrin degradation product was related to traumatic brain injuries of pediatric patients. FDP levels under the cut-off had a high NPV for TBI. We conclude that measuring FDP and matching it with PECARN rules would reduce unnecessary head CT scans.

Poster #103

THE EFFECT OF AGE AND GENDER ON OUTCOMES FOLLOWING ISOLATED MODERATE TO SEVERE TRAUMATIC BRAIN INJURY

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Introduction: The impact of female gender on traumatic brain injury (TBI) outcomes remains controversial. Preclinical studies have shown that circulating female sexual hormones have a neuroprotective effect and female rodentshave better recovery outcomes following brain injury than their male counterparts. However, clinical studies with human data have produced mixed results. Furthermore, the combined impact of age and gender on TBI outcomes must be clarified. Ourobjective was to analyze the influence of age and gender on severe TBI outcomes. We hypothesized that premenopausal females would have better outcomes and lower mortality than other older females and all male groups.

Methods: Data from the National Trauma Data Bank (NTDB) 2007-2016 were used. After excluding cases of mild traumatic brain injury (Head AIS 1 and 2), and polytrauma with moderate to severe injury in other body regions (AIS > 2), a total of 686,549 patients were entered into the study, of which 251,491 were female and 435,058 were male. Comparison analyses of clinical characteristics and outcomes between males and females at different age groups: age < 45 years (premenopausal stage), age from 45 to 55 years (perimenopausal stage) and age > 55 years (postmenopausal stage) were conducted. Logistic regression analyses were performed to assess the impact of age associated with female gender on mortality and complications. Statistical significance was set at $p < 0.05$.

Results: No significant difference in mortality was observed between females and males in the subgroups of age < 45 years and age from 45 to 55 years (3.7% vs 3.7%, p=0.964; 6.1% vs. 6.3%, p=0.212; respectively). Females age > 55 years had significantly lower unadjusted mortality rate than their male counterparts (9.1% vs. 11.8%, $p < 0.001$). After multivariate logistic regression analysis controlling for multiple confounding factors, females and males at age < 45 years had similar risk of mortality (AOR:1.043, 95% CI:0.978-1.112, p=0.204), whereas females age 45-55 years had relatively higher risk of mortality (AOR:1.137, 95% CI:1.054-1.225, p=0.001) compared to their male counterparts. On the contrary, females age > 55 years had markedly decreased risk of mortality (AOR:0.857, 95%CI:0.835-0.879, $p < 0.001$) and complications, except UTI and catheter associated UTI.

Conclusions: Female patients in the post-menopausal stage have lower mortality, following TBI than their male counterparts, but pre- and perimenopausal females do not, suggesting that female sexual hormones may not provide a significant protective effect on clinical outcomes following isolated moderate to severe TBI.

Poster #104

IL-22:FC MITIGATES ENDOTHELIAL GLYCOCALYX SHEDDING AFTER LPS INJURY

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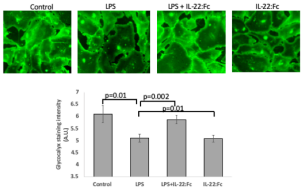
Introduction: The endothelial glycocalyx (EGX) on the luminal surface of endothelial cells contributes to the permeability barrier of vessels and prevents activation of the coagulation cascade. EGX damage, which occurs in the shock state, results in endotheliopathy. Interleukin-22 is a cytokine with both pro-inflammatory and anti-inflammatory properties and how IL-22 affects the EGX has not been studied. We hypothesized that IL-22:Fc, a recombinant fusion protein with human IL-22 and the Fc portion of human immunoglobulin G1 (which extends the protein half-life), would not affect EGX shedding in endothelium after injury.

Methods: Human umbilical vein endothelial cells (HUVECs) were exposed to 1 µg/ml lipopolysaccharide (LPS). LPS injured cells (n=284) were compared to HUVECS with LPS injury plus 0.375 µg/ml of IL-22:Fc treatment (n=293) for 12 hours. These two cohorts were compared to control HUVECs (n=286) and HUVECs exposed to IL-22:Fc alone (n=269). Cells were fixed and stained with FITC-labelled wheat germ agglutinin to quantify EGX. Total RNA was collected and select mRNAs quantified by RT-qPCR using SYBR green fluorescence.

Results: Exposure of HUVECS to LPS resulted in degradation of the EGX compared to control (5.86 vs. 6.09 AU, p=0.01). IL-22:Fc alone also resulted in degradation of EGX when compared to control (5.08 vs. 6.09 AU, p=0.01). Treatment with IL:22:Fc after LPS injury resulted in less degradation of EGX compared to LPS injury alone (5.86 vs. 5.08 AU, p=0.002). Expression of the IL-22Ra1 receptor was not different for IL-22:Fc treated compared to LPS injury only (0.72 vs. 0.97 relative expression, p=0.15). Treatment with IL-22:Fc after LPS injury resulted in less matrix metalloproteinase-2 (0.66 vs. 1.91 relative expression, p=0.04) and matrix metalloproteinase-14 (0.72 vs. 2.47 relative expression, p=0.04).



Conclusions: IL-22:Fc alone induces EGX degradation. However, IL-22:Fc treatment after LPS injury appears to mitigate EGX degradation. This protective effect appears to be mediated via reduced expression of metalloproteinases.

Poster #105

A NEW DEFINITION FOR MASSIVE TRANSFUSION IN THE MODERN ERA OF WHOLE BLOOD RESUSCITATION.

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Introduction: Hemorrhage is the leading cause of preventable death among trauma patients. Ideal treatment includes balanced blood product resuscitation. Multiple different transfusion thresholds have been defined to identify patients at risk of death from hemorrhagic shock, including massive transfusion (MT), critical administration threshold (CAT), and resuscitation intensity (RI). These definitions are unsuited for current practice, given their failure to account for the use of whole blood (WB). Further, no scoring system has been developed with a focus on mortality within 3-6 hours, when the majority of hemorrhagic deaths occur. We hypothesized that a definition including WB transfusion would better predict early mortality following trauma.

Methods: We performed a retrospective review of all trauma patients from 12/2018 to 02/2020. All patients with activation of the massive transfusion protocol (MTP) were eligible for inclusion except those with prehospital blood products or pulseless on arrival. MT was defined as 10 units RBCs in the first 24 hours following arrival. CAT was positive with 3 units RBCs in an hour and calculated for the first three hours after arrival. RI was determined by scoring 1 point each per unit of any blood product (RBC, FFP, or platelets), 1000 mL crystalloid, or 500 mL colloid in the first 30 minutes after ED admission. We defined the Whole Blood Massive Transfusion (WB MT) score as the sum of each unit RBC plus 2 times each unit of WB for each hour for the first three hours following admission. Different thresholds for a positive score were then considered. The primary outcome was the predictive ability of the different measures to identify 3-hour and 6-hour mortality with maximum sensitivity and diagnostic accuracy. ROC curves and AUROC analyses were subsequently performed.

Results: There were 269 patients during the study period with 235 eligible for analysis. Sixty were resuscitated with at least one unit of WB with an average of 3.5±2.3 units WB, 8.6±8.58 units RBCs, and 7.7±7.04 units FFP in the first 24 hours after arrival. Those treated without WB required 9.3±9.89 units RBCs and 8.2±8.75 units FFP. Overall, 27 patients died in the first 3 hours following arrival and 29 died within 6 hours. The sensitivity of WB MT for 6-hour mortality ranged from 86-93% compared to MT (55.2%), CAT (82.8%), and RI4+ (89.7%). Median time to death in patients with WB MT$\geq$5 was 1.3 [0.83,2.88] hours compared to 2.5 [1.14,5.37], 1.5 [0.82,2.93], and 1.3 [0.82,2.95] hours for patients positive for MT, CAT, and RI4+ respectively. WB MT score $\geq$5 AUROC was superior to all other criteria for both 3-hour (0.70, p=0.001) and 6-hour mortality (0.72, $p < 0.001$).

Conclusion: To our knowledge the WB MT is the first system to incorporate use of WB and demonstrates better diagnostic accuracy compared to other thresholds for identifying patients at risk for early hemorrhage related mortality. Further studies are needed to validate the WB MT score on a multicenter, prospective basis.

Poster #106

LOCATION LINKS TRAUMA CENTERS TO FATAL OPIOID OVERDOSES

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Introduction: Trauma patients are at greater risk for opioid misuse and overdose, yet recommendations for trauma physicians regarding safe opioid prescribing have not been established. To identify the utility of developing such prescribing education for trauma teams, we sought to explore the geographic relationship between fatal opioid overdoses and trauma center locations in our state. Because trauma centers treat both local residents and individuals transferred from farther distances, we hypothesized that opioid overdoses would not geographically cluster with trauma center locations.

Methods: Using our state's department of public health 2018 data repository, we abstracted county-level fatal overdose rates (per 100,000 people) for all drugs, all opioids, synthetic opioids excluding methadone, methadone, and heroin. County level demographic, social, and economic characteristics were obtained from the U.S. Census American Community Survey (2014-2018). Designated trauma centers (TC), their level (L1, L2, L3 or L4), and their geographic coordinates were identified. Using a geographic information system, we mapped county-level fatal overdoses and trauma center locations. To assess for a geospatial relationship, we used a multivariable regression comprised of trauma center level, unemployment, median age, sex, race, and poverty to predict each type of fatal overdose; a repeated covariance structure for geographic coordinates was used in the model's design.

Results: There are 5 L1 TC, 10 L2 TC, 7 L3 TC, and 7 L4 TC in the state. For all counties, the mean fatal drug overdose rate was 11.7 (±10.1), mean fatal opioid overdose rate 4.8 (±6.4), mean fatal synthetic opioid overdose rate 0.9 (±2.6), and mean fatal methadone overdose rate 0.1 (±0.3). Trauma center locations did not geospatially correlate with all drug overdoses nor all opioid overdoses; however, L1 TCs positively geospatially correlated with synthetic opioid overdoses (β 3.6, 95% CI 0.5-6.7, $p=0.02$) and methadone overdoses (β 0.7, 95% CI 0.4-1.0, $p < .0001$). L3 TC locations geospatially correlated with heroin overdoses (β 2.2, 95% CI 0.9-3.4, $p=0.001$) but L1 TC locations did not ($p > 0.05$). Counties with higher poverty rates significantly correlated with lower overdose rates for all 5 drug categories ($p < .05$).

Conclusion: Counties with more opioid overdoses geospatially correlate with L1 TCs. Specifically, in counties with L1 TCs, rates of synthetic opioid overdoses increase by 3.6 per 100,000 people and methadone overdose rates increase by 0.7 per 100,000 people. These findings would suggest that L1 TCs are poised to tackle fatal opioid overdoses and should serve as a catalyst for trauma-specific opioid prescribing education.

Poster #107

INTEGRATING VALUE IN TO TRAUMA CARE: AN ACTIONABLE ANALYTIC APPROACH

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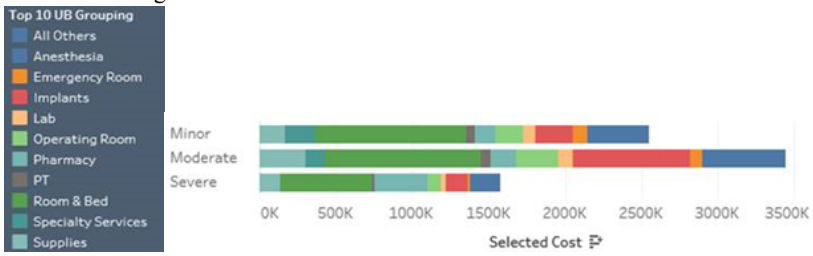
Introduction: Trauma as a service line has been a leader in setting the standards for optimal resources, quality and outcomes. With growing economic pressures in the delivery of healthcare, it is imperative that we incorporate the value proposition and account for our cost to care and associated opportunities for improvement.

Methods: Using the trauma registry at an urban LI (2018) and rural LII (2019) Trauma Center, patients were crossmatched to our institutional enterprise data warehouse to obtain associated demographic, injury severity, ethnicity and financial data: total and average fixed and variable costs; cost accounting units.

Results: 3477 patients met study criteria: 2595/882, with 15.6/20.6% with ISS > 15 at LI and LII facilities respectfully. Payor mix was predominantly Medicaid and Medicare, with higher % of commercial at LII facility. The total cost of care at LI and II facilities was $44.4 and 17.6 M, with total and average variable cost of $27.8/8.9M and $16/18K respectfully. There was no significant disparity in total and average variable cost with respect to ethnicity. The primary drivers of variable cost were room and board, implants and trauma readiness, with laboratory, radiology, therapies having significantly lower contributions (figure 1).

Conclusions: Understanding the cost to care, the primary components that drive it and which are impacted by the delivery arm of care, is imperative as we strive to optimize value in trauma care. This study provides a directional structure to identifying areas of opportunity not traditionally recognized as cost drivers and developing, implementing appropriate cost reduction strategies.



Poster #108

CAN MEASURES OF TRAUMA INDUCED COAGULOPATHY PREDICT MASSIVE TRANSFUSION?

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Introduction: Trauma-induced coagulopathy (TIC) is associated with increased mortality and massive transfusion. We hypothesize that aggregate measures of TIC can predict the need for massive transfusion.

Methods: All patients ≥ 18 who presented to our level 1 trauma center over two years, were admitted to the surgical intensive care unit and had a presentation thrombelastogram (TEG), were included. TIC was identified and the severity graded using both conventional coagulation studies (CONV): INR ≥ 1.4, PTT ≥ 35s, platelet (PLT) count < 150; and thrombelastography (TEG): R-time ≥ 9min, angle ≤ 65°, MA ≤ 55mm. Each abnormality was given a score of 1 and summed. The CONV score and TEG score were then compared to the Assessment of Blood Consumption (ABC) score and the Shock Index (SI) using 3 definitions of massive transfusion (MT): classic (CMT) – ≥ 10 PRCs / 24 hrs; Resuscitation Intensity ≥ 4(RI4) – ≥ 4 units PRBCs, FFP, PLTs, crystalloid (L), or albumin (0.5L) in the first 30 min; and Critical Administration Threshold (CAT+) – ≥ 3 PRBCs / hr within 24 hours of injury. Area under the receiver operating characteristic curves (AUROC) were calculated and compared by t-test.

Results: 77 patients were included during our study period. Patients were transfused a mean (± SE) RBC (8.7 ± 2.2), FFP (7.5 ± 2.0), PLT (1.9 ± 0.4) and whole blood (0.5 ± 0.1) over the first 24 hours. Scores tended to differ between MT groups regardless of measure or definition (Table 1). ABC was the best predictor of CMT (AUROC 0.761) and CAT (AUROC 0.765); SI was the best predictor of RI4 (AUROC 0.726).

Conclusion: Trauma-induced coagulopathy severity can be quantified and MT predicted using lab-based scoring systems; however, the ABC score reliably predicts the need for MT without need for laboratory data. ABC should thus be used for MT activation and labs including TEG for resuscitation refinement.

Table 1: Predictors of Massive Transfusion

	CMT+	CMT-	p-value	AUROC
ABC	2	1	<0.001	0.761
SI	1.09	0.90	0.031	0.605
CONV	1	0	<0.001	0.716
TEG	2	1	0.002	0.699
	RI4+	**RI4-**	**p-value**	**AUROC**
ABC	2	1	<0.001	0.720
SI	1.05	0.87	0.014	0.726
CONV	1	0	0.212	0.609
TEG	1	1	0.011	0.667
	CAT+	**CAT-**	**p-value**	**AUROC**
ABC	2	1	<0.001	0.765
SI	1.03	0.87	0.038	0.660
CONV	1	0	<0.001	0.729
TEG	1	1	0.190	0.555

Poster #109

EARLY OR LATE GASTROGAFFIN CHALLENGE FOR THE NON-OPERATIVE MANAGEMENT OF SMALL BOWEL OBSTRUCTION

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Introduction: Gastrogaffin (GG) challenge is becoming the standard of care for the non-operative management of adhesive small bowel obstruction (SBO). Protocols vary in the timing of GG challenge from early (≤ 24 hours) to late (> 24 hours). Concerns remain regarding the safety of early GG due to inadequate stomach and bowel decompression raising fear of complication such as aspiration. Few studies have investigated the relationship between the timing of GG and patient outcomes, including time to OR, length of stay or complication rate. We hypothesized early GG challenge would be non-inferior to late GG challenge and would have shorter length of stay.

Methods: A retrospective cohort study of 215 patients over two years (2018-2019) who underwent non-operative management of adhesive SBO. We stratified patients by timing of GG challenge, ≤ 24 hours (Early GG) or > 24hours (Late GG). Our primary outcome was success of GG challenge defined by discharge without an operation. Secondary outcomes included bowel resection, re-admission rate, hospital length of stay, and mortality. Our non-inferiority margin was 4%. We used the Chen Quasi-Exact method to determine confidence intervals for small sample sizes to determine non-inferiority. Continuous data was assessed by one-way ANOVA and categorical data with Fischer's Exact test.

Results: A total of 215 patients underwent planned non-operative management of adhesive SBO over the study period, of whom 102 received a GG challenge. Early GG was administered in 33 (32%), Late GG was administered in 79 (68%). There was no difference in age or gender, but more African Americans received Late GG (40% vs 15%, $p = 0.01$). The need for operative intervention was lowest in the early group, 6.1% compared to 17.7%in the late group. The difference of -11.6% [95% CI -22.9% - 3.3%] was non-inferior ($p=0.03$) but did not meet superiority. No patient receiving Early GG required bowel resection compared to 5 (35%) in the Late GG group ($p = 0.45$). Hospital length of stay was a median of 3 (IQR 2) for Early GG compared to 4 (IQR 8) for Late GG ($p < 0.001$). There was no difference in mortality, re-admission rates, ICU admission or ICU length of stay.

Conclusion: Early GG challenge (≤ 24 hours) is non-inferior to late GG challenge (> 24 hours) for the non-operative management of adhesive SBO. Patients who received early GG had a shorter length of stay, and no complications associated with early GG. Additionally, fewer patients who received early GG received a bowel resection, although this is not statistically significant. This indicates need for multi-center evaluation of GG administration and development of practice management guidelines for patients with adhesive SBO. We recommend early GG challenge to decrease the time for operative decision making and reduce length of stay. A prospective study comparing early versus late GG challenge is needed to determine optimal timing.

Poster #110

MENTAL HEALTH DISORDERS AFTER INJURY: WHO IS AT HIGHEST RISK?

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Background: Mental health disorders (MHD) are common after injury. One in five survivors of moderate-severe injury will struggle with PTSD, depression and/or anxiety 6-12 months post-injury. Early identification of those at highest risk for MHD post-injury will support targeted interventions to mitigate the long-term mental health symptoms following injury that complicate a return to independent functioning. We aim to develop a simplified risk score to identify individuals who are most likely to struggle with MHD post-injury.

Methods: We used data from a multi-institutional long-term outcomes registry of adults with moderate-severe injuries. Patients with a complete follow-up interview between 6-12 months post-injury were included. During the interview, patients completed screenings for MHD (PTSD, depression, and anxiety) among other questionnaires (i.e. perceived socioeconomic status, social support network, resilience, etc). We used multivariable logistic regression models to identify the top significant predictors of MHD from the trauma registry and interviews. We then calculated the predictive performance of each model using receiver operating characteristic (ROC) analyses and developed a scoring system with an optimal cutoff score to discriminate patients at low and high risk for MHD.

Results: A total of 895 patients were analyzed [mean age 59 (SD: 19.9); 58% male]. At 6-12 months post-injury, 6% of patients screened positive for PTSD, 14% for moderate-severe depression, and 14% for moderate-severe anxiety. The factors most significantly associated with MHD were **R**esilience, **A**ge, **S**ocioeconomic status, and the strength of one's **S**ocial support network. The Area Under ROC curve of each prediction model was: PTSD: 0.91, depression: 0.88, anxiety: 0.83, and any MHD: 0.85. Based on the presence of these factors, we created a score from 0 to 9 to determine the individuals' risk of MHD post-injury. The table shows the sensitivity, specificity, positive and negative predictive values for MHD associated with a score of 3 or higher.

	Prevalence	Sensitivity	Specificity	PPV	NPV
PTSD	6%	88.7%	76.6%	19.3%	99.1%
Depression	14%	83.7%	79.6%	40.9%	96.7%
Anxiety	14%	78.1%	78.2%	36.4%	95.7%
Any MHD	19%	76.2%	81.3%	48.5%	93.7%

Conclusions: We developed a simple 4-item score (RASS: Resilience, Age, Socioeconomic status, Social support network) that may allow us to accurately predict which patients are at highest risk for MHD post-injury. After validation, this tool has the potential to be scalable to clinical practice and may inform proactive psychosocial intervention to support optimal return to functioning post-injury

Poster #111

IMPROVING ABCDEF BUNDLE COMPLIANCE IN CRITICALLY ILL TRAUMA PATIENTS: AS EASY AS ABC-123

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Background: Delirium is associated with mortality and cognitive dysfunction in the critically ill, including trauma. Compliance with the ABCDEF Bundle has been demonstrated to improve mortality and ventilator dependence in critically ill patients. However, there is no standardized tool used to measure real-time compliance. We created ABC-123, an EPIC-EMR based real-time scoring schema that assigns a minimum of 1 and maximum of 3 points for compliance with each ABCDEF Bundle element (total 18 points, Figure) and can be used to make clinical care decisions.

Hypothesis: We hypothesized that increases in daily maximum ABC-123 score would be associated with increasing likelihood of delirium-free/coma/free ICU days(DF/CF-ICU days) in critically ill trauma patients.

Methods: We reviewed adults in the trauma registry at an ACS-verified level I trauma center admitted to the ICU over 6 months. We collected demographics, injury severity, use of mechanical ventilation and restraints, Richmond Agitation and Sedation (RASS) Score and Confusion Assessment Method-ICU (CAM-ICU). Patients with missing RASS and CAM-ICU were assumed to have a DF/CF day. The likelihood of an DF/CF-ICU day was the endpoint for binary logistic regression with ISS, Head AIS, patient undergoing surgery, penetrating trauma, gender, age, restraint use, and mechanical ventilation as covariates, as well as maximum daily ABC-123 score.

Results: Our cohort had 172 patients. 69.8% (120) were male with mean age of 50.3±20.9 years. 16.3%(28) had penetrating trauma. Mean ISS was 18.5±9.5 with mean head AIS of 2.3±2.5. 48.3% (83) of patients underwent surgery during their admission, including 12.2% (21) laparotomies (8.1% (14) damage control laparotomies). 12.8% (22)had solid organ injuries, 5.8% (10) had small bowel injuries, 4.1% (7) had colon injuries, and 12.2% (21) had vascular injuries. 51.7% (89) were mechanically ventilated, 11.0% (19) died, 66.9% (115) had delirium during their admission, and 48.8% (84) had restraints used during their admission. Logistic regression analysis indicated ISS (OR 0.955[95%CI 0.934, 0.976],p<0.001), AIS Head (0.859[0.770, 0.959],p<0.001), restraint use (0.219[0.151, 0.320],p<0.001), and mechanical ventilation (0.342[0.229, 0.511],p<0.001) were associated with decreased odds of DF/CF days. Male gender (2.326[1.555, 3.480],p<0.001) was associated with increased odds of DF/CF days. Each point increase in the ABC-123 score was associated with a 19% increase in the odds of DF/CF days (OR 1.187[1.125, 1.252],p<0.001).

Conclusion: This is the first demonstration of the validity of a novel EPIC-EMR real-time ABCDEF Bundle compliance tool. With this tool providers can monitor compliance in real time and take corrective action to improve patient outcomes and prevent complications.

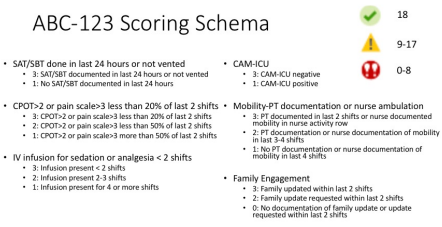

Figure. Scoring schema for ABC-123 score based on all six bundle elements.

Poster #112

STAYIN' ALIVE: MAN VERSUS MACHINE. COMPARING OUTCOMES IN MANUAL AND MECHANICAL CARDIOPULMONARY RESUSCITATION IN PREHOSPITAL TRAUMATIC CARDIAC ARREST

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Introduction: Mechanical cardiopulmonary resuscitation (MecCPR) has become more prevalent in the resuscitation of patients in out-of-hospital cardiac arrest. Previous studies have found no difference in survival in medical patients undergoing MecCPR versus manual CPR (ManCPR). However, no studies have examined its use in the trauma population. Prehospital MecCPR with the LUCAS (Lund University Cardiopulmonary Assist System) was introduced by local EMS in 2015. We sought to determine whether there was a difference in outcomes between prehospital ManCPR and MecCPR following acute traumatic injury.

Methods: This is a retrospective study of all adult trauma activations with concomitant prehospital CPR at an urban level 1 trauma center from January 2015 – December 2019. The primary endpoint was the rate of return of spontaneous circulation (ROSC); the secondary endpoints were the rate of survival to hospital admission and the rate of survival to 30 days.

Results: A total of 174 prehospital traumatic cardiac arrest patients were analyzed. Of these patients, 76 (44%) received MecCPR and 98 (56%) had ManCPR. There were 25 (14%) patients identified with signs of life (SOL) on EMS scene arrival. There was no difference in mechanism of injury between CPR groups (75% versus 77% penetrating injury, $p = 0.69$). ROSC was obtained in 36 of the 174 patients (21%). Of these, 29 (81%) patients had undergone ManCPR and 7 (19%) had undergone MecCPR ($p = 0.001$). Survival to hospital admission was achieved by 23 patients. A significantly higher number of patients achieved ROSC and survived to hospital admission by ManCPR compared to MecCPR (18 versus 5, $p = 0.023$). Survival to hospital admission was achieved by 11/18 (61%) of patients who had SOL and ManCPR and 5/7 (71%) with SOL and MecCPR. Overall, there was no difference in survival to 30 days post-cardiac arrest between CPR methods ($p = 0.079$).

Conclusion: Patients who underwent ManCPR after prehospital traumatic cardiac arrest had a significantly higher rate of ROSC and survival to hospital admission compared to patients who underwent MecCPR. There was no difference in 30-day survival between these two groups. Further prospective studies involving triage of CPR technique may impact the management of prehospital traumatic cardiac arrest.

Poster #113

EVALUATING THE RELATIONSHIP BETWEEN MEDICAID EXPANSION AND TRAUMA CENTER CLOSURES

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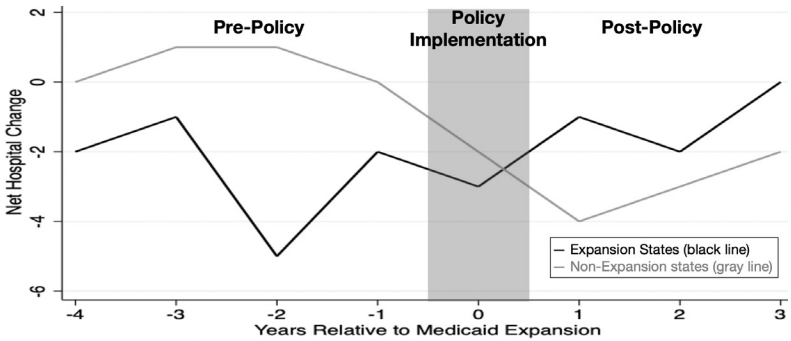
Introduction: While prior studies have demonstrated that participation in the Affordable Care Act's (ACA) Medicaid expansion was associated with better financial performance and lower likelihood of hospital closure, little is known regarding the association of a state's decision to expand Medicaid eligibility and trauma center closures.

Methods: The 2009-2017 American Hospital Association annual survey was used to identify all Level 1 and 2 trauma centers (TCs). The primary outcome was the net change in TCs (TC openings minus TC closures) each year. A difference-in-difference (DID) analysis was used to evaluate for pre- vs post-policy changes between states that did and states that did not expand Medicaid eligibility. For all non-expansion states and most expansion states, the pre-policy period was defined as 2010 to 2013 and the post-policy period was defined as 2015-2017. If a state expanded medicaid in a year other than 2014, then the pre-policy and post-policy periods were shifted accordingly. A washout period was defined as 2014 or the year a state expanded Medicaid.

Results: Overall mean annual number of major trauma centers was 674 (SD 23.4). Throughout the study period there were 63 major trauma center closures (South: 48%; Midwest: 22%; West 20%; Northeast 9%). Conversely there were 38 openings identified (South: 56%; Midwest:18%; West 26%; Northeast 0%). In the pre-policy period, the net change in TCs was -2.5 TCs in expansion states and +0.5 TCs in non-expansion states. In the post-policy period, the net change in TCs was -1 TCs in expansion states and -3 TCs in non-expansion states. Combined, the DID analysis yields a policy-associated net change of -5 TCs in states that did not expand Medicaid as opposed to expansion states (Figure, p=0.001).

Conclusion: States that did not take part in the ACA's Medicaid expansion had higher rates of TC closure than states that expanded Medicaid eligibility. These findings have important implications for financial viability of TCs and population-level access to timely trauma care.



Poster #114

THE SHOCKING TRUTH: PREHOSPITAL DELTA SHOCK INDEX PREDICTS MORTALITY, THE NEED FOR TRANSFUSION, AND OPERATIVE INTERVENTION

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Introduction: Shock Index (SI), the pulse rate divided by the systolic blood pressure, is associated with need for blood products, laparotomy and mortality in trauma. The delta shock index, assessed between the field and the emergency department is predictive of need for massive transfusion even among patients with normal blood pressures. Our hypothesis is that the change in shock index among trauma patients in the field is associated with increased need for blood product transfusion, operative intervention and mortality, and the impact of the change will differ based on the initial shock index.

Methods: We performed a prospective observational study to obtain vital signs (VS) from EMS agencies transporting patients to trauma centers as part of the Linking Investigators in Trauma and Emergency Services (LITES) network. SI was calculated from the first prehospital VS data and the change in SI was calculated from the field to the trauma bay. We performed logistic regression to estimate the odds ratio of delta SI, stratified by initial SI, with mortality or a composite outcome of mortality need for transfusion with 24 hours, and disposition to the OR. We used recursive partitioning to determine the values of SI and delta SI that functioned as the best discriminators for the composite outcome.

Results: A SI of 0.9 was the best discriminator for patients with the composite outcome. Among patients with a SI < 0.9, a delta SI 0.2 was the next best discriminator. Among patients with a SI > 0.2 the Odds ratio for the composite outcome is 3.3 (CI 3.0-3.8). For patients with a SI < 0.9, having an increase in delta SI of 0.2 from the field to the ED is associated with the combined outcome (OR 2.9, CI 2.5-3.4). Patients with both a first SI > 0.9 and a delta SI > 0.2 have an odds 12 time greater then patients with initial SI < 0.9 and a delta SI < 0.2 (OR 12.2, CI 8.8-16.8).

Conclusion: As both initial prehospital SI and delta SI increase, mortality, the need for blood transfusion, or operative intervention increases. SI and delta SI may improve existing models of trauma triage and identify patients in need of resuscitative interventions.

Poster #115

VITAL CAPACITY AT TERTIARY SURVEY PREDICTS COMPLICATIONS IN OLDER TRAUMA PATIENTS

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Introduction: Older trauma patients are at risk for both short and long-term complications. Vital capacity (VC) of 30% has been established as a clinical marker for stratifying risk of pulmonary complications in trauma patients with rib fractures. We hypothesize that a higher VC cut-off is necessary to predict complications in patients older than 65 years.

Methods: Patients ≥ 65 years old admitted to the trauma service between June 2017 and November 2018 were reviewed. Patients without documented VC or tertiary survey (TS) were excluded. The primary outcome was complications within 30 days post-injury. Demographics, VC, TS, and complications were compiled from the institution trauma registry and EMR. Complications included: death, pneumonia and other infections, aspiration, unplanned chest tube placement, retained hemothorax, acute deep vein thrombosis, pulmonary embolism, new oxygen requirement at discharge, dysphagia, delirium, urinary retention, severe electrolyte abnormalities, acute kidney injury, arrhythmia, symptomatic anemia, and ICU and hospital readmission. Secondary outcomes were ICU and hospital length of stay (LOS).

Results: We analyzed 151 patients; 71 (47.02%) had a recorded VC and TS and were included in the study. TS was performed at a median of 38.60 (IQR: 18.12-67.73) hours from admission. Patients who developed any complications within 30 days had a significantly lower VC at TS (38.18% vs 49.09%, $p = 0.033$). Using a receiver operating characteristic curve, a VC cut-off of 43% was deemed appropriate. Patients who had a VC at TS < 43%had more complications (1.63 vs 0.56, $p = 0.002$), were at higher risk for complications (RR 2.14, 95% CI: 1.29-3.56, $p = 0.0032$), and had increased ICU LOS (3.29 vs 0.97 days, $p = 0.0001$) and hospital LOS (7.94 vs 4.81 days, $p = 0.001$).

Conclusion: This is the first study to show that VC of < 43% at TS predicts a higher incidence of complications in older trauma patients. This is a higher cut-off than has been described for all adults which suggests that the lower cut-off may under-estimate risk in older patients. VC is an important tool to help risk stratify older trauma patients.

Poster #116

SIMULTANEOUS VERSUS SERIAL/SYNCHRONOUS INTERVENTIONS IN A HYRBID OPERATING SUITE FOR SEVERELY INJURED PATIENTS: A PROSPECTIVE EVALUATION OF DIFFERENCES IN RAPTOR OUTCOMES AND TECHNIQUES.

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Introduction: Truly simultaneous open and percutaneous procedures aimed at arresting life-threatening hemorrhage following major trauma are uncommon and underutilized. More frequently, hybrid procedures are performed in rapid serial/synchronous fashion by surgeons and interventional radiologists. Simultaneous procedures require modifications in technique, workflow and collaboration. The goal of this study was to prospectively audit outcomes in patients with ongoing hemorrhage who underwent truly simultaneous/concurrent open and percutaneous procedures compared to rapid serial/synchronous cases.

Methods: All adult ($\geq$ 16 years) patients who were severely injured (ISS $\geq$ 12), and required an intervention (open and percutaneous procedures) within the hybrid suite (R.A.P.T.O.R.) between April 4, 2013 and December 5, 2019 were prospectively evaluated. Simultaneous cases were compared to serial/synchronous procedures. Patient and injury demographics, flow of care, specific interventions and patient outcomes were evaluated. Standard statistical methodology was employed ($p < 0.05$=significant).

Results: Hybrid procedures required to stop ongoing hemorrhage were more frequently serial/synchronous (23) than simultaneous (12) in technique. Patient demographics were similar between groups (age = 46 years; sex = 89% male; 74% blunt mechanism; mean ISS = 29)($p > 0.05$). Patients undergoing truly simultaneous procedures were more often hemodynamically unstable (92% vs. 57%; p=0.033), required damage control (83% vs. 52%; p=0.03), were faster from hospital arrival to procedure initiation (31 vs. 59 minutes) and had fewer initial radiologic studies (25% vs. 70%; p=0.01). Hospital length of stay (16 vs. 13 days; p=0.44), intensive care unit stay (7 vs. 5 days; p=0.73), and mortality (17% vs. 13%; p=0.77) were similar between groups. Most percutaneous components were therapeutic (69%), and targeted the liver (46%), pelvis (33%) and/or aorta (21%). Specific technical alterations were also critical to successful simultaneous hybrid procedures (clinician positioning, instrumentation set-up, nursing teams, monitor/room orientation, closed loop communication).

Conclusion: Truly simultaneous hybrid procedures aimed at stopping ongoing hemorrhage are unique in both patient and procedural details. With appropriate pathways however, patient outcomes appear equivalent to rapid serial/synchronous procedures.

Poster #117

SEVERE BURNS WITH CONCOMITANT INHALATION INJURY ARE ASSOCIATED WITH HYPOFIBRINOLYSIS ON THROMBOELASTOGRAPHY.

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Introduction: Burn injury is associated with systemic coagulopathy. Concomitant inhalation injury (IHI) increases morbidity and likely contributes to the severity of burn-induced coagulopathy. Thromboelastography (TEG) is a viscoelastic hemostatic assay that provides a dynamic assessment of coagulation homeostasis at the point-of-care. The aim of this work is to identify the impact of IHI on coagulation parameters measured by TEG following burn.

Methods: A total of 119 burn-injured patients presenting to a regional burn center from 2012 to 2017 were enrolled in this prospective study. Whole blood was assessed at set intervals from admission through 21 days. Demographic data, and injury characteristics were obtained from the medical record. Blood samples underwent viscoelastic assay with kaolin-activated TEG (kTEG). Patients were grouped by the presence or absence of concomitant IHI. Statistical analyses of viscoelastic parameters (R, α, MA, and LY30) were performed using mixed-effect models. P-values < 0.05 were considered significant.

Results: Of the 119 thermally injured patients, most were male (70%) with a median age of 40 (IQR, 29-57) years. Patients with IHI (n=29) had higher TBSA burn size with median of 41 (21-80) vs. 10 (5-19) and greater mortality (41.4% vs. 7.8%). There was a trend towards higher α-angle in patients with IHI and this difference was significant at hour 24 (70.8, 68.8-74.6 vs. 68.1, 63.9-70.8, $p = 0.02$) and day 14 (81.5, 80.7-82.8 vs. 75.7, 67.5-79.8, $p = 0.02$). MA measurements were higher in the inhalation group at early timepoints (Hour 4: 62.4, 58-68.4 vs. 60 54.4-63.2, Hour 8: 59.4, 56.1-62.7 vs. 66.1, 58.3-67.8). On kTEG, LY30 was significantly lower in patients with inhalation injury at hours 2, 8, 48, 60, 84, 96, 108, 120, 132, and 156, $p < 0.05$. IHI is associated with a 3.43-fold (2.20-5.37, $p < 0.001$) risk of hypofibrinolysis (LY30 < 0.9%) after adjusting for gender, TBSA, and BMI.

Conclusions: Burn patients with IHI exhibited a greater degree of hypofibrinolysis. Based on higher α-angles and greater MA, the IHI subgroup was also relatively hypercoagulable. As expected, the group of patients with IHI had greater TBSA burns and greater mortality, suggesting that hypofibrinolysis and hypercoagulability are associated with increased burn severity and worse outcomes.

Poster #118

A COMPARISON OF GROWTH FACTORS AND CYTOKINES IN FRESH FROZEN PLASMA AND NEVER FROZEN PLASMA

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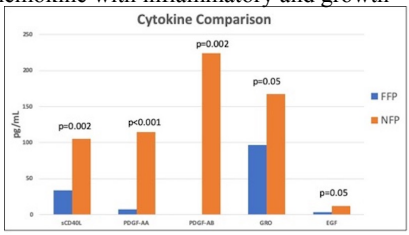
Introduction: Fresh frozen plasma (FFP) contains proinflammatory mediators released from cellular debris during frozen storage. In addition, recent studies have shown that transfusion of never-frozen plasma (NFP), instead of FFP, may be superior in trauma patients. We hypothesized that FFP would have higher levels of inflammatory mediators when compared to NFP.

Methods: FFP (n=8) and NFP (n=8) samples were obtained from an urban, level 1 trauma center blood bank. The cytokines in these samples were compared using a Milliplex (Milliplex Sigma) human cytokine magnetic bead panel multiplex assay for 41 different biomarkers.

Results: Growth factors that were higher in NFP included endothelial growth factor (EGF) (3.4 vs. 12.1 pg/mL, p=002), platelet-derived growth factor-AA (PDGF-AA) (7.8 vs. 114.4 pg/mL, $p < 0.001$), and PDGF-AB (0.0 vs. 224.1 pg/mL, $p < 0.002$). Soluble CD40-ligand (sCD40L), a platelet activator and pro-coagulant, was higher in NFP (1.4 vs. 6.9 pg/mL, p=0.002). Growth-regulated oncogene (GRO), a chemokine with inflammatory and growth stimulating properties was higher in NFP (96.9 vs. 167.3 pg/mL, p=0.05). RANTES, a leukocyte chemotactic cytokine was higher in NFP (107.1 vs. 1496.1 pg/mL, $p < 0.001$). Vascular endothelial growth factor (16.6 vs. 0.0 pg/mL, p=0.05) and macrophage inflammatory-protein-beta (20.1 vs. 11.6 pg/mL, p=0.02) were higher in FFP.



Conclusions: Frozen storage of plasma may result in inactivation of several growth factors and/or pro-coagulants found in NFP. In addition, the freezing and thawing process may induce release of pro-inflammatory chemokines. Further studies are needed to determine if these cytokines result in improved outcomes with NFP over FFP in transfusion of trauma patients.

Poster #119

RANDOM FOREST MODELING OUTPERFORMS ISS IN PREDICTING TRAUMA OUTCOMES

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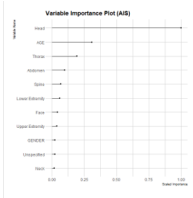
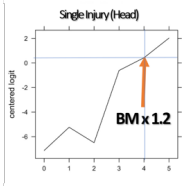
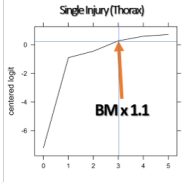
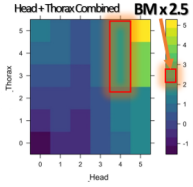
Oishei Children's Hospital of Buffalo









Introduction– Injury Severity Score (ISS) is the current standard in characterizing the anatomical injury severity in general trauma population however, it does not account for injury combinations or age. The purpose of this study was to compare ISS performance to 2 random forest (RF) models: 1) Abbreviated Injury Scale (AIS) mapped to 9 body regions (BR) and 2) ICD10 injury codes (RF-ICD10).

Methods– Pediatric (<18) and adult retrospective database analysis was performed using TQIP 2015-2017. Injury codes were deconstructed in the pre-dot (BR) and post-dot (AIS) components. ISS was calculated as the sum of the squares of the 3 most severe injury in 3 different BR. The first RF model included all injuries mapped to the 9 BR along with age (RF-AIS). The second RF model included age and all ICD10 injury codes logged for each patient (RF-ICD10). Model performance was assessed by comparing AUCs and confidence intervals for mortality and MSE and R2 for hospital length of stay (HLOS). Mortality risk (MR) for injuries, isolated or in combination, was expressed in reference to cohort baseline mortality (BM).

Results– 237593 children and 2357343 adults were included. Mortality was 0.87% in children and 2.73% in adults. RF-ICD10 (AUC-0.889, 95%CI[0.885, 0.894]) and RF-AIS (AUC-0.893, 95%CI[0.888, 0.897]) had similar performance in predicting mortality. Both outperformed ISS (AUC-0.861, 95%CI[0.856, 0.867]). In survivors, RF-ICD10 (MSE-61.4; R^2-0.325) outperformed both RF-AIS (MSE 61.8; R^2-0.246) and ISS (MSE-69.2; R^2-0.293) in predicting HLOS. Both models showed isolated head injuries (ICD10-S06) as the most lethal (MR=1.2xBM), followed by thoracic injuries (ICD10-S27; MR=1.1xBM). MR for the injury combination (2.5xBM) was higher than the sum of the risks of the isolated injuries.

Conclusions– By adjusting for age and factoring the combination of injuries, RF methodology allows for a better characterization of the anatomical injury and superior performance in predicting mortality and HLOS. With further improvement and validation on larger populational samples, RF may represent the future in trauma outcome benchmarking

Poster #120

USING CLAIMS DATA TO BENCHMARK HOSPITAL PERFORMANCE ACROSS THE U.S.

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Introduction: Trauma is a time-sensitive and heterogeneous condition with high morbidity and mortality. Registry-based risk adjustment is the current gold-standard for benchmarking hospital performance, but assessment is limited to hospitals that report their outcomes. We aimed to benchmark hospital performance across all US hospitals using an administrative claims-based risk adjustment model.

Methods: All 2013-14 ED-based claims for injured Medicare beneficiaries >= 65 years in the continental U.S. were included. A logistic regression model using CMS claims was trained on Pennsylvania trauma registry data, and used to estimate in-patient mortality in hospitals with > 9 cases. Proxies for physiologic registry variables (ICD-9-CM codes for abnormal blood pressure, pulse rate, and mental status), comorbidities, injury characteristics, and demographics were included. Predicted probabilities of death were estimated for all cases, summed, and compared as observed:expected (O:E) ratios. Trauma center (TC) designation was assigned using American College of Surgeons (ACS) accreditation, with state accreditation assigned for any non-ACS hospitals. Mortality at 1-year after hospital admission was also measured.

	Level I/II Trauma Centers (N=492)	Level III–V Trauma Centers (N=559)	Non-Trauma Centers (N=1,992)
Total Cases n (row %)	1,356,307 (26.0)	889,152 (17.1)	2,967,787 (56.9)
Cases/Hospital, median (IQR)	2,347 (1,600-3,533)	1,251 (718-2,015)	1,116 (566-1,901)
ISS >15, n (row %)	64,907 (46.8)	17,397 (12.6)	56,301(40.6)
ISS, median (IQR)	4 (1-5)	2 (1-5)	2 (1-5)
Head AIS ≥3, n (row %)	80,997 (45.5)	22,434 (12.6)	74,733 (42.0)
Hospital O:E Ratio, median (IQR)	1.2 (0.9-1.5)	0.9 (0.6-1.2)	0.8 (0.5-1.1)
O:E Ratio <1, n (row %)	24 (3.4)	130 (18.2)	562 (78.5)
O:E Ratio >1, n (row %)	141 (35.3)	70 (17.5)	189 (47.3)
Inpatient Mortality %, median (IQR)	1.7 (1.3-2.2)	1.0 (0.6-1.2)	0.8 (0.6-1.1)
1-year Mortality %, median (IQR)	17.3 (15.6-19.1)	16.6 (14.8-18.5)	16.3 (14.1-18.5)

Results: Among 3,043 hospitals, 5,213,246 trauma cases were identified. The mean age was 80 (SD: 8 years), 35% of injured patients were male, and falls accounted for > 60% of visits. Unadjusted mortality rates were highest in Level I/II TCs (2% vs 1% in other centers). O:E ratios were similar for Level I/II and Level III-V TCs (0-3.5 vs 0-3.9) but varied more for Non-TCs (0-6.4). The table describes case and hospital characteristics. High performing centers (O:E < 1) included 5% of Level I/II, 23% of Level III-V, and 28% of Non-TCs. More deaths than expected (O:E > 1) were seen in 29% Level I/II, 13% Level III-V, and 10% Non-TCs. One-year mortality for patients who survived to hospital discharge ranged from 5-24% at Level I/II TCs, 2-24% at Level III-V, and 2-40% at Non-TCs.

Conclusion: We benchmarked hospital performance for injured older adults using a claims-based risk adjustment model. While Level I/II TCs had the highest mortality rates, the variation in outcomes was also lowest in these centers. Our model used claims variables that served as proxies for TQIP registry variables and allowed for measurement of outcomes in 50% of the older adult population treated at non-TCs. In addition to inpatient mortality, claims-based models may also allow for estimation of long-term outcomes.

Poster #121

USE OF A NOVEL GIS PLATFORM TO MEASURE THE IMPACT OF SPATIAL ACCESS ON OUTCOMES FOR EMERGENCY GENERAL SURGERY

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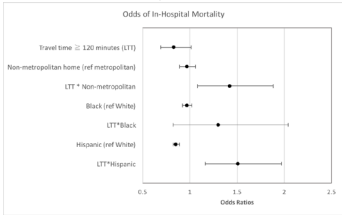
Introduction: Hospitals with emergency general surgery (EGS) capabilities are unequally distributed across the United States, leading to disparities in access and time to definitive care. Yet, it remains unclear how spatial access affects outcomes for EGS diseases - particularly for vulnerable populations. We developed a novel geographic information science (GIS) platform to examine the contribution of spatial access to outcomes and disparities for common EGS diseases using California as a pilot state.

Methods: California state inpatient discharge data was obtained from 2014-15 for all adults with non-elective admission for one of nine common EGS diseases. Shortest travel time from each patient's home zip code to the hospital of admission was calculated using serial modeling on existing road networks. Outcomes examined were in-hospital mortality and a composite of major morbidity. Generalized linear mixed effects regression analysis was performed to test the association of travel time ≥ 120 minutes with each outcome, controlling for relevant patient and hospital characteristics including advanced resources.

Results: 772,383 patients were analyzed: 772,383 (98.6%) < 120 minutes (short travel time, STT) and 11,006 (1.4%) ≥ 120 minutes (long travel time, LTT). Compared to the STT group, LTT had a greater proportion of white (65% vs 51%), private insurance (29% vs 21%), non-metropolitan residence (25% vs 6%) and advanced-resource hospitals (69% vs 64%), $p < 0.01$ for all. In multivariable analysis, LTT was not independently associated with in-hospital mortality (OR 0.83, 95% CI 0.69-1.01), however LTT significantly increased mortality for Hispanic patients (OR 1.51, 95% CI 1.16-1.97) and those from non-metropolitan areas (OR 1.42, 95% CI 1.08-1.88) (Figure). LTT was inversely associated with major morbidity overall (OR 0.84, 95% CI 0.78-0.90), but significantly increased odds of morbidity for Asian/Pacific Islander (OR 1.52, 95% 1.21-1.91), Black (OR 1.30, 95% 1.05-1.60) patients, and those requiring operative intervention (OR 1.16, 95% CI 1.01-1.32).



Conclusion: Spatial access to care, while not associated with overall mortality, is a contributor to disparities in EGS outcomes in California. LTT significantly increases mortality for Hispanic patients and those from non-metropolitan regions. Further work is needed to examine national patterns of spatial access and disparities in more geographically diverse regions. GIS modeling holds promise in planning EGS systems of care that optimize outcomes and mitigate disparities, particularly for non-metropolitan areas.

Poster #122

TRAUMATIC BRAIN INJURY INDUCED TEMPERATURE DYSREGULATION: WHAT IS THE ROLE OF BETA BLOCKERS?

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Introduction: Traumatic brain injury (TBI) is associated with sympathetic discharge that leads to post-traumatic hyperthermia (PTH). Beta-blockers (ββ) are known to counteract overactive sympathetic discharge by blocking the effect of epinephrine and nor-epinephrine. The aim of our study was to evaluate the effect of ββ on PTH in critically-ill TBI patients.

Methods: We performed a retrospective cohort analysis of the Medical Information Mart for Intensive Care (MIMIC-III) database. We included all critically-ill TBI patients with head abbreviated injury severity (AIS) ≥ 3 and other body regions AIS < 3 who developed PTH defined as (at least one febrile episode [T>38.3 °C] with negative microbiological cultures [blood, urine, and BAL]). Patients on preinjury ββ were excluded. Patients were stratified into two groups: (ββ +) and (ββ -). Propensity score matching was performed (1:1 ratio) controlling for patient demographics, injury parameters and other medications that influence temperature. Outcomes were the number of febrile episodes, maximum temperature, and the time interval between febrile episodes. Multivariate linear regression was performed.

Results: We analyzed a total of 4,286 critically-ill TBI patients. A matched cohort of 1,544 patients was obtained: 772 ββ +(metoprolol: 60%, propranolol 25%, and atenolol 15%) and 772 ββ -. The mean age was 54±25y, median head-AIS 3[3-4], and median ISS 16[10-20]. The overall median number of febrile episodes was 9[4-19], the median maximum temperature was 38.1[37.6-38.6] °C, and the median time between episodes was 2[1-6] hours. Patients in the ββ group had a lower number of febrile episodes (8 episodes vs 12 episodes; $p < 0.001$), lower median maximum temperature (38 °C vs. 38.2 °C; p=0.01), and a longer median time between febrile episodes (3 hours vs. 1 hour; p=0.01). On linear regression analysis, propranolol was found to be superior in terms of reducing the number of febrile episodes and the maximum temperature compared to metoprolol and atenolol. **Table 1** However, there was no significant difference between the three ββ in terms of reducing the time interval between febrile episodes ($p > 0.05$).

Conclusion: ββ attenuate post-traumatic hyperthermia by decreasing the frequency of febrile episodes, spacing out episodes, and reducing the maximum rise in temperature. Non-selective ββ are associated with greater control of post-traumatic hyperthermia. ββ may improve outcomes in TBI patients by preventing hyperthermia.

Table 1. Linear regression analysis for Beta Blockers sub analysis

	β -coefficient [95% Confidence Interval]		
Outcome	**Propranolol**	**Metoprolol**	**Atenolol**
Number of febrile episodes	-0.05[-0.07-(-0.02)]	-0.03[-0.04-(-0.01)]	-0.01[-0.02-(-0.016)]
Efficacy of reducing temperature	-0.2[-0.25-(-0.34)]	-0.17[-0.2-(-0.13)]	-0.15[-0.3-(-0.009)]

Poster #123

TRAINING NON-MEDICAL PERSONNEL AND MEDICAL STUDENTS IN "STOP THE BLEED": AN APPROACH TO TEACHING BLEEDING CONTROL IN MOZAMBIQUE

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Loma Linda Medical Center

Introduction: The *Stop the Bleed* campaign is well underway in the United States to teach the community how to identify life-threatening bleeding, apply pressure, pack wounds and apply tourniquets when appropriate. Our goal was to implement *Stop the Bleed* training in Mozambique, both in the community setting and in the medical school, and to assess the usefulness of the training provided.

Methods: We identified two groups of individuals to whom we provided *Stop the Bleed* training utilizing both foam noodles for instruction on pressure and packing and the use of Combat Application Tourniquet (CAT) and improvised tourniquets. The first group included individuals in the community in Maputo, Mozambique. This informal class was taught with a Portuguese translator with only a lecture, no PowerPoint, followed by a demonstration and hands-on practice by the community individuals. A survey was administered to the community setting following completion of training. The second group consisted of medical students at Universidade Eduardo Mondlane with traditional classroom instruction. A pre and post-survey was given to the medical students evaluating their perceived ability to identify and control bleeding.

Results: Groups of 30-50 individuals were taught *Stop the Bleed* in the community setting. Given the fluidity of the environment the exact number of individuals trained is unknown. A total of 39 surveys were returned by the community participants. Participants strongly agreed with the following statements: "I feel confident that I can recognize life threatening bleeding" (n=30, 76.9%), "I feel confident that I can apply pressure to a wound to control bleeding" (n=25, 64.1%), "I feel confident that I can pack a wound to control bleeding" (n=21, 53.8%), "I feel confident that I can place a tourniquet to control bleeding" (n=22, 56.4%). The formal setting included 10 medical students with one student lost at the post-instruction survey. We observed a statistically significant improvement comparing the pre-to post-instruction survey results from medical students in the ability to recognize life threatening bleeding (3 vs 9; p=0.0031), application of pressure (2 vs 9; p=0.0007), wound packing (3 vs 9; p=0.0031) and tourniquet placement (1 vs 9; p=0.0004).

Conclusion: *Stop the Bleed* instruction in the community and medical school setting in Mozambique is both feasible and effective. The community instruction received strong agreement in meeting the objectives of the *Stop the Bleed* course and the medical students showed a significant improvement in achieving the *Stop the Bleed* course objectives. This is the first research to our knowledge on *Stop the Bleed* education outside of the United States and requires further implementation and research to determine actual rather than perceived knowledge and skill level.

Poster #124

ANTIBODY-MEDIATED P-SELECTIN BLOCKADE DOES NOT EXACERBATE BLEEDING IN A MURINE CORTICAL CONTUSION TRAUMATIC BRAIN INJURY MODEL

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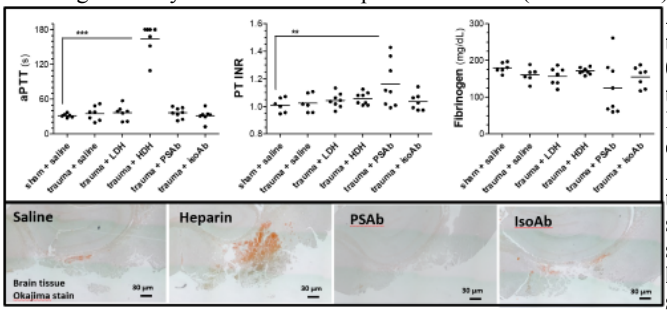
University of California Davis Medical Center

Introduction: Previously we demonstrated that blunt thoracic trauma promotes *in situ* P-selectin-dependent pulmonary arterial thrombosis (PAT). PAT was decreased by *in vivo* administration of a P-selectin blocking antibody. Current management of pulmonary thromboembolic events includes heparin anti-coagulation which poses risk of bleeding. Presently, our objectives were two-fold. In our thoracic trauma model, we first investigated the potential for systemic coagulative consequences following P-selectin antibody or heparin treatment. We then investigated effects of P-selectin blockade on intracranial hemorrhage after traumatic brain injury.

Methods: Adult male C57BL/6 mice were divided into two groups: sham and experimental injury by lateral blunt thoracic trauma. Thirty minutes after injury, mice were treated with P-Selectin blocking antibody (PSAb), isotype control antibody (IsoAb), low dose heparin (LDH), therapeutic/high dose heparin (HDH), or normal saline. At 90 minutes, whole blood was collected to test for plasma coagulation parameters (PT/aPTT/fibrinogen). Another set of mice were subjected to cerebral cortical impact (CCI) injury, followed by treatment (as above) at 30 minutes. Brains were examined at 24 hours using Okajima staining for hemoglobin to assess bleeding.

Results: In both groups, saline alone, IsoAb or LDH had no effect on coagulation parameters. HDH significantly increased PT compared to vehicle (normal saline) alone ($p < 0.001$; ANOVA; Dunnett post test). PSAb did not ($p > 0.05$). In contrast, PSAb treated mice had longer PT compared to the control group ($p < 0.01$; ANOVA; Dunnett post test). Heparin had no such effect. In mice subject to CCI, hemoglobin staining showed bleeding in all treatment groups, yet bleeding was not increased in the PSAb group, suggesting PSAb treatment does not increase intracranial bleeding after traumatic brain injury.



Conclusion: Despite change in PT, P-Selectin blockade did not increase intracranial bleeding following CCI injury. P-selectin blockade is a potentially effective therapy that may circumvent bleeding risk associated with heparin.

Poster #125

WORK SMARTER, NOT HARDER: TOWARD OPTIMAL STAFFING OF AN ACUTE CARE SURGERY SERVICE THROUGH ASSESSMENT OF TIME-DEPENDENT VOLUME

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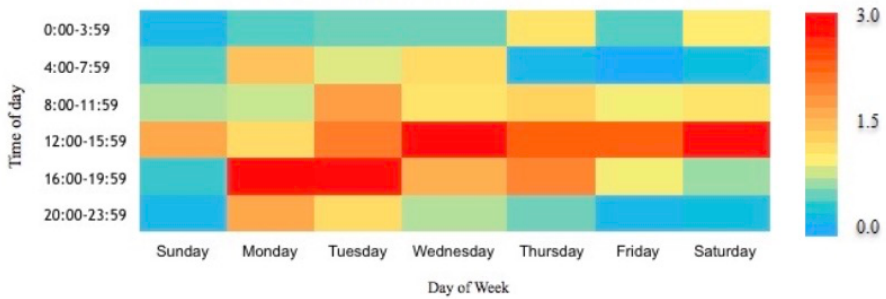
Introduction: A majority of Acute Care Surgery services in the United States are staffed on a fixed-call rotational basis. The staff schedule remains fixed, however, emergency surgery consults, cases, trauma activation, and trauma admissions fluctuate. Research has established variation in trauma admission in relation to time, these data are lacking in Acute Care Surgery. This study investigates temporal variations in Acute Care Surgery consults and admissions.

Methods: A single center retrospective review of our prospective Acute Care Surgery Database from 2017-2018. We included all consults and admissions that resulted in an operative procedure during that admission. Hourly and daily relative frequency of surgical consults and admissions were calculated to identify patterns and compare differences in relative volume by time.

Results: We identified 1138 total Acute Care Surgery emergency room consult and admissions and inpatient consults resulting in an operative procedure. To better visualize temporal variation, we utilized a heat map to illustrate the relative frequency of surgical cases compared to the total consults for daily time intervals (Figure 1). We found that there was a significant surge in frequency of operative surgical consults from 1200 to 1900 on weekdays ($p<0.001$ relative to the remainder of the day) while weekends showed lower volume overall than weekdays ($p=0.01$).

Conclusion: Data from our center suggest that weekday consultations from 1200 to 1900 result in the greatest number of surgical interventions. A staffing model that is tailored to meet the demand of this temporal surge will result in more timely surgical evaluations and has the potential to improve patient throughput. Additional work considering temporal variation in trauma and intensive care unit volume and acuity will shape optimal staffing for the comprehensive care delivered by our service.

Figure 1. Acute Care Surgery operative consultation frequency by day and time.



Poster #126

AN ABBREVIATED TRAUMA ACTIVATION FOR SELECT GERIATRIC PATIENTS OPTIMIZES TRAUMA RESOURCE UTILIZATION

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Introduction: Geriatric patients on anticoagulant and antithrombotic (AC/AT) therapies comprise an expanding portion of the population with a higher incidence of injury. Guidelines recommend elevating the level of trauma team activation for patients ≥ 65 years to appropriately triage this medically complex population. Our institution amended its trauma criteria to require a Tier II activation for patients ≥ 65 years on AC/AT therapy presenting with suspected head or torso trauma. Review of institutional data demonstrated significant over triage with this protocol change. To address trauma overutilization, an abbreviated level of trauma activation (Tier III) was instituted that prioritized patients ≥ 65 years on AC/AT therapy without engaging a full complement of trauma resources.

Methods: We performed a retrospective review of trauma patients one year before (PRE) and after (POST) Tier III implementation. AC/AT therapy was defined as all coagulation-altering agents including low-dose aspirin. Statistcal analysis of data including demographics, activation level, injury severity, ED disposition, mortality, and LOS was performed; $p < 0.05$ was significant.

Results: 869 patients met inclusion criteria. There were no differences in demographics, LOS or mortality. GCS, ISS, AIS-head, and ICU admissions significantly differed between groups (Table 1 & 2). A majority (59.5%) of Tier III patients were discharged home from the ED.

Conclusions: Institution of an abbreviated trauma activation criteria for select geriatric patients on AC/AT therapy improved trauma resource utilization without negatively affecting patient outcomes.

Table 1. Patient Demographics & Characteristics

	PRE	POST	P-Value
Number of Patients	398	471	
Average Age, y (SD)	80 (8.8)	79 (8.6)	0.092
Males, No. (%)	163 (41)	201 (42.7)	0.6183
GCS, Mean (SD)	14.6 (0.8)	14.2 (2.4)	<0.001
ISS, Mean (SD)	8.7 (6.5)	12.1 (10)	<0.001
AIS Head, Mean (SD)	2.4 (1.2)	2.7 (1.3)	<0.001
ICH (%)	35 (8.79)	53 (11.25)	0.2313
LOS (SD)	1.4 (0.8)	1.4 (0.95)	1.0
Mortality (%)	11 (2.8)	10 (2.1)	0.5038

Table 2. Post ED Disposition

	PRE	POST	P-Value
Number of Patients*	386	449	
Home (%)	172 (44.56)	201 (44.77)	0.9523
ICU (%)	38 (9.84)	81 (18.04)	0.0007
OR (%)	4 (1.04)	11 (2.45)	0.1254
Med/Surg Unit (%)	51 (13.21)	46 (10.25)	0.1824
Step Down Unit/Intermediate (%)	116 (30.05)	109 (24.28)	0.0609
Interventional Angiography (%)	0 (0)	1 (0.22)	0.3568
Morgue (%)	2 (0.52)	0 (0)	0.1270
Transfer to Another Hospital (%)	3 (0.78)	0 (0)	0.0610

*Patients with known post ED disposition

Poster #127

PREHOSPITAL WHOLE BLOOD TRANSFUSION IS ASSOCIATED WITH INCREASED SURVIVAL AND LESS BLOOD TRANSFUSIONS

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Introduction: US trauma centers have begun incorporating low-titer, group O whole blood (WB) into hemorrhage resuscitation, with some even adding WB to aeromedical transports. We hypothesized that patients receiving prehospital WB would require less post-arrival products and have increased survival compared to those receiving only component.

Methods: This study was approved by our institutional IRB. We evaluated all trauma patients that received prehospital blood products by our helicopter service between 07/17-07/19. Patients were divided into those who received prehospital WB and those who received RBC and/or plasma (COMP). Following univariate analyses, a multivariate model was created to evaluate survival and post-arrival blood products (0 to 24 hours). Statistical analysis was performed using STATA 12.1.

Results: 366 patients met inclusion criteria (220 prehospital WB, 146 prehospital COMP). WB patients were more likely to be male (77 vs 53%), have sustained penetrating trauma (31 vs. 25%), and to have higher ISS (median 27 vs. 19); all $p < 0.05$. WB patients had lower field systolic pressures (median 94 vs. 102; p=0.023) and were more likely to have (+) field FAST exam (63% vs. 53%; p=0.071). On arrival, WB patients had lower systolic pressures (median 92 vs. 102; p=0.028) and higher lactate values (4.4 vs 3.4, p=0.051) than COMP patients. While the univariate analysis noted no difference in survival (81 vs. 77%, p=0.364), the multivariate regression model demonstrated field WB was associated with a two-fold increase in survival (TABLE). Using this same model, patient's receiving prehospital WB had an almost 60% reduction in post-arrival transfusions (OR 0.42, 95% C.I. 0.21-0.86, p=0.018).

Conclusion: Prehospital WB transfusion is associated with two-fold increased odds of survival compared to COMP transfusions. In addition, WB patients received less transfusions after arrival than those treated with prehospital COMP products.

TABLE: Multivariate model for predictors of survival

	Odds Ratio	95% C.I.	p-value
Prehospital WB	2.18	1.02-4.69	0.042
Male gender	1.49	0.72-3.11	0.279
ISS	0.92	0.90-0.95	< 0.001
Prehospital SBP	1.01	0.99-1.03	0.165
Arrival Lactate	0.84	0.77-0.92	< 0.001

Poster #128

DO HOSPITALS THAT DELAY AMPUTATIONS SAVE MORE MANGLED LOWER EXTREMITIES?

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Introduction: One of the most challenging decisions in the management of the severely injured, or "mangled", lower extremity is the decision to proceed with amputation. Although early amputations may result in shorter hospital stays and lower rates of sepsis, they may also result in the removal of otherwise salvageable limbs. Given the challenge in deciding when to proceed with an amputation, we hypothesized that rates of early amputation, and potentially limb salvage, vary across hospitals. The objective of this study was to evaluate the relationship between a hospital's early amputation rate and a patient's overall odds of undergoing an amputation after sustaining a mangled lower extremity.

Methods: We performed a retrospective, cohort study of adults who sustained a mangled lower extremity and were treated at a Level I trauma center. Data were derived from the American College of Surgeons Trauma Quality Improvement Program (2012–2017). Patients who sustained either a severe crush injury (Abbreviated Injury Scale score ≥ 3) or a severe fracture with significant associated tissue injuries were identified as having a mangled leg. Early amputation was defined as an amputation within 24hrs of presentation. A hospital's early amputation rate was calculated by dividing the number of patients who underwent an amputation within 24hrs of presentation by the total number of patients with a mangled extremity. Hierarchical logistic regression was used to model the relationship between early amputation rate, patient and hospital characteristics, and the overall probability of amputation.

Results: A total of 4,987 patients with a mangled lower extremity were identified at 209 hospitals. Of these, 848 (17.0%) received an early amputation and 2,797 (56.1%) underwent amputation at any point during their hospital course. Across hospitals, the rate of early amputations ranged from 0 to 83.3% (mean 29.6%, ± 14.9%). Controlling for patient and hospital characteristics, the median difference in the odds of undergoing an amputation varied by 54% across hospitals (median odds ratio 1.54). However, there was no association between a hospital's rate of early amputation and a patient's overall odds of undergoing an amputation (OR 1.00; 95% CI 0.99 – 1.00). The only hospital characteristic associated with amputation was the volume of patients presenting with a mangled lower extremity (OR 0.59; 95% CI 0.41 – 0.85, highest vs lowest volume hospitals).

Conclusion: Both timing of amputations and likelihood of receiving an amputation vary significantly across trauma centers. However, variability in hospital volume rather than in timing of amputations contribute to the variability in amputation rates. These findings suggest that trauma centers that delay amputations are not increasing rates of limb salvage. Instead, centers with greater experience have higher rates of limb salvage. Identifying strategies to ensure patients with mangled lower extremities are triaged to these high-volume centers may represent an opportunity to improve the management of these complex injuries.

Poster #129

INADEQUATE VTE CHEMOPROPHYLAXIS WITH EPIDURALS IS ASSOCIATED WITH HIGHER VTE RATES

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Cedars-Sinai Medical Center

Introduction: Venous thromboembolism (VTE) is a potentially preventable complication after trauma that has recently led to higher doses of low molecular weight heparin (LMWH) for prophylaxis. For those patients who require an epidural catheter the risks and benefits of the recommended treatment with LMWH must be considered. Our aim was to compare adequate and inadequate pharmacological prophylaxis to determine the impact on the VTE rate and epidural complications to better understand the risk and benefits associated with the higher recommended doses of LMWH.

Methods: Trauma patients who required an epidural catheter between 2012 and 2019 were reviewed for VTE and epidural related complications. The type and dosing of pharmacological prophylaxis was compared to determine if there was an association with VTE or epidural related complications. Adequate dosing was defined as enoxaparin 30 mg or 40 mg twice daily. Inadequate dosing was defined as receiving unfractionated heparin subcutaneously, enoxaparin once daily, or no chemoprophylactic agent.

Results: Over the 8-year study period, 115 trauma patients required an epidural catheter with 65.2% male with a mean age 55.5 years and ISS of 16.2. Epidural catheters were associated with 11 (9.6%) patients developing an acute deep vein thrombosis (DVT) and 2 (1.8%) patients with an acute pulmonary embolism. Those patients who received adequate doses of enoxaparin were less like to have any VTE or DVT (table). Complications associated with epidural catheters were not dependent on the type of pharmacological prophylaxis (table).

Conclusion: Given the high VTE rate observed in trauma patients who required an epidural catheter, along with the low rate of complications that were not associated with the type of pharmacological prophylaxis, the data indicate that the current efforts for higher doses of LMWH appear to be safe and should be encouraged.

Table	Total (115)	Inadequate (71)	Adequate (44)	P value
VTE (%)	11 (9.6%)	10 (14.1%)	1 (2.7%)	0.049
DVT (%)	11 (9.6%)	10 (14.1%)	1 (2.7%)	0.049
PE (%)	2 (1.7%)	2 (2.8%)	0 (0%)	0.52
Epidural Abscess	1 (0.9%)	1 (1.4%)	0 (0%)	>0.99
Epidural Hematoma	1 (0.9%)	1 (1.4%)	0 (0%)	>0.99
Infection at epidural site	2 (1.7%)	2 (2.8%)	0 (0%)	0.52
Spinal headache	1 (0.9%)	1 (1.4%)	0 (0%)	>0.99

Poster #130

PNEUMONIA DIAGNOSIS USING FUNCTIONAL NEUTROPHIL ANALYSIS ON BAL FLUID

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Introduction: Although secondary pulmonary infection continues to be the most frequently reported infection in surgical ICU patients, diagnosis remains a challenge. With the flux of inflammation after injury and infection, accurate prediction of which patients are susceptible or immunologically competent to combat a secondary lung infection has yet to be determined. The innate immune system is the first to mobilize in response to a lung infection, and neutrophils are fine-tuned to functionally respond. Neutrophil populations are accessible through routine bronchoscopy and BAL, whereas culture data may take days to be of diagnostic use. We hypothesized that functional analysis of neutrophils in BAL fluid can be utilized to diagnose infection after trauma.

Methods: We analyzed clinical markers from surgical ICU patients who underwent diagnostic bedside bronchoscopy for pneumonia (n=78) to investigate possible differences in diagnostic criteria (labs, vitals, radiologic findings) and current prognostic scores between patients with and without pneumonia, as determined by final bacterial growth of >10,000 on BAL. We then obtained BAL samples from surgical ICU patients suspected of having pneumonia (n=9). These samples then underwent neutrophil functional analysis using oxidative burst measured on flow cytometry. We additionally analyzed cellular TNF-alpha production using enzyme-linked immune absorbent spot (ELISpot) analysis, before and after LPS stimulation. A student t-test was used for statistical comparison, and p-values ≤ 0.05 were considered significant.

Results: Results from our clinical data demonstrated that the Charlson Comorbidity, Pneumonia Severity Index (PSI) and APACHE II scores were poor predictors of infection and outcomes in our trauma patient population, with no significant difference between patients with and without pneumonia. Flow cytometric analysis from neutrophils from BAL fluid demonstrated significantly higher proportion of total and activated neutrophils in patients ultimately diagnosed with pneumonia ($p<0.01$). Functionally, patients without pneumonia were capable of responding to LPS stimulation with higher TNF-alpha levels than patients with pneumonia, in both spot number and size ($p<0.03$).

Conclusions: The use of current clinical prognostic scores did not predict the presence of secondary pneumonia in our trauma ICU population. This indicates that better early diagnostic indicators of infection are needed. Data using human BALs shows specific neutrophil patterns in BAL fluid from patients with and without pneumonia as well as differential production of TNF-alpha in response to an LPS challenge. Our data suggests a novel mechanism to predict pneumonia in the trauma population. The ability to predict pneumonia and immune response using BAL fluid could lead to targeted early care of trauma patients most susceptible to pulmonary infection.

Poster #131

THE UPTIC SCORE: A TRAUMA BAY TOOL FOR IDENTIFYING PATIENTS AT HIGH RISK OF UNPLANNED ICU TRANSFER

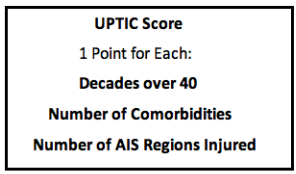
Michael Mazzei MD, Jessica Beard MD, MPH, Zoe Maher MD, Elizabeth D. Dauer MD, Leonard Mason MD, Thomas A. Santora MD, Amy J. Goldberg MD, Lars O. Sjoholm MD, Abhijit S. Pathak MD
Temple University Hospital

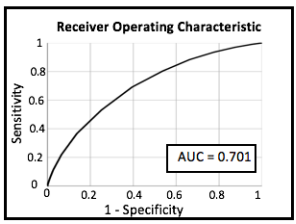
Objectives: For trauma patients, unplanned ICU transfer after floor admission is associated with increased mortality, and patients admitted to the ICU from general medical floors have worse outcomes than those admitted to the ICU directly from the ED. Appropriate triage of trauma patients is paramount to ensure good outcomes. The objective of this study was to develop a simple trauma bay score for identifying patients at high risk of unplanned ICU transfer after floor admission.

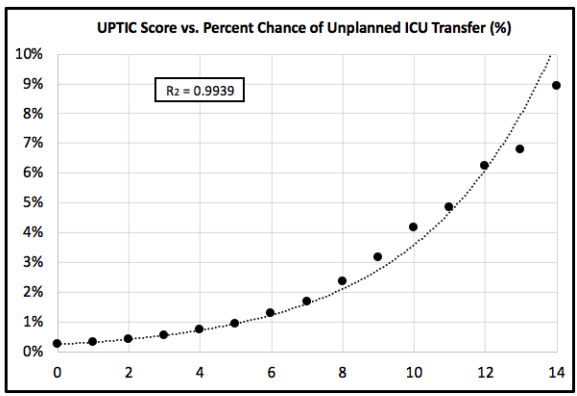
Methods: Using univariate and multivariate analyses, characteristics associated with unplanned transfer to the ICU after initial floor admission were identified from a 2013-2014 derivation cohort. A simple predictive model, the Unplanned Transfer to Intensive Care (UPTIC) Score, was generated [age in decades over forty + number of comorbidities + number of AIS regions injured] and tested against a validation cohort derived from the 2015-2016 TQIP database.

Results: Of the 431,304 patients initially admitted to the floor, observation, or telemetry from the ED, 5,023 had an unplanned ICU admission during their hospital stay. This was associated with significantly higher mortality than patients either admitted to the floor who did not require ICU (12.6% vs. 0.86%, RR=14.6, $p < 0.001$), or patients who were primarily admitted to the ICU (12.6% vs. 9.07%, RR=1.39, $p < 0.001$). The UPTIC Score predictably identifies individuals at risk of unplanned ICU transfer ($R2 = 0.994$) with fairly strong discriminative capacity in both the derivation (AUC = 0.71) and validation cohorts (AUC = 0.69). Potential cutoffs for ruling out (UPTIC 10 = > 5% risk) high-risk patients are proposed.

Conclusion: The UPTIC score is a simple and effective tool which may be employed in the trauma bay to identify patients with a heightened risk for unplanned ICU transfer if initially admitted to the floor.







Poster #132

PRE-INJURY FUNCTIONAL INDEPENDENCE DOES NOT CORRELATE WITH DISCHARGE DISPOSITION IN OLDER TRAUMA PATIENTS

Emma Holler BS, Ashley D. Meagher MD, MPH, Gabriel Kinnaman BS, Damaris Ortiz MD, Malaz Boustani MD, MPH, Ben L. Zarzaur MD, MPH
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Introduction: There is little in the current literature describing trauma patients' perception of functional independence prior to injury. We aimed to describe self-reported functional independence prior to injury in relation to discharge disposition after hospitalization.

Methods: Data were obtained from baseline surveys completed by 179 patients in the Trauma Medical Home study cohort, enrolled from October 2017 to present at three level 1 trauma centers in Indiana. Patients were included if they were at least 50 years old, had an Injury Severity Score (ISS) of 9 or higher, were able to consent, spoke English, and had access to a telephone. Terminal illness, neurodegenerative illness, substance abuse disorder, severe psychiatric illness, traumatic brain injury, incarceration, neurologic deficit, and a primary residence > 50 miles from Indianapolis were exclusionary. Data collected included demographics, injury information, and select patient reported outcome measures including: Katz Index of Activities of Daily Living, Short Form 36, GAD-7, and PHQ-9. Multivariable logistic regression was performed to identify predictors of non-home discharge after hospitalization for injury. All analyses were completed using SAS 9.4.

Results: Average patient age was 67.79 (SD 10.7). Patients were predominantly white (88.8%) and female (53.6%) with a median ISS of 12 (IQR 10-14). The most common mechanism of injury was fall (52.1%), followed by motor vehicle crash (44.2%). Nearly all patients (n=168, 93.9%) reported independence in basic activities of daily living prior to hospitalization for injury. Overall discharge disposition varied, 51.4% (n=91) of patients were discharged home, 37.3% to subacute rehabilitation (n= 66) and 10.7% to acute rehabilitation (n=19). On multivariate regression, there was no relationship between reported pre-injury independence and likelihood of discharge home (p=0.059). However, ISS $\geq$ 16 (OR=2.62, 95% CI 1.15-5.97) and female gender (OR=3.25, 95% CI 1.61-6.59) were associated with significantly greater odds of discharging to a facility.

Conclusion: This is the first examination of trauma patient discharge disposition and relationship with pre-injury self-reported functional status in injured older adults. Despite the vast majority of patients reporting high functional independence prior to injury, just over half will discharge home after their acute hospitalization. It is imperative that discussions regarding discharge disposition are initiated early during acute hospitalization and that trauma programs work to improve patients' likelihood of returning to functional independence.

Poster #133

INCREASED INCIDENCE OF DEEP VENOUS THROMBOSIS IN GERIATRIC TRAUMA PATIENTS TREATED WITH EMPIRIC TRANEXAMIC ACID

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Introduction: Hemorrhage remains the leading cause of preventable death in trauma. The early empiric administration of tranexamic acid (TXA) has been shown to decrease mortality, though most investigations have focused on a young trauma population. Further, studies have reported an increase in venous thromboembolic (VTE) complications in patients receiving TXA. Our ACS Level 1 Trauma Center serves a state with the oldest per capita population in the United States. To our knowledge, there have been no studies regarding the survival benefit and incidence of VTE in elderly trauma patients receiving empiric TXA. We sought to investigate the impact of empiric TXA administration in geriatric trauma patients ($\geq$65 years of age) with respect to mortality, blood product use, and complications, including VTE (diagnosed deep venous thrombosis, pulmonary embolism).

Methods: A retrospective 5-year review of a single Level 1 Trauma Center registry was performed. Patients $\geq$65 years of age who received early empiric TXA between January 1, 2014 and December 31, 2019 were included. A matched (ISS, lower extremity AIS, gender, age and who received $\geq$1 unit of blood product) control group was identified from the trauma registry and used in a 2:1 (no TXA: TXA) paired case-control study. Statistics were performed using Student's t-test and chi-squared test with $p<0.05$ for significance.

Results: Nineteen patients were identified in our trauma registry from January 1, 2014 – December 31, 2019 who were $\geq$ 65 years old and received TXA following a blunt mechanism of injury. The average age of these 19 patients was 66 ± 15 years of age, equivalent to the control cohort (n=38, 71 ± 4.1 years of age). There was no difference in ISS, incidence of lower extremity injuries, lower extremity AIS score, head AIS score, units of total blood products received, or hospital mortality between cohorts. There were no pulmonary embolisms in either cohort. There were 2 deep venous thromboses (DVT) diagnosed in the TXA cohort and no DVTs in the matched cohort ($p=0.04$).

Conclusion: No improvement in survival was observed with the early empiric use of TXA in elderly trauma patients. Importantly, an increased incidence of DVT was observed (11%) in patients who received TXA. To the authors' knowledge, this represents the first efforts to specifically look at the empiric use of TXA in geriatric patients, a population at high risk for complications including VTE and hemorrhage related death. The incidence of DVTs was significantly higher in those elderly patients who received TXA and notably higher than the reported incidence in younger patients receiving empiric TXA. This warrants further study. We are currently undertaking a prospective and protocol-driven effort to continue this work to further elucidate the benefits and potential complications of empiric TXA in geriatric trauma patients.

Poster #134

TRAUMA SYSTEM ACCREDITATION AND PATIENT OUTCOMES IN BRITISH COLUMBIA: AN INTERRUPTED TIME SERIES ANALYSIS

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Introduction: Periodic external accreditation visits aiming to determine whether trauma systems and centers are fulfilling the criteria for optimal care are now common in Canada. However, their impact remains unclear. A recent systematic review found inconsistent results on the association between accreditation and patient outcomes, mostly due to the lack of robust controls. We aim to address these gaps using a quasi-experimental design to assess the impact of several accreditation cycles on patient outcomes, specifically in-hospital mortality, complications and hospital length of stay.

Methods: Data are from admissions to all level I and II trauma centers in British Columbia, Canada between January 2008 and March 2018. We first obtained quarterly estimates of the proportions of in-hospital mortality, complications and survival to discharge status adjusted for change in patient case-mix using prognostic scores and the Aalen-Johansen estimator of the cumulative incidence function. We then performed piecewise regressions to estimate the change in levels and trends for patient outcomes following accreditation.

Results: For in-hospital mortality and major complications, accreditation was associated with a sustained reduction in levels and trends of these outcomes after the first cycle. Only temporary changes were observed for subsequent cycles. However, the 95% confidence intervals for these estimates were wide, and we lacked the precision to consistently conclude that accreditation is beneficial.

Conclusion: Using a quasi-experimental design while accounting for changes in patient case-mix, our results indicate that accreditation might reduce in-hospital mortality and major complications. Further studies looking at clinical processes of care and other outcomes such as patient or health staff satisfaction are needed.

Poster #135

GENTRIFICATION: WHAT IS THE IMPACT ON SHOOTING VICTIMS IN A RAPIDLY CHANGING CITY?

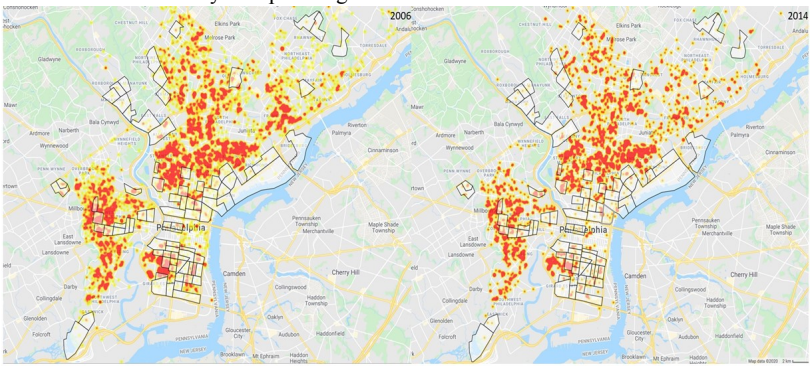
Dane Scantling DO, MPH, **Whitney Orji BS,** Justin Hatchimonji MD,
Elinore J. Kaufman MD, MSc, Daniel N. Holena M.D.
University of Pennsylvania

Introduction: Many major trauma centers are located in areas with high population and injury densities. In recent decades, urban centers in the U.S. have undergone a renewal process, and the associated gentrification has led to displacement of communities at risk for violent injury. We hypothesized that gentrification in Philadelphia had moved gunshot wound (GSW) victims away from the trauma centers that serve them.

Methods: Philadelphia Police Department data between 2006 and 2014 was queried for GSW, defined here as aggravated assault with a firearm. We plotted GSW using city block level location and provided latitude and longitude and blocks were grouped into tracts. Census tracts were eligible to gentrify if they had at least 500 residents as well as income and median home values in the bottom 40th percentile of the metropolitan area at the beginning of study period as determined by US Census data. Census tracts were considered to have gentrified over the study period if the number of residents over 25 years with a bachelor's degree increased and the inflation-adjusted home price increased to the top third percentile in the metropolitan area. Census tracts were cross-mapped to compare to shooting data and create heat maps of incident density. Number of shootings within one mile of an adult trauma center (n=6) was calculated as was the difference in number of shootings in gentrified and non-gentrified areas over the study period.

Results: 83/384 tracts (28%) gentrified over the study period and 23,164 shootings were captured in the PPD database (Figure, shooting density depicted in heat mapping, gentiried tracts outlined). The proportion of shootings within gentrifying tracts significantly dropped between 2006 and 2014 (16.6% to 13.7%, $p < 0.001$). 2/6 trauma centers were located in tracts that gentrified over the study period. The number of shootings within a mile of a Philadelphia trauma center did not change between 2006 and 2014 (17.9% vs 18.5%, $p = 0.612$). However, the share of shootings within one mile of the hospitals in gentrifying centers significantly decreased (13% vs 8%, $p = 0.03$ and 13.2% vs 7.8%, $p = 0.01$). Shooting densities moved but with no clear pattern of change. Overall shootings decreased year to year over the study period from 3,742 in 2006 to 2,318 in 2014.

Conclusion: The distribution of shootings in Philadelphia moved signifcantly out of gentrifying areas but remained largely within a mile of an adult trauma center, though not necessarily the same ones as in 2006s. Overall shootings decreased from 2006-2014. It is not known what the contribution of gentrification was to the overall drop in shootings across the city. Given ongoing gentrification across the country, and ongoing rapid changes in Philadelphia, such study may aid in future resource allocation and trauma system planning.



Poster #136

WHAT DOSE OF LEVOPHED JUST LEAVES'EM DEAD: DETERMINING FUTILITY OF VASOPRESSOR SUPPORT ACROSS ICU POPULATIONS

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Introduction Norepinephrine (Levophed) is the first line agent for vasopressor support in the setting of septic shock, however, there is no consensus on a maximum or futile dose. We sought to elucidate the maximum dose of Levophed with respect to cumulative dose and singular maximum infusion rate in surgical and medical intensive care units (SICU and MICU) and trauma patients. We hypothesized that trauma patients on Levophed would have a higher rate of mortality compared to other surgical and medical patients.

Methods A retrospective review was conducted of 937 SICU and MICU patients admitted May 2017-June 2018 at a large academic medical center. Trauma patients were analyzed as a subgroup of SICU patients. Univariate, multivariate, and Area Under the Curve analyses with Youden Index (sensitivity + specificity -1) were calculated to determine inflection points for futility of Levophed for maximum infusion rate (in mcg/min, per the standards of our institution) and cumulative dosage (in mg).

Results The patient population was 54.9% male, 75.8% white, and 60±16 years old. 384 (69.8%) were admitted to MICU and 166 (30.2%) were admitted to SICU, including 38 trauma patients. An overall inflection point in mortality was seen at a maximum rate of 15.5mcg/min (sensitivity .73; specificity .75; Youden Index .482) and a cumulative dose of 17.52mg (sensitivity .62; specificity .77; Youden Index .394). On multivariate analysis, Levophed dose correlated with an increase in mortality, with odds ratios increasing to 14.42 (95% CI 6.46-32.19; Youden Index .23) for those on Levophed greater than 41mcg/min. On subgroup analyses, the inflection point was higher in the MICU patients at 20 mcg/min (sensitivity .66; specificity .82; Youden Index .48) and lower in the SICU patients at 10mcg/min (sensitivity .77; specificity .77; Youden Index .54). MICU patients also had an increased maximum dosage of 30.18mg (sensitivity .52; specificity .87; Youden Index .39) while SICU patients had a decreased dosage at 2.64 (sensitivity .85; specificity .51; Youden Index .36). In trauma patients, Levophed ≤10mcg/min was found to have a mortality rate of 76.2% (OR 7.68; 95% CI 1.81-32.68; Youden Index .468) and 11-20mcg/min was found to have an 84.6% mortality rate (OR 8.25; 95% CI 1.5-45.43; Youden Index .406). Trauma patients receiving over 20mcg/min Levophed had a 100% mortality rate.

Conclusion A maximum administration rate of 15.5mcg/min and cumulative dose of 17.52mg of Levophed were the inflection points for mortality risk in all ICU patients, with SICU patients tolerating lower maximum single and total doses. In trauma patients, Levophed greater than 20mcg/min was associated with 100% mortality, which was notably more lethal than in other populations. Taken together, our data suggest that MICU, SICU, and trauma patients in shock differ in need for, response to, and outcome from escalating doses of vasopressor support.

Poster #137

EMERGENCY GENERAL SURGERY PATIENTS: RATES OF PSYCHIATRIC DISORDER AND IMPACTS OF SOCIAL SUPPORT AND PAIN

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Introduction: Annually, more than three million patients in the United States are admitted to hospitals for emergency general surgery (EGS), a patient population that accounts for more than $6 billion in annual costs to healthcare systems. EGS patients are complex; approximately half develop post-operative complications, and 15% require readmission within 30 days. These findings highlight the complicated medical course of EGS patients and the need to understand factors that impact their well-being. One such factor likely impacting the trajectory of EGS outcomes is psychiatric health. Psychiatric comorbidities have been shown to impact treatment adherence, cost, and premature mortality risk. Despite the complexities of the EGS patient population, and research in other patient populations showing the impact of psychiatric comorbidities on patient outcomes, there is a dearth of research on mental health of EGS patients. To the authors' knowledge, no prior study has explored mental health outcomes in an EGS population. Thus, the purpose of the current study was to characterize the mental health of EGS patients and to assess the impact of pain and social support on symptom severity.

Methods: Adult EGS patients were screened for participation in this study during their inpatient hospitalization. Exclusion criteria were age less than 18 years, inability to communicate in English, and altered mental status. Eligible patients were approached by trained research staff. Enrolled patients ($N = 53$) were administered several assessments while in the hospital. Assessments included a standardized psychiatric diagnostic interview (MINI International Neuropsychiatric Interview); the Center for Epidemiologic Studies of Depression Scale, Revised (CESD-R); the Beck Anxiety Inventory (BAI); the Brief Pain Inventory (BPI); and the Social Support Questionnaire (SSQ).

Results: Results of the MINI indicate that 32.1% of the sample reported symptoms consistent with a current diagnosis of a major depressive episode and 5.7% with generalized anxiety disorder. Individuals with lower levels of social support had significantly greater symptoms of both depression ($r = .46$, $p < .01$) and anxiety ($r = .50$, $p < .01$). Level of pain interference was also associated with severity of depression ($r = .62$, $p < .01$) and anxiety ($r = .56$,$p < .01$) symptoms.

Conclusion: EGS patients in our sample report rates of psychiatric disorder greater than that of the general public. Low social support and pain interference were associated with more severe depression and anxiety symptoms. Development of pain management strategies and fostering patients' social support may serve as protective factors in this population, and longitudinal studies are needed to elucidate these effects.

Poster #138

INTRACRANIAL PRESSURE MONITORING DOES NOT INCREASE MORTALITY: A PROPENSITY MATCHED ANALYSIS

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Introduction Approximately 20% of patients with traumatic brain injury undergo intracranial pressure (ICP) monitoring but controversy exists over its association with mortality. The results of multiple retrospective studies are inconclusive, especially on the two extremes of age. We aimed to determine the impact of ICP monitoring on mortality on different age groups of patients with isolated head trauma.

Methods The 2016-2017 TQIP database analysis was performed on pediatric and adult patients with isolated head injury (HI) who did not undergo a craniotomy. Subgroups were devised based on the ICP monitoring status [ICP(+) and ICP(-)] and age (pediatric: < 18, adult:18-54, geriatric: > 54). Gender, GCS, pupillary response, midline shift, head AIS, number of injury codes, vital signs, teaching status, hospital and trauma center type were used to calculate a propensity score reflecting the probability of receiving ICP monitoring. ICP(+) patients were matched using "nearest neighbor" method with ICP(-) patients. Multivariate analysis was used to identify variables associated with increased mortality in the matched cohorts.

Results Analysis included 57,663 patients with 1,671 ICP (+). In the matched cohorts, mortality was 26% and 24% in the ICP(-) and ICP(+), respectively (p=0.187) in all age patients. No difference in mortality was noted between ICP(+) and (-) in adult and geriatric patients. However, pediatric ICP(+) patients had lower mortality compared to their ICP(-) counterpart (AOR-0.16, 95%CI[0.03, 0.74], p=0.019). As shown in the table, overall variables associated with increased mortality were non-reactive pupils (AOR-3.5, 95%CI [1.15, 1.97], p=0.002) requirement of supplemental O2 (AOR-1.5, 95%CI [1.15, 1.97], p=0.002) and multiple focus HI (AOR-1.22, 95%CI [1.17, 1.27], pp < 0.001), high GCS on admission (AOR-0.79, 95%CI [0.75, 0.82], p < 0.001), no midline shift (AOR-0.47, 95%CI [0.38, 0.58], p < 0.001) were protective factors for mortality. Overall mortality was independent of ICP monitoring status (AOR-0.9, 95%CI [0.7, 1.1], p=0.54).

Conclusion ICP monitoring does not increase mortality in all age groups. It confers protection for mortality in pediatric patients. Further investigation into the exact mechanisms involving its impact on outcomes is warranted.

Variable	*p* val	OR	95%CI	Variable	*p* val	OR	95%CI
Gender	0.15	1.17	0.94±1.46	Injury Count		1.2	1.17±1.27
Age		0.26	0.16±0.43	Supplemental O2	0.002	1.5	1.15±1.97
ICP-monitor	0.54	0.94	0.77±1.14	Community Hosp	0.25	0.82	0.59±1.14
GCS		0.79	0.75±0.82	University Hosp	0.07	0.73	0.53±1.02
Pupil non-reactive x1	0.054	1.5	0.99±2.27	Non-profit Hosp	0.04	1.41	1.01±1.96
Pupil non-reactive x2		3.54	2.66±4.71	Pediatric TC	0.46	0.64	0.2±2.05
No midline shift		0.47	0.38±0.58	Adult TC	0.44	0.63	0.2±2.01

Poster #139

MASSIVE TRANSFUSION (MT) AND TRANEXAMIC ACID (TXA) INCREASES THE RISK OF VENOUS THROMBOEMBOLIC EVENTS (VTES): NECESSARY EVILS IN THE MANAGEMENT OF HEMORRHAGING TRAUMA PATIENTS?

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Introduction: Balanced hemostatic resuscitation (BHR) strategy which consist of limiting crystalloid administration, permissive hypotension and administering 1:1:1 ratio of packed red blood cells (PRBCs), fresh frozen plasma (FFP), and platelets has been the mainstay for managing hemorrhaging trauma patients. In addition, there is strong evidence recommending administration of a 1-gram bolus of tranexamic acid (TXA) to bleeding patients requiring blood product transfusion. The objective of this study was to examine the incidence of venous thromboembolic events (VTEs) defined as deep venous thrombosis (DVT) and/or pulmonary embolism (PE) in patients requiring administration of blood products and TXA.

Methods: We performed a retrospective review of 867 patients from January 2013 to September of 2019 which required administration of blood products within the first 24 hours of presentation. Institutional massive transfusion protocol (MTP) is initiated when patients require ≥ 6 units of PRBCs and FFP. Basic demographics, clinical characteristics and the incidence of VTEs were obtained from our trauma registry and electronic medical record. Descriptive statistics and biivariate analysis of variables associated with the development of VTEs was performed. A *P* value of < than 0.05 and a 95% confidence interval (CI) were considered to be statistically significant.

Results: Eight hundred-nineteen (819) patients in this analysis received blood products within the first 24 hours. Thirty-four (4.1%) patients developed a VTE. The incidence of VTE was higher in patients requiring the initiation of MTP (148 (18.9 %) vs 11 (33%); *P*=0.05). Patients that developed a VTE also had longer intensive care unit (ICU) and hospital lengths of stay respectively (23.2 ± 17.9 vs 9.9 ± 11.8 $P > 0.001$; 28.3 ± 19.0 vs 10.9± 12.7 $P > 0.001$). Patients with VTEs were also noted to have longer ventilator days (18.8 ± 17.5 vs 6.5 ± 8.2 $P > 0.001$). Biivariate analysis revealed that massive transfusion is an independent risk factor for the development of a VTE (odds ratio (OR) 2.15, 95% CI 1.02-4.54, $P = 0.05$). When patients received TXA in addition to the initiation of MTP, the odds ratio of developing VTE was noted to be increased (OR 3, 95% CI 0.89-10.2, $P = 0.067$)

Conclusion: BHR is an excellent strategy in the resuscitation of patients presenting with hemorrhagic shock. Our study demonstrates that patients requiring ≥ 6 units of PRBCs and FFP have an increased risk of developing a VTE, and this risk is further increased when TXA is administered, though our results did not quite achieve statistical significance. Strategies directed at reducing the risk of VTE in the massively transfused patient while maintaining the survival advantages conferred by product-based resuscitation are necessary. The development of VTE is however a complication afforded only to survivors after injury.

Poster #140

IMPACT OF A DEDICATED TRAUMA HYBRID OPERATING ROOM ON THE MANAGEMENT OF HEPATIC INJURY HEMORRHAGE

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Introduction: Transcatheter arterial embolization facilitates minimally invasive control of liver hemorrhage after injury. However, the utility of a hybrid operating room for the endovascular control of traumatic hemorrhage is not well codified. The goal of this study was to determine the impact of a dedicated trauma hybrid operating room and a process guideline on the management of injury.

Methods: We conducted a retrospective analysis of an injured adults at Level 1 Trauma Center with diagnosed with liver injury. The comparison groups were developed from patients admitted between 01/01/11-3/31/14 before (PRE) and 04/01/14-12/31/17 after (POST) implementation of the hybrid OR. Data collected included: demographics, vital signs, angiography time and outcome metrics, surgical procedures, transfusions, organ injury grade, and survival. Data comparisons were made utilizing the Student's t-test or Mann-Whitney U test for continuous variables and categorical data was assess using chi squared test.

Results: Review demonstrated 1,272 patients with liver injury (76 PRE and 696 POST). From the population of patients with liver injury, 101 patients had angiography as their initial therapeutic procedure (50 PRE and 51 POST). The mean time from activation to endovascular intervention decreased from 117 minutes PRE to 54 minutes POST (P<0.05). The POST group had a significantly lower rate of urgent laparotomy (9.7%) for hemorrhage control compared to the PRE group (15.1%) (p<0.05). While there were no differences in pre-angiography or 24 hour pRBC transfusion between groups, the rate of transfusion was higher in the POST group. There were no demonstrated significant differences in presentation physiology, high grade liver injury, or hospital outcomes

	PRE	POST	Significance
Presentation Systolic BP<90 mmHg	24.3%	25.3%	NS
Presentation Systolic BP<110 mmHg	55.7%	56.2%	NS
Grade IV Liver Injury	9.3% (66/708)	10.3% (58/564)	NS
Grade V Liver Injury	4.3% (31/708)	3.9% (25/564)	NS
Time to Angiography	117 min	54 min	p<0.05
pRBC prior to Angiography	4.1 units	4.0 units	NS
pRBC within 24 hours	8.34 units	8.08 units	NS
Rate of Transfusion Prior Angiography	2.05 u/hr	4.44 u/hr	p<0.05
Urgent Laparotomy	15.1% (87/576)	9.7% (66/696)	P<0.05
ICU LOS	6.15 days	6.07 days	NS
Hospital LOS	11.9 days	12.2 days	NS
Mortality Post Angiography	10.0%	11.6%	NS

Conclusion: After implementation of a hybrid OR and establishment of a multidisciplinary endovascular hemorrhage control guideline, time to endovascular intervention decreased and wasn associated with a decrease in urgent laparotomy for liver hemorrhage control. This novel study provides evidence to highlight the benefits of dedicated hybrid operating room resources and process for the endovascular control of liver hemorrhage.

Poster #141

ABOVE THE CLAVICLE: A SIMPLIFIED SCREENING METHOD FOR ASYMPTOMATIC BLUNT CEREBROVASCULAR INJURY

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Introduction: Blunt cerebrovascular injury (BCVI) is an increasingly detected pattern in trauma (2-3%) with 40% stroke incidence in the absence of treatment. Complex screening protocols exist to determine who should undergo CT angiography of the neck (CTAN). Once identified, stroke incidence may be reduced to approximately 5% with appropriate treatment across grades. We hypothesize that a simplified method for screening patients with CTAN based upon injury above the clavicle (ATC) will increase detection of BCVI

Methods: A retrospective review of adult (age ≥ 18 years) blunt trauma patients with BCVI from January 1, 2010-December 31, 2019 was conducted at a single, tertiary academic medical center. Eligible patients were included from our institutional trauma registry. Patients receiving CTAN were divided into two groups based upon qualification for the study by either the expanded Denver criteria or clinical evidence of any injury above the clavicle (ATC criteria), not otherwise satisfying expanded Denver criteria. Data were obtained from the electronic health record for all examined patients regarding demographics and outcomes.

Results: A total of 220 patients were diagnosed with BCVI (25,566 blunt trauma admissions, 0.8%). The mean age was 49 years old (SD 21.31). Fifty-one percent were male. The most common mechanisms were MVC (n=128, 58%), followed by fall (n=36, 16%), motor bike (n=21, 10%), pedestrian struck (n=12, 5%) and ATV (n=8, 4%). Overall median LOS is 6 days (IQR 3-15), median ICU LOS is 2 days (IQR 1-7) and mortality is 20% (n=43). The distribution of carotid artery injuries (CAI) and vertebral artery injuries (VAI) are demonstrated in the below table. Seventeen patients (8%) who did not satisfy expanded Denver were diagnosed with BCVI by ATC, most commonly undergoing CTAN due to facial trauma (n=8). The incidence of stroke in each group was 3.8% vs 10% (p=0.17). ASA alone or as combination therapy was the most common treatment (63%).

Conclusion: ATC criteria captures an additional 8% (n=17) of patients with asymptomatic BCVI beyond the expanded Denver criteria and may inform CTAN with initial whole-body imaging.

Criteria	Total patients n (%)	Total injured vessels	CAI (n=vessels)					VAI (n=vessels)					Stroke n (%)
	(n=220)	(n=267)	I	II	III	IV	V	I	II	III	IV	V	
Denver criteria	201 (91)	234	27	21	11	4	1	70	40	10	48	1	9 (3.8)
ATC criteria	17 (8)	30	5	4	2	1	0	10	3	2	3	0	3 (10)
Symptomatic	2 (1)	3	1	0	0	0	0	0	1	0	1	0	

Poster #142

DELAYED CHOLECYSTECTOMY AFTER PREOPERATIVE ERCP FOR COMMON DUCT STONES IS ASSOCIATED WITH WORSE OUTCOMES: A POST-HOC ANALYSIS OF AN EAST MULTICENTER STUDY

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Introduction: The use of endoscopic retrograde cholangiopancreatography (ERCP) with sphincterotomy has nearly supplanted surgical management of retained common bile duct (CBD) stones. However, the optimal timing for cholecystectomy after ductal clearance is unknown. We hypothesized that a longer delay between ERCP and cholecystectomy would be associated with a greater odds of perioperative complications.

Methods: We performed a prospective observational study of patients who underwent same admission cholecystectomy for choledocholithiasis and gallstone pancreatitis between 2016 and 2019 at 12 U.S. centers. Patients that did not undergo a preoperative ERCP were excluded. Data on time until ERCP and time to cholecystectomy were collected. The cohort was stratified based on the time interval between ERCP and cholecystectomy: ≤ 24 hours and > 24 hours. Primary outcomes included operative duration and hospital length of stay (LOS), while secondary outcomes included rates of conversion to open, CBD exploration, retained stones, as well as intraoperative and postoperative complications. Multivariable logistic and/or linear regression were used to identify whether the interval between ERCP and cholecystectomy was a risk factor for adverse outcomes.

Results: There were 355 patients who underwent preoperative ERCP; median age 52.6 (34.7-68.7) years, percent female 66.8% (n=237), and percent white race 70.7% (n=251). For the cohort, 33.3% (n=118) underwent cholecystectomy within ≤ 24 hours of ERCP while 66.7 % (n=237) were delayed > 24 hours. Operative duration was significantly longer in the > 24-hour group (96 vs 84.5 min, p=0.005) as was hospital LOS (3 vs 6 d, p < .0001). Rates of conversion to open were significantly higher in the > 24-hour group (11% vs 0.8%, p < .0001), as were CBD explorations (5.5% vs 0.8%, p=0.02) and retained stones (2.1% vs 0%, p=0.04). There was no difference in infectious, biliary, or renal complications, intraoperative injuries, or bleeding rates between groups. On multivariable regression adjusting for age, gender, body mass index, and white blood cell count, > 24-hour duration between ERCP and cholecystectomy remained a significant risk factor for increased operative duration (β 17, 95% CI 5-30.9, p=0.007), increased hospital LOS (β 2, 95% CI 1.1-2.8, p < .0001), and conversion to open (OR 13.1, 95% CI 1.7-98.4, p=0.01).

Conclusion: Our findings suggest that patients can safely undergo cholecystectomy within 24 hours of ERCP without an increased risk of perioperative complications. Surgical intervention < 24 hours following ductal clearance may help decrease patient morbidity and reduce the use of hospital resources.

Poster #143

INJURED PATIENT ECONOMIC PROFILE EXPLAINS INTEREST IN NEW TRAUMA CENTER DESIGNATIONS

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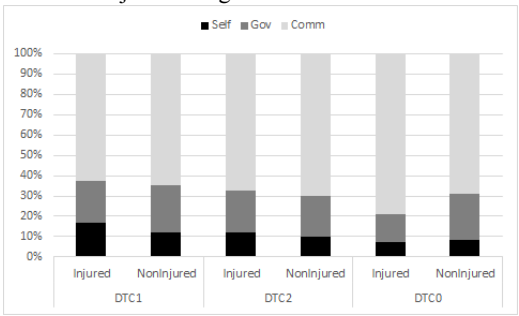
Background: Optimal trauma care requires immediately available specialized resources and personnel. Historically, trauma care has been considered economically unsustainable due to the high costs of readiness and low reimbursement rate for trauma care. Paradoxically, there has been a recent surge in hospitals seeking new trauma center designations. The purpose of this study was to reexamine injured patient economics in trauma centers and community hospitals relative to non-injured patients as a potential explanation of this phenomenon.

Methods: Patients discharged from Florida adult acute care hospitals between 2017 and 2108 were classified as injured or non-injured by IDC-10 diagnoses using a statewide discharge dataset. Major trauma patients were defined by trauma admission priority or presence of trauma alert charges. Hospitals were classified as State designated Level I (DTC1) or Level II (DTC2) trauma centers, or undesignated (DTC0).

Results: There are 8 DTC1, 25 DTC2, and 187 DTC0 hospitals in Florida. Major trauma patients are transported to DTC1 or DTC2 according to a statewide prehospital trauma triage tool. There were 4.98 million patients discharged Florida hospitals, 434 thousand (9%) were injured: of injured patients, 14% were discharged from DTC1, 31% from DTC2 and 55% discharged from DCT0. Injured patients accounted for 12% of DTC1, 13% of DTC2 and 8% of DTC0 discharges while major trauma accounted for 34% of DTC1 and 27% of DTC2 injured patients. Compared to DTC0, injured patients discharged from DTC1 and DTC2 were more often younger, male, more severely injured, and more often underwent operations and ICU admission. Injured patients accounted for 17% of $46.6b DTC1, 19% of $75.7b DTC2, and 8% of 223.9b DTC0 charges. The economic profile of injured and non-injured patients is shown in the fig. Mean Major trauma:Injured:Non-Injured charges were: DTC1 (167.3k;$97.3k:$76.7k), DTC2($168.8k:$84.6k:$68.1k), and DTC0 (NA:$75.9k:$64.8k).



Conclusions: Injured patients account for a disproportionally higher share of total patient charges in designated trauma centers. Major trauma patient charges are substantially higher than injured patients. The injured patient payer profile is similar to non-injured patients in DTC1 and DTC2 hospitals. injured patients often qualify for outlier payments based on a proportion of charges due to the frequency of emergent, complex, out of network and workers comp cases. Together these findings suggest that major trauma patients are an economically desirable patient population and may explain the interest in hospitals seeking new trauma center designations.

Poster #144

HOW OLD IS TOO OLD FOR RIB FIXATION? A REVIEW OF ELDERLY RIB FRACTURES USING THE TQP NATIONAL DATABASE

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Introduction: Rib fractures are a common injury in the adult trauma population, associated with significant morbidity and mortality shown to increase with age. Recent data demonstrates that surgical stabilization of rib fractures (SSRF) in select patients improves outcomes when compared to nonoperative management (NOM). As surgical intervention is increasingly adopted, few studies have investigated the clinical impact of this procedure on elderly patients. We hypothesize that SSRF in elderly patients results in decreased mortality, length of stay (LOS), and pulmonary complications.

Methods: Using the American College of Surgeons Trauma Quality Programs (TQP) dataset, a retrospective review analyzed patients aged 65 years and older with three or more rib fractures, with or without flail chest, as defined by ICD-9/10 codes. Primary outcome was in-hospital mortality; secondary outcomes included need for intensive care unit (ICU) and overall hospital LOS, as well as TQP defined in-hospital complications including need for tracheostomy. A propensity score model of age, gender, race, Injury Severity Score (ISS) and Charlson Comorbidity Index (CCI) was used to create Inverse Probability of Treatment Weights (IPTW) to compare SSRF and NOM groups balanced for these covariates. Poisson regression was used to compare mortality and tracheostomy rates.

Results: 115,002 elderly patients with multiple rib fractures were admitted between 2007-2017, with 2779 patients undergoing SSRF. Compared to NOM, SSRF demonstrated overall decreased mortality (4.7% vs 6.2%, $p < 0.0001$). The SSRF group also had a significant increase in LOS and in-hospital complications, including need for tracheostomy. While SSRF patients were more likely to be functionally independent at admission, they also demonstrated higher rates of discharge to subacute rehabilitation (SAR) than the NOM group (71.5% vs 44.7%, $p < 0.0001$). When stratified by age category, SSRF demonstrated decreased mortality in all age groups, however this survival benefit was diminished after age 85 (39.3%, $p < 0.0001$ vs 70.7%, $p < 0.013$). Notably, SSRF patients over age 80 required tracheostomy twice as often as their NOM peers (RR 2.2, $p < 0.0001$).

Conclusion: Our study demonstrates that SSRF is associated with decreased mortality in all elderly patients. Despite higher baseline functional status, SSRF patients had longer LOS with increased rates of both tracheostomy and discharge to SAR, suggesting that this improved survival comes at the cost of a highly morbid procedure. Given these findings, careful consideration should be taken before intervening on patients over age 80.

Poster #145

DOES A PREHOSPITAL AIRWAY IMPACT OUTCOMES AFTER TRAUMATIC BRAIN INJURY?

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Introduction: Hypoxia is associated with increased morbidity and mortality after traumatic brain injury (TBI). After TBI, pre-hospital providers have the choice to use advanced pre-hospital airway (e.g., supraglottic devices, endotracheal tubes) to optimize oxygenation and ventilation. Our aim was to understand the impact of pre-hospital airway on outcomes after TBI and hypothesized their use would improve outcomes.

Methods: This is a retrospective single center cohort study over a 7-year period of adult (age>=17 years) blunt TBI patients with Abbreviated Injury Scale (AIS) Head score ≥3 and GCS ≤8. Exclusion criteria were pre-hospital cardiac arrest and interfacility transfers. Ordered logistic regression was performed for modified Functional Independence Measure (FIM) score at discharge. Multiple logistic regression for mortality and discharge disposition were performed. Covariates for the models included age, sex, race, insurance type, Injury Severity Score (ISS), time to follow commands, ventilator days, intensive care unit (ICU) length of stay, and hospital length of stay.

Results: Eligibility criteria was met for 1671 patients, who has a median age=36y (IQR 23-52), ISS=29 (IQR 22-38), and ICU stay=3.5d (1-8). Among the cohort, 1337 (80%) had a pre-hospital airway and there was a 431 (26%) in-hospital mortality. A pre-hospital airway did not improve FIM score at discharge (OR 1.23, 95% CI 0.93-1.62, p=0.14), affect mortality (OR 0.91 95% CI 0.65-1.27 p=0.594), or alter odds of discharge to advanced care facility (OR 0.82 95% CI 0.563-1.18 p=0.281).

Conclusions: An advanced pre-hospital airway did not improve functional status at discharge, mortality, or discharge disposition after TBI. Further prospective work is needed on unmeasured post-injury factors such as pre-hospital neurologic function, respiratory status, transport distance, first responder scope of practice, and advanced airway choice, as well as long-term functional outcomes post-TBI.

Poster #146

EAST, WEST AND LIBERAL EMERGENCY DEPARTMENT THORACOTOMY GUIDELINES: A COMPARATIVE ANALYSIS ON SURVIVAL, ORGAN DONATION, AND COST

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LAC+USC Medical Center

Objective: Emergency department thoracotomy (EDT) guidelines established by the Eastern Association for the Surgery of Trauma (EAST) and Western Trauma Association (WTA) have subtle differences and adherence to these guidelines varies by institution. We sought to compare whether compliance with EAST or WTA EDT guidelines produced differences in outcomes.

Methods: Our institution's trauma registry was queried for all patients who underwent EDT from 2009 - 2018. Patients were classified according to established recommendations for EDT by EAST and WTA. Outcomes were compared between groups for survival, organ donation, total number of hospital procedures, and total hospital cost (USD) using Chi Square analysis at a p value of 0.05 or less.

Results: A total of 558 EDT were performed. Of these, 52% met both EAST and WTA guidelines, 74% met EAST guidelines, 62% met WTA guidelines, 22% met neither ("liberal.") There was a 2% overall survival rate that was increased to 3.1% under EAST guidelines and 3.7% under WTA guidelines ($p = 0.0001$.) A total of 11% fewer EDT were performed under WTA guidelines and 3 additional patients were organ donors ($p = 0.06$) compared to EAST with no impact on overall survivorship to discharge ($p > 0.1$.) Significantly more organs were procured with a liberal EDT strategy ($p = 0.05$) compared to EAST and WTA. More procedures and higher cost were associated with WTA guidelines compared to EAST ($p = 0.01$) and liberal EDT ($p < 0.001$.)

	EAST	WTA	Liberal
Number of EDT performed	414 (74%)	347 (62%)	126 (22%)
Survivors to discharge	13 (3.1%)	13 (3.7%)	0 (0%)
Number of organ donors	5	8	6
Total procedures	3854	3429	955
Cost per EDT (USD)	35,580	41,054	9,274

Conclusion: Data supports the adoption of the WTA guidelines for EDT, as there are fewer unnecessary EDTs performed with no change in survival with a slight trend of improved organ procurement. Liberal EDT has no impact on survival but does improve organ procurement.

Poster #147

THE MORTALITY IN PATIENTS WITH RIB FRACTURES IS HIGHER IN GERIATRIC PATIENTS, BUT INVERSELY RELATED TO CHEST INJURY SEVERITY IN NON-SURVIVORS

Laura Nicolais MD, Carolyne Falank PhD, Joseph Mack MD, Daniel C. Cullinane MD, Bryan C. Morse MD, Joseph F. Rappold MD, Julianne Ontengco, David L. Ciraulo DO, Forest R. Sheppard MD
Maine Medical Center

Introduction: Rib fractures increase the risk of clinical complications and mortality. Previous reports indicate linear relationships between age and clinical outcomes. The impact of rib fractures in geriatric ($\geq$ 65 years) versus non-geriatric patients with regards to clinical outcomes remains to be fully defined. We sought to evaluate for differences in morbidity, mortality, resource utilization and disposition at discharge between geriatric and non-geriatric patients with rib fractures.

Methods: A retrospective review of a single Level 1 Trauma Center registry was performed. Geriatric patients ($\geq$ 65 years) and non- geriatric patients (< 65years) admitted with at least 1 rib fracture over a 5 year period were included. Analysis included injury mechanism and severity (ISS, AIS), and outcomes: hospital length of stay (HLOS), ICU length of stay (ICU LOS), ventilator days, in-hospital mortality and morbidities. Results reported as mean $\pm$ SEM or percent. Statistical analysis was done using Student's t-test and Chi-squared test with $p < 0.05$ significance.

Results: 11,899 patient records were reviewed, a total of 2,134 trauma patients were admitted with at least one rib fracture. Of those with rib fractures 1,037 (49%) were geriatric patients (78.6 years ± 8.9) and 1,097 (51%) were non-geriatric (47.4 years $\pm$ 12.7). The geriatric cohort had a lower ISS (11.4 vs. 14.5; $p < 0.0001$), shorter HLOS (7.4 vs. 9; $p=0.001$), shorter ICU LOS (6.7 vs. 9; $p < 0.0001$) and lower incidence of mechanical ventilation (9.5% vs. 18.5%, $p < 0.0001$) than non-geriatric patients. Geriatric patients had higher in hospital mortality: 6.3% vs. 3.6% ($p=.03$). Discharge to home was higher in non-geriatric patients (72% vs. 36%, $p < 0.0001$) as was rehab (22% vs. 17%, $p=.004$) and geriatric patients had higher incidence of discharge to skilled nursing (32% vs. 5%, $p < 0.0001$) and others (10% vs. 6%, $p=0.0007$). The ISS was statistically higher in geriatric non-survivors (7.8 vs. 6.1, $p=0.0001$). Falls were the predominant mechanism of injury in geriatric patients (62% vs. 31%, $p=0.002$) and motor vehicle crashes in non-geriatric patients (52% vs. 31%, $p=0.034$). Further subgroup analysis in geriatric non-survivors demonstrated lower head AIS (4.1 vs 3.5, $p=0.032$) and lower chest AIS (2.6 vs. 3.1, $p=0.006$), and no difference in ventilator days, ICU LOS or HLOS when compared to survivors.

Conclusion: Of the patients admitted with rib fractures ~50% were geriatric. Geriatric patients had a higher mortality at 6.3%, however both cohorts had a low mortality. Early mortality in geriatric patients influenced shorter HLOS and ICU LOS. Though overall ISS was higher in geriatric non-survivors, these patients had chest and head injury severities lower than survivors, indicating cumulative injuries and other factors such as pre-trauma functional status and comorbidities contributed more to mortality than chest injury.

Poster #148

SHOULD ECMO IN THE ELDERLY BE CONSIDERED A FUTILE THERAPY? A NATIONAL TRAUMA DATA BANK ANALYSIS

Natthida Owattanapanich MD, Kenji Inaba MD, Demetrios Demetriades MD, PhD, Brad Allen MD, Meghan Lewis MD, Reynold Henry MD, Damon Clark MD, Kazuhide Matsushima MD, Aaron Strumwasser MD
LAC+USC Medical Center

Introduction: Extracorporeal membrane oxygenation (ECMO) is being increasingly applied for the rescue of severely injured trauma patients. However, its use for elderly patients is still controversial, specifically in patients over the age of 75. The purpose of this study was to identify the characteristics and outcomes of ECMO in elderly trauma patients (≥ 75 years of age).

Methods: The National Trauma Data Bank (2016-2017) was queried for all adult patients (≥ 18) that underwent ECMO. Patient demographics (age, gender) injury profiles (ISS, associated injuries, ED vital signs, time to ECMO), and outcomes (mortality, hospital LOS, ventilator days, in-hospital complications) were abstracted. Patients that were transferred in from another center to undergo ECMO, patients that expired in the emergency department and/or patients that had an abbreviated injury score (AIS) of 6 were excluded. Multivariate logistical regression was used to compare outcomes between groups. Statistical significance was denoted at a p value of 0.05 or less.

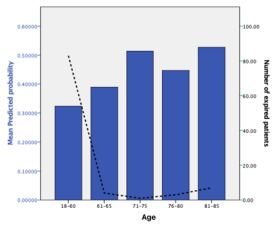
Results: After exclusion criteria were applied, a total of 1,018 trauma patients underwent ECMO. The median age of the population was 41 [26-59], of which 76% male. Of the total population, 78 (8%) were patients over the age of 75. The most common mechanism was blunt (74%) with motor vehicle collision as the major cause (n = 550, 54%). Median chest AIS was 4 [3-5]. Compared to a matched younger group, the elderly had significantly lower ISS (p<0.0001). Median time to ECMO cannulation was 14 hours, of which 543 (53%) underwent ECMO within 24 hours and 163 (16%) after 7 days. The majority of elderly patients underwent ECMO after 7 days (36%), while adult patients underwent ECMO within 24 hours (56%). There was no significant difference in mortality between groups (22% vs 25%, p=0.5). On multivariate analysis, age over 75 was not associated with mortality (OR 0.74, p=0.9). (Table 1). Figure 1 demonstrated the relationship between mean predicted probability for mortality and age. There was no significant upward trend in mortality among elderly patients.

Conclusion: Age of 75 or greater was not demonstrated as an independent risk factor for mortality among ECMO trauma patients. ECMO should not be summarily rejected as a potential therapy in this trauma population. Future prospective study is warranted.

Table 1 Multivariate Analysis of Independent Risk Factors for In-hospital mortality

	MORTALITY		
	Adj p-value	OR	95%CI
AGE ≥75	0.855	0.737	(0.028 – 19.616)
MALE	0.030	4.508	(1.153 – 17.619)
BLUNT MECHANISM	0.412	2.246	(0.325 – 15.535)
ABDOMINAL AIS	0.197	0.747	(0.480 – 1.164)
SPINE AIS	0.121	0.521	(0.228 – 1.189)
ISS	0.343	1.013	(0.972 – 1.055)
SBP	0.149	0.990	(0.977 – 1.004)
HR	0.406	1.007	(0.990 – 1.024)
GCS	0.845	1.009	(0.922 – 1.104)
EARLY ECMO IN 24 H	0.516	0.732	(0.285 – 1.878)
DVT	0.335	0.515	(0.133 – 1.989)
ARDS	0.450	1.521	(0.512 – 4.520)
AKI	0.813	0.831	(0.179 – 3.863)
PROLONGED VENTILATION 7 D	0.013	0.280	(0.102 – 0.766)

Test for multicollinearity was performed prior to multivariate analysis. AUROC= 0.728 (95% CI= 0.631-0.825). OR, odds ratio; CI, confidence interval; SBP, systolic blood pressure; AIS, abbreviated injury scale; ISS, Injury severity scale; ECMO, Extracorporeal membrane oxygenation; ARDS, acute respiratory distress syndrome; AKI, acute kidney injury



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Member Since 1984

Gerardo A. Gomez, M.D.
Indianapolis, IN
(1946-2020)
Member Since 1994

Melvin H. Worth, Jr., M.D.
Sun City Center, FL
(1930-2019)
Member Since 1970

John M. Cahill M.D.

(1925-2020)

Fondly know as Jack or Mosh, he was born on January 2, 1925, in Boston, Massachusetts, the 2nd son of Harry P. and Anne Ryan Cahill of Brookline. Jack was predeceased by his brother Philip H.R. Cahill in 2017. Jack attended Boston College High School (1941), and the College of the Holy Cross (1945). He attended Tufts Medical School (1948) under the Navy's V12 Medical Corp program and began his training at Boston City Hospital with the 3rd Surgical Service.

During his training, the Korean War began and he was stationed in a military hospital in Osaka, Japan. While chief surgical resident at Bridgeport Hospital in Connecticut he met a beautiful young nurse, Corinne Savoie Haines. He and Corinne married on September 6, 1958 and settled in Cohasset where they raised their five children.

Jack established his academic general surgery career at Boston City Hospital and Boston University School of Medicine. After retiring from the practice of surgery, Jack chose to work for many more years in hospital utilization at Boston Medical Center and finally retired at age 86.

He was a member of the American College of Surgeons, New England Surgical Society, and Boston Surgical Society. He was also a member of the Holy Cross Club of Boston and the Clover Club of Boston. Jack was an active congregant at Saint Anthony's Parish in Cohasset, serving as a lector, alter server, and CCD teacher. Yearly family ski trips to Waterville Valley were the source of many happy memories.

Jack is survived by Corinne, his loving wife of 60 years and their five children Susan Cahill and her husband Frank Bailey of Wayland; John Christopher Cahill and his wife Robin of Marshfield; Harry Stuart Cahill of Cohasset; Leslie Cahill and her husband Mark Prashker of Savannah, Ga.; Steven Cahill and his wife Stephanie of Newton; and, his five wonderful grandchildren: Matthew and Michael Bailey; and Remy, Ella and Alexandra Cahill. He is also survived by many loving nieces, nephews, great-nieces and great-nephews in Connecticut, Vermont, Florida, and California.

William G. DeLong, Jr., M.D.

(1948-2020)

William G. DeLong Jr., M.D., was an accomplished orthopaedic surgeon, Network Chairman of Orthopaedic Surgery at St. Luke's University Health Network, former team physician for the Philadelphia Flyers, and widely respected doctor both nationally and internationally. He leaves his wife (Ginny) of 48 years, son Christian, daughter Lauren (Greg Ng) and grandson Joel Opdenhoff. Sisters Rosemary Duffy (William), Theresa Ackerman (Bruce) and Brother in Law Frederick Decker. His nephew Daniel Ackerman (Christina). Nieces Jennifer Duffy, Julia Higgins (Tim), Sarah Becker (Matt), Bonnie Baab, Lisa Dowd (Mike), Emma Ackerman and of course his faithful four legged companion Stella.

Dr. DeLong trained countless surgeons and was a genuine leader whose most recent position as Chairman at St. Luke's oversaw the rapid growth and development of a community program into a large network of academic specialists. Always leading by example, he continued to take overnight trauma call responsibilities and maintained full surgical and clinic schedules up until his passing. He never turned a patient away, never said no to a colleague in need, and generously mentored countless new surgeons. His contributions continue to benefit patients and doctors around the world.

Bill was also well-known for his "boots on the ground" humanitarian efforts during Hurricane Katrina and the Haiti earthquake and his leadership as Chairman of the Humanitarian Committee of the OTA. He was a member of the Trauma Critical Care Team of the Department of Homeland Security for many years. In addition to these professional service activities, he was active as a consultant to the Haddonfield Child Care Advisory Board, a member of the Haddonfield Little League Board of Directors, Cub Scout master, the Haddonfield Substance Abuse Task Force, and coach of the Haddonfield Junior Basketball Team.

Stanley J. Dudrick, M.D.

(1935-2020)

Stanley was a remarkably humble and approachable man known for his charming charisma and sincere compassion and care for all those whom he encountered. He earned a B.S. cum laude with biology honors in 1957 from Franklin and Marshall College, then his M.D. degree from the University of Pennsylvania School of Medicine.

In 1975, he founded the first helicopter acute care ambulance service in the United States, LifeFlight. Prior to LifeFlight, aircraft were used exclusively as transport only. In 1988, he was appointed as chairman of the Department of Surgery of Pennsylvania Hospital, the nation's first hospital.

A fellow of the American College of Surgeons since 1970, he received its Jacobson Innovation Award in 2005.

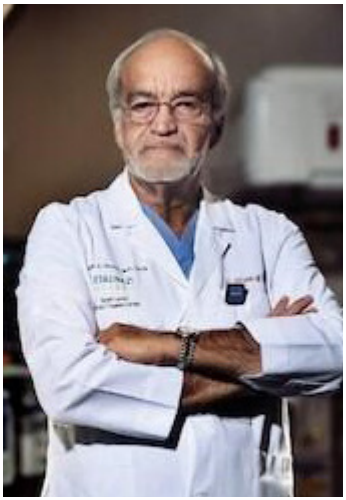
In 2012, the Stanley J. Dudrick Hospital was dedicated in his honor in Skawina, Poland. In 2013, Franklin and Marshall College awarded him the honorary degree of Doctor of Science and the University of Texas Health Science Center at Houston awarded him its highest medal and established the annual Stanley J. Dudrick, M.D., lectureship at its 40th anniversary.

He also received the Distinguished Service Award of The Society of Surgical Oncology. In 2014, the American College of Surgeons honored him with a video presentation as one of the "Heroes of American Surgery." In 2016, he was cited by Medscape as one of the "Fifty Most Influential Physicians in History."

Stanley is survived by his wife of 61 years, Theresa, who resides at their Crystal Lake property in Eaton; six children, 16 grandchildren, and five great-grandchildren.

Gerardo A. Gomez, M.D.

(1946-2020)



Dr. Gerardo Alfredo Gomez Losada graduated from medical school at Universidad de Carabobo in Venezuela. He completed his surgical residency at the University of Massachusetts, Worcester.

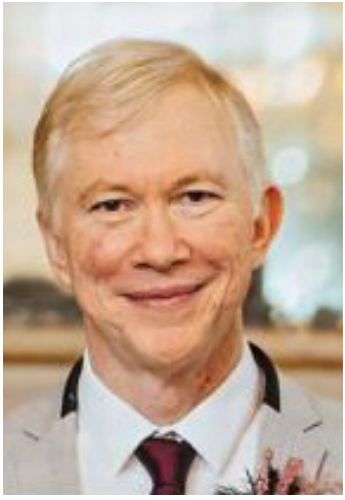
After he completed his residency, he started his career as a staff Trauma surgeon in 1982 at Jackson Memorial in Miami, Fl. In 1990, he accepted the Chief of Trauma Surgery position at Wishard Hospital as a faculty member at Indiana University. This began his 26-year career serving the community of Indianapolis. He was integral in the design of the first level one Trauma Center in the state of Indiana at Wishard Hospital. Throughout his career, he has impacted thousands of students, doctors, nurses, and paramedics; he took great pride in these relationships.

He has saved countless lives and strived to make a difference with the violence in the community that he loved. He loved teaching Advanced Trauma Life Support and Advanced Trauma Operative Management courses all over the world and he was a proud member and former president of the Pan-American Trauma Society. He is known as a father figure for trauma in Indiana and assured the successful transition from Wishard Hospital to Eskenazi Hospital in 2013.

Along with being an amazing surgeon, he also found the time to become a pilot. He learned how to fly during his residency in Massachusetts and continued the hobby throughout his life. After he retired from Eskenazi Hospital he enjoyed working with his son Michael at Gomez BBQ at City Market located in downtown Indianapolis. He was the accountant, the payroll manager, and of course the comic relief. Aside from all of his accomplishments, he took the most pride in his 6 children, 5 grandchildren, and 2 great-grandchildren. He is survived by wife Adrienne, sons Alfredo (wife Amanda), Carlos, Tito, Michael, and Anthony, daughter Amanda, grandsons Nico, Corbin, and Liam, granddaughters Alexandra and Bailee, and great-granddaughters Sophia and Camilla.

Daniel J. Ledbetter, M.D.

(1956-2019)



Born May 5th, 1956 in Missouri, Dr. Daniel Ledbetter was raised with his two sisters by Fern and Floyd Ledbetter in Orlando, Florida. He flourished in the Sunshine State and was inspired by his uncle and namesake, Dr. Daniel Wisely, to pursue a career in surgery. He earned his undergraduate and medical degrees from the University of Florida. While there, he played for the UF soccer team and became a life-long Gator fan.

In 1981 he moved to Seattle for his General Surgery residency at the University of Washington. While working as 'trauma doc' at Harborview he met his future wife, Dr. Sandra 'Sunny' Juul, a pediatric resident. They married on February 29th, 1984 and had two beautiful children. He completed his fellowship in Pediatric Surgery at the UW in 1991 and was triple Board-certified in Surgery, Pediatric Surgery and Surgical Critical Care. He worked at the University of Chicago and the University of Florida but ultimately returned to Seattle in 2000 where he worked at Seattle Children's Hospital until his death. At the UW and SCH, he dedicated his time and energy to caring for patients and their families, mentoring surgical residents and fellows, and teaching medical students. His trainees and colleagues will remember a leader who embodied humility, grace, truth and excellence.

He lived a full and meaningful life and will be remembered as a wonderful husband and father who had a passion for World Cup soccer, golfing rain or shine, weekend walks at Marymoor park with his beloved golden retrievers, wine tasting, and non-fiction.

Dan is survived by his wife who will love and cherish his memory forever as well as by his two children, Kelly - who is continuing his legacy as a surgical resident at the UW and Brian - who inherited his dad's broad intellectual curiosity and dedication to family. His sisters share his love of teaching and mentorship: Nancy as a STEM instructor in North Carolina and Susan as a family practice physician in Florida.

Harvey J. Sugerman, M.D.

(1938-2020)

Born in Pittsburgh, Harvey was the David M. Hume professor of surgery at the VCU School of Medicine and chief of the Division of General/Trauma Surgery from 1978 to 2003, during which time he operated on thousands of patients. Never one to sit still, following retirement, Harvey became Editor-in-Chief of Surgery of Obesity and Related Diseases (SOARD), while simultaneously pursuing the invention of an abdominal device to cure preeclampsia.

He spent three years as a surgeon in the U.S. Army and served as president of the Western Trauma Association (WTA) and American Society for Metabolic and Bariatric Surgery (ASMBS). Harvey was a pioneer of gastric bypass surgery, providing evidence that it was the most effective option for weight loss and making it one of the most common operations performed by general surgeons today.

He earned his Bachelor of Science degree from Johns Hopkins University and Master of Science and Medical Degrees from Jefferson Medical College, and he completed his post-doctoral training at the University of Pennsylvania.

Harvey loved skiing, traveling and photographing the world, 18-year old scotch, eating and drinking well, an occasional Baby Ruth candy bar and spending time with his wife, friends, four children and nine grandchildren.

Harvey had a relentless drive in the pursuit of scientific truth and made a lasting impact by challenging prevailing dogma. He inspired countless students, fellow surgeons and his children and loved to share the stories he gathered throughout his long and remarkable life.

He is survived by his wife, Betsy; sister, Marilyn Latterman; and children, Kathryn, Andy, David and Elizabeth.

Joseph J. Tepas, III, M.D.

(1946 -2019)

Joseph John Tepas, III M.D. was raised in Baltimore, MD, where he attended Loyola Blakefield. A graduate of The College of the Holy Cross and Georgetown Medical School, the principles of faith and learning of these Jesuit institutions guided his professional and personal life.

Dr. Tepas was board certified in general surgery, pediatric surgery and critical care. A Fellow of the American College of Surgeons and the American Academy of Pediatrics, Dr. Tepas was actively involved in advancing quality outcomes and health policy. His legacy of generations of residents trained in surgery includes 16 fellows inspired to pursue pediatric surgery, to him "the prince of services". A retired captain, Dr. Tepas was a proud member of the US Navy Medical Corps providing pediatric surgical support to NAS Jacksonville for many years.

Dr. Tepas was instrumental in the certification of Trauma One as a Level I trauma center and helped develop the first regional trauma system for the State of Florida. He guided the process for Wolfson Children's Hospital's designation as a pediatric trauma center. A rescue helicopter based in St. Johns County bears his initials on its tail rotor. He is remembered for his care of the injured child, advancements in the management of traumatic brain injury, and his skill in neonatal surgery.

While medicine was his passion, Dr. Tepas' first love was his wife and family. He enjoyed sailing, windsurfing, being at Crescent Beach with Jean and the children, sailing with friends in the islands, and vacationing on Martha's Vineyard. His pride in his children and their accomplishments was boundless. He was a doting grandfather, who loved being surrounded by the noise and chaos of his Irish family.

Dr. Tepas is survived by his loving wife of 48 years, Jean Ryan Tepas, daughters Kathleen Tepas Wise and Meghan Abrams (John), son Joseph W. Tepas (Salena), seven grandchildren, brother Kevin Tepas (Sally), sister Margaret Ober (Paul) and many nieces and nephews.

Melvin H. Worth, Jr., M.D.

(1930-2019)

In addition to private practice, Dr. Worth was the founder and director of the Trauma Service of Bellevue Hospital (1966-1979); and director of surgery of Staten Island University Hospital (1979-1996).

He was an associate professor of medicine at NYU, and a clinical professor at Downstate Medical School. Dr. Worth was appointed by Governor Cuomo to the NY State Hospital Planning and Review Committee (1988-95). He served as president of the NY Surgical Society, and held offices in other professional organizations.

In retirement, he volunteered and served, for more than 20 years, as a consultant and scholar in residence for the Institute of Medicine, and became a member of the Cosmos Club. Dr. Worth also volunteered for the Sun City Center Emergency Squad. He graduated Clark University (B.A., 1950), and NYU School of Medicine (1954). He completed his internship and residency at NYU, and served in the U.S. Army (1955-57).

Dr. Worth was predeceased by his daughter, Carol, and son, David. He is survived by his wife, Alice; daughter, Nancy, and grandson, Benjamin.

SAVE THE DATE

September 29-October 2

80TH ANNUAL MEETING
AAST

80th Annual Meeting of AAST &
Clinical Congress of Acute Care Surgery

2021
ATLANTA

Hilton
HOTELS & RESORTS

79th Annual Meeting of AAST and Clinical Congress of Acute Care Surgery

VIRTUAL Schedule • September 8-18, 2020 • All times are CST

TUE. 9/8/2020	Function
9:00 AM - 9:30 AM	Presidential Introduction
9:30 AM - 12:30 PM	Session I: Plenary Papers 1-9
1:00 PM - 2:00 PM	Business Meeting
2:00 PM - 6:00 PM	Add-On Session: Sponsored by the Communications Committee
6:00 PM - 7:00 PM	Happy Hour with AAST President! ***
WED. 9/9/2020	**Function**
12:00 PM - 1:00 PM	Lunch Session: Sponsored by the Palliative Care and Geriatrics Committees
1:00 PM - 2:40 PM	Session II: Papers 10-14
2:40 PM - 3:00 PM	Scholarship Presentations
3:00 PM - 4:40 PM	Session III: Papers 14-18
5:00 PM - 8:00 PM	Poker Night! ***
THURS. 9/10/2020	**Function**
9:00 AM - 10:20 AM	Session IV: Papers 19-22
10:35 AM - 12:55 PM	Session V: Papers 23-39
1:00 PM - 2:00 PM	Lunch Session: Sponsored by the Equity, Diversity, and Inclusion Committee
2:10 PM - 6:10 PM	Add-On Session: Sponsored by the Acute Care Surgery Committee
6:30 PM - 7:30 PM	Meet the Leadership: Sip and Chat with Dr. Mary Fallat ***
FRI. 9/11/2020	**Function**
8:55 AM - 9:00 AM	Moment of Silence - 9/11
9:00 AM - 11:40 AM	Session VI: Papers 30-37
12:00 PM - 1:00 PM	Lunch Session: Sponsored by the Critical Care Committee
1:00 PM - 1:30 PM	Diversity and Inclusion Committee Statement
2:00 PM - 3:00 PM	Virtual Escape Room ***
SAT. 9/12/2020	**Function**
9:00 AM - 1:00 PM	Add-On Session: Sponsored by the Education Committee
1:00 PM - 2:00 PM	Yoga Session
SUN. 9/13/2020	**Function**
1:00 PM - 3:00 PM	COVID-19 Panel
3:00 PM - 4:00 PM	Lunch Session: Sponsored by the Military Liaison Committee
4:00 PM - 5:00 PM	Acute Care Surgery and ABS Certification: Opportunities and Challenges
5:00 PM - 6:00 PM	Meet the Leadership: Sip and Chat with Dr. David Livingston ***
6:00 PM - 7:00 PM	Virtual Comedy Show

MON. 9/14/2020	Function
9:00 AM - 11:20 AM	Session VII: Papers 38-44
12:00 PM -1:00 PM	Lunch Session: Sponsored by the Program Committee
1:00 PM - 2:00 PM	Lunch Session: Sponsored by the International Relations Committee
2:00 PM - 3:30 PM	Paint and Pour ***
4:00 PM - 5:00 PM	International Breakfast ***
TUE. 9/15/2020	**Function**
3:00 PM - 4:00 PM	Meet the Leadership: Coffee Time with Dr. Reilly ***
4:00 PM - 6:20 PM	Session VIII: Papers 46-52
6:40 PM - 7:40 PM	Add-On Session: Sponsored by the Education Committee
7:40 PM - 8:00 PM	Chair Yoga
8:00 PM - 9:00 PM	Add-On Session: Sponsored by the Program Committee
WED. 9/16/2020	**Function**
12:00 PM - 2:40 PM	Session IX: Papers 52-59
3:00 PM - 4:00 PM	Lunch Session: Sponsored by the Program Committee
4:00 PM - 5:00 PM	Game Night Out ***
THURS. 9/17/2020	**Function**
2:00 PM - 4:00 PM	Session X: Papers 60-65
4:20 PM - 5:20 PM	Lunch Session: Sponsored by the Palliative Care Committee
5:35 PM - 6:35 PM	Lunch Session: Sponsored by the Communications Committee
7:00 PM - 8:00 PM	Meet the Leadership: Sip and Chat with Dr. Sharon Henry ***
Friday. 9/18/2020	**Function**
9:00 AM - 10:18 AM	Session XI: Quick Shot Session I 1-13
10:30 AM - 11:48 AM	Session XII: Quick Shot Session II 14-26
12:00 PM - 1:00 PM	Lunch Session: Sponsored by the Associate Member Committee
1:00 PM - 2:00 PM	Associate Member Happy Hour! ***
2:00 PM - 3:30 PM	Virtual Farewell Concert ***

*** = Registration Required