80TH ANNUAL MEETING OF
AAST & CLINICAL CONGRESS OF
ACUTE CARE SURGERY

ATLANTA

SEPTEMBER 29 - OCTOBER 02, 2021

Program Requirements

1. **Continuing Medical Education Credit Information (include exactly as displayed below)**

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 Other activity (**Hybrid in-person and virtual stream**) for a maximum of 50.75 *AMA PRA Category 1 Credits™.* Physic8ians 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 **7.00** credits meet the requirements for Self-Assessment.

Of the *AMA PRA Category 1 Credits*™ listed above, a maximum of **50.75** hours meet the requirements for **Trauma**. *

Of the *AMA PRA Category 1 Credits*™ listed above, a maximum of **16.25** hours meet the requirements for **Pediatric Trauma**. *

Of the *AMA PRA Category 1 Credits*™ listed above, a maximum of **8.25** 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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2. **PROGRAM OBJECTIVES**

The entire meeting is based on scientific research conducted at individual sites and through multi-center sites. The research has been conducted within the past 12-24 months and is being presented at AAST as original work. All presentations are new research and all presentations could not have been presented prior to AAST.

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/discussants/moderators) has disclosed all financial relationships with any commercial interest (termed by the ACCME as "ineligible companies", defined below) held in the last 24 months (see below for definitions). Please note that first authors were required to collect and submit disclosure information on behalf all other authors/contributors, if applicable.

Ineligible Company: The ACCME defines an "ineligible company" 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 an ineligible company with which he/she has a financial relationship.

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.

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DISCLOSURE INFORMATION

80TH ANNUAL MEETING OF AAST & CLINICAL CONGRESS OF ACUTE CARE SURGERY
SEPTEMBER 29-OCTOBER 2, 2021
ATLANTA, GEORGIA

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/discussants/moderators) has disclosed all financial relationships with any commercial interest (termed by the ACCME as an "ineligible company", defined below) held in the last 24 months (see below for definitions). Please note that first authors were required to collect and submit disclosure information on behalf all other authors/contributors, if applicable.

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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.
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SPEAKERS / MODERATORS / DISCUSSANTS/AUTHORS	NOTHING TO DISCLOSE	DISCLOSURE		
		COMPANY	ROLE	RECEIVED
Example: John Smith				
A. Britton Christmas	Yes	UpToDate, Inc.	Author	Royalties
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Adam Nelson	No			
Adam Fox	No			
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Alexis Lauria	No			
Alfonso Lopez	No			
Ali Salim	No			
Alicia Mohr	No			
Alicia Mangram	No			
Alicia Sykes	No			
Alison Wilson	No			

Allan Stolarski	No			
Amanda Celii,	No			
Amber Himmler	No			
Amy Gore	No			
Anastasia Kunac	No			
Andre Campbell	No			
Andrea Pakula	Yes	Beckton Dickinson; Intuitive, Inc.	Speaker, Speaker	Speaker Fees, Speaker Fees
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Andrew Doben	No			
Andrew Young	No			
Andrew Chang	No			
Andrew-Paul Deeb	No			
Angela Ingraham	No			
Anna Romagnoli	No			
Anupamaa Seshadri	No			
Arielle Thomas	No			
Ashley Meagher	No			
Avery Nathens	No			
Babak Sarani	No			
Barbara Gaines	No			
Bellal Joseph	No			
Ben Zarzaur	No			
Brandy Jones	No			
Brett Tracy	No			
Brian Cain,	No			
Brian Eastridge	No			
Brittany Bankhead-Kendall	No			
Bryan Cotton	Yes	Haemonetics Corp	Consultant Services	Consultant Fees
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Carl Hauser	No			
Carlos Brown	No			
Caroline Reinke	No			
Caroline Park	No			
Carrie Sims	No			
Cherisse Berry	No			
Chrissy Guidry	No			
Christine Toves	No			
Christopher Ull	No			
Christopher Michetti	No			
Colin Buckley	No			
D'Andrea Joseph	No			
Daniel Holena	No			
Daniel Margulies	No			

Daniel Neubauer	No			
David Efron	No			
David Kauvar	No			
David Livingston	No			
David Shatz,	No			
David Notrica	No			
David Milia	No			
David Feliciano	No			
David Spain	No			
David Skarupa	No			
David Morris	No			
David Zonies	No			
Deborah Stein	No			
Deniz Vurmaz	No			
Dennis Ashley	No			
Derek Benham	No			
Diego Vicente	No			
Donald Jenkins	No			
Doug Schuerer	No			
Doulia Hamad	No			
Eileen Bulger	No			
Elizabeth Benjamin	Yes	3M-KCI	Consultant	Honorarium
Elliott Haut	Yes	Vixient	Consultant/speaker	Consulting/ Speaking Fees
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Felipe Lisboa	No			
Francis Guyette	No			
Grace Rozycki	No			
Grant Bochicchio	No			
Hasan Alam	No			
Hayatham Kaafarani	No			
Hayato Kurihara	Yes	Boston Scientific	Lecturer	Honorarium
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Isidro Martinez	No			
Jace Franko	No			
Jacob Glaser	No			
James Betts	No			
James Byrne	No			
Jamie Coleman	No			
Jarrett Santorelli	No			
Jason Smith	No			
Jason Sperry	No			
Jason Brill	No			
Jay Yelon	No			
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Jeffrey Kerby	No			
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John Agapian	No			
John Armstrong	No			
Jon Simmons	No			
Jonathan Scott	No			
Jonathan Black	No			
Jonathan Meizoso	No			
Jonathan Ratcliff	No			
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Joseph Kim	No			
Joseph Galante	No			
Joseph Forrester	Yes	Varian	Researcher	Research Fund
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Joshua Rosen	No			
Joshua Brown	No			
Juan Duchesne	No			
Juan Figueroa	No			
Juan Asensio	No			
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Karen Brasel	No			
Karyn Butler	No			
Katherine Hrebinko	No			
Kathleen Singer	No			

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Kristan Staudenmayer	No			
Kristen Spoor	No			
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Laura Godat	No			
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Lauren Tanner	No			
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Lawrence Diebel	No			
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Leigh Ann O'Banion	No			
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Lewis Somberg	No			
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Lisa Knowlton	No			
Louis Magnotti	No			
Lucy Kornblitth	No			
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Marin Chavez	No			
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Martin Zielinski	No			
Martin Schreiber	Yes	Haemonetics; CSL Behring	Consultant, Consultant/researcher	Money, Grant support
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Mary Fallat	No			
Mathew Tadlock	No			
Matthew Guttman	No			
Matthew McGuirk	No			
Matthew Ward	No			
Matthew Martin	Yes	Z-Medica	Advisory Board	Stipend
Matthew Tadlock	No			
Meaghan Crawley	No			
Melissa Hausburg	No			
Michael Klein	No			
Michael Rotondo	No			
Michael Carge	No			
Michael Goodman	No			
Michael Cripps	No			
Michaela West	No			
Mitu Agarwal	No			
Molly Douglas	No			
Nancy Parks	No			
Nathan Mowery	No			
Navpreet Dhillon	No			
Neil Parry	No			
Nicholas Namias	No			
Nicole Stassen	No			
Nicole Werner	No			
Niels Martin	No			
Oscar Guillamondegui	No			
Panagiotis Liasidis	No			
Parker Hu	No			
Patricia O'Neill	No			
Patrick Heindel	No			
Patrick Murphy	No			
Patrick Reilly	No			
Paul Maggio,	No			
Paula Ferrada	No			
Peter Hammer	No			
Peter Fagenholz	No			
Philip Efron	No			
Preston Miller	No			
Purvi Patel	No			
R. Stephen Smith	No			
Rachael Callcut	Yes	GE Healthcare; Humacyte; Philips Healthcare	Inventor of technology; site PI; site PI	Royalties; Research funding; Research funding
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Randeep Jawa	No			
Raul Coimbra	No			
Rebecca Fabian	No			
Red Hoffman	No			
Richard Lewis	No			
Rishi Rattan	No			
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Robert Winchell	Yes	Stryker Corporation	Consultant	Consulting Fees
Robert Laverty	No			
Robert McIntyre	Yes	Atox-Bio, OctaPharma, Medtronic, Genentech	PI, PI, PI, PI	Grant, Grant, Grant, Grant
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Ronald Maier	No			
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S. James El Haddi	No			
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Samuel Tischerman	No			
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Shahin Mohseni	No			
Sharmila Dissanaike	No			
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Stephanie Savage	No			
Stephanie Bonne	No			
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Stephen Barnes	No			
Sue Fu	No			
Susan Rowell	No			
Susannah Nicholson	No			
Sydney Timmer-Murillo	No			
Tanya Zakrison	No			
Tanya Egodage	No			
Tanya Anand	No			
Tarek Razek	No			
Taylor Wallen	No			

Tejal Brahmbhatt	No			
Theodore Habarth	No			
Timothy Pritts	No			
Tina Palmieri	No			
Todd Costantini	No			
Todd Rasmussen	No			
Tommy Thomas	No			
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Tracey Dechert	No			
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Weidun Alan Guo	No			
William Chiu	Yes	McGraw-Hill Educaiton	Editor	Honorarium
William Terzian	No			
William Marx	No			
Zain Hashmi	No			

Planning Committee	**Nothing to Disclose**	**Disclosure**		
		Company	**Role**	**Received**
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Timothy Fabian	No			
David Livingston	No			
Patrick Reilly	No			
Susan Rowell	No			
Ali Salim	No			
Jason Smith	No			
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Clay Burlew	No			
David Spain	No			
Louis Magnotti	No			

Christopher Michetti	No			
Ben Zarzaur	No			
Timothy Pritts	No			
Rachael Callcut	No			
Jonathan Meizoso	No			

Schedule

80th Annual Meeting of the American Association for the Surgery of Trauma and Clinical Congress of Acute Care Surgery

September 29 – October 02, 2021 • Atlanta, GA

GENERAL SCIENTIFIC PROGRAM SCHEDULE

MONDAY, SEPTEMBER 27, 2021

7:30 AM - 4:00 PM — Emergency Surgery Course (additional fee)
Location: Room 211

TUESDAY, SEPTEMBER 28, 2021

7:30 AM - 4:00 PM — Emergency Surgery Course (additional fee)
Location: Room 211

7:30 AM - 4:30 PM — AAST Board of Managers Meeting
Location: Room 303-304

12:00 PM - 7:00 PM — Registration
Location: Lobby Level

1:00 PM - 5:00 PM — Pre-sessions

The New Surgeon: Life after Residency and Fellowship (AAST Associate Member Council)
Location: Room 301

Emerging Technology, Artificial Intelligence, Telemedicine, and Simulation: Where are we now? (Education Committee)
Location: Room 307

Neurocritical Care Update and Board Review Course (Education, Critical Care, Geriatric Committees)
Location: Room 308

5:00 PM - 6:00 PM — Pre-session Reception
Location: Room 212

WEDNESDAY, SEPTEMBER 29, 2021

6:30 AM - 7:30 AM — Resident/Student/In-training Fellow Breakfast
Presenter: David Livingston, M.D., AAST President-Elect
Location: Room 303

6:30 AM - 5:15 PM — Registration
Location: Lobby Level

6:30 AM - 7:45 AM — Committee Meetings I

Communications Committee — *Location: Room 216*
Educational Development/MOC Committee — *Location: Room 217*
Pediatric Trauma Surgery Committee — *Location: Room 218*
Prevention Committee — *Location: Room 219*
Research and Education Fund Committee — *Location: Room 221*

8:00 AM - 7:30 PM — Donor Lounge
Location: Grand Ballroom Foyer

7:30 AM - 8:30 AM — Breakfast
Location: Grand Ballroom

7:30 AM - 7:00 PM — Exhibits Open
Location: Grand Ballroom

8:00 AM - 8:20 AM — Welcome
Location: Salon

8:20 AM - 11:00 AM — **Session I: Plenary Papers 1-8**
Moderator: David Spain, M.D. — *Recorder: Patrick Reilly, M.D.*
Location: Salon

Paper 1 — **8:20AM - 8:40 AM**
HARD, SOFT, & IRRELEVANT: HEMORRHAGIC & ISCHEMIC SIGNS BETTER DISTINGUISH IMPORTANT CHARACTERISTICS OF EXTREMITY VASCULAR INJURIES
Presenter: Anna Romagnoli, M.D. — Discussant: Mark Seamon, M.D.

Paper 2 — **8:40 AM - 9:00 AM**
IMPACT OF TIME TO SURGERY ON MORTALITY IN HYPOTENSIVE PATIENTS WITH NON-COMPRESSIBLE TORSO HEMORRHAGE: AN AAST MULTICENTER PROSPECTIVE STUDY
Presenter: Juan Duchesne, M.D. — Discussant: Lawrence Lottenberg, M.D.

Paper 3 — **9:00 AM - 9:20 AM**
AFTER 9,000 LAPAROTOMIES FOR BLUNT TRAUMA, RESUSCITATION IS BECOMING MORE BALANCED AND TIME TO INTERVENTION SHORTER: HOW LOW CAN WE GO?
Presenter: Molly Douglas, M.D. — Discussant: Bryan Cotton, M.D.

Paper 4 — **9:20 AM - 9:40 AM**
ADMISSION THROMBOELASTOGRAPHY REFLECTS THE RELATIONSHIP BETWEEN CYTOKINES AND COAGULOPATHY : A PROPPR SUB-ANALYSIS
Presenter: Stephanie Savage, M.D., M.S. — Discussant: Ronald Maier, M.D.

Paper 5 — **9:40 AM - 10:00 AM**
EMERGENCY GENERAL SURGERY TRANSFER TO LOWER ACUITY FACILITY: THE ROLE OF RIGHT-SIZING CARE IN EGS REGIONALIZATION
Presenter: Maria Baimas-George, M.D. — Discussant: Lillian Kao, M.D., M.S.

Paper 6 — **10:00 AM - 10:20 AM**
FINANCIAL VULNERABILITIES OF AMERICAN COLLEGE OF SURGEONS VERIFIED TRAUMA CENTERS: A STATEWIDE ANALYSIS
Presenter: Derek Benham, M.D. — Discussant: Grant Bochicchio, M.D., M.P.H.

Paper 7 — **10:20 AM - 10:40 AM**
EARLY METABOLIC SUPPORT FOR CRITICALLY ILL TRAUMA PATIENTS – A PROSPECTIVE RANDOMIZED CONTROLLED TRIAL
Presenter: Allan Stolarski, M.D., M.S. — Discussant: Alicia Mohr, M.D.

Paper 8 **10:40 AM - 11:00 AM**
ALIVE AND AT HOME: FIVE-YEAR OUTCOMES AMONG OLDER ADULTS WITH SEVERE TRAUMATIC INJURY
Presenter: Matthew Guttman, M.D. Discussant: Robert Barraco, M.D., M.P.H.

11:00 AM - 11:25 AM Break
Location: Grand Ballroom

11:25 AM - 12:25 PM **Session II: Presidential Address**
"Be Worthy"
Presenter: David Spain, M.D., AAST President
Location: Salon

12:25 PM - 1:40 PM Lunch Sessions I

Jacks Of All Trades: Military, Rural, and Humanitarian Surgical Perspective On Competencies For Surgical Care In Austere Settings *Location: Room 301*
(Military Committee)

Cultural Complications: Using M&M To Learn, Change, Improve *Location: Room 302*
(Diversity, Equity, Inclusion, Patient Assessment, and Acute Care Surgery Committees)

Beyond Hospital Survival: Improving Outcomes After Injury *Location: Room 303*
(Patient Assessment and Palliative Care Committees)

Disaster Medicine Opportunities For The Interested Surgeon: How To Get Involved and What To Expect *Locaiton: Room 304-305*
(Disaster Committees)

1:40 PM - 5:20 PM **Session IIIA: Papers 9-19**
Moderator: Eileen Bulger, M.D. ***Recorder: Stephanie Savage, M.D., M.S.***
Location: Salon East

Paper 9 **1:40 PM - 2:00 PM**
SOCIOECONOMIC DISADVANTAGE IS ASSOCIATED WITH HIGHER MORTALITY AFTER EMERGENCY SURGERY
Presenter: Brian Cain, M.D. Discussant: Cherisse Berry, MD

Paper 10 **2:00 PM - 2:20 PM**
A REVISED AAST GRADING SYSTEM FOR ACUTE CHOLECYSTITIS RESULTS IN SIGNIFICANTLY IMPROVED OUTCOME PREDICTIONS
Presenter: Kevin Schuster, M.D., M.P.H. Discussant: Nicole Stassen, M.D.

Paper 11 **2:20 PM - 2:40 PM**
A NOVEL PREOPERATIVE SCORE TO PREDICT SEVERE ACUTE CHOLECYSTITIS
Presenter: Kali Kuhlenschmidt, M.D. Discussant Peter Hammer, M.D.

Paper 12 **2:40 PM - 3:00 PM**
ANALYSIS OF REACTIVE ASCITES COLLECTED IN ACUTE APPENDICITIS OR SMALL BOWEL OBSTRUCTION
Presenter: Melissa Hausburg, M.D. Discussant: Kazuhide Matsushima, M.D.

Paper 13 **3:00 PM - 3:20 PM**
THE UNEQUAL IMPACT OF INTER-HOSPITAL TRANSFERS ON EMERGENCY GENERAL SURGERY PATIENTS: PROCEDURE RISK MATTERS
Presenter: Raul Coimbra, M.D., Ph.D Discussant: Angela Ingraham, M.D., M.S.

Paper 14 **3:20 PM - 3:40 PM**
REOPERATIVE SURGERY FOLLOWING CAWR: WE SHOULD LOOK PAST 30 DAYS
Presenter: Matthew McGuirk, M.D. Discussant: Preston Miller, M.D.

Paper 15 **3:40 PM - 4:00 PM**
READY OR NOT? A COMPARISON OF IN-THEATER AND STATESIDE TRAUMA EXPOSURE AMONG MILITARY OTOLARYNGOLOGISTS
Presenter: Matthew Ward, M.D. Discussant: Travis Polk, M.D.

Paper 16 **4:00 PM - 4:20 PM**
HYPER-REALISTIC ADVANCED SURGICAL SKILLS PACKAGE WITH CUT SUIT SURGICAL SIMULATOR IMPROVES SURGERY TRAINEE CONFIDENCE IN OPERATIVE TRAUMA
Presenter: Michael Klein, M.D. Discussant: Elizabeth Benjamin, M.D., Ph.D.

Paper 17 **4:20 PM - 4:40 PM**
ERROR REDUCTION IN TRAUMA CARE: LESSONS FROM AN ANONYMIZED, NATIONAL, MULTI-CENTER MORTALITY REPORTING SYSTEM
Presenter: Doulia Hamad, M.D. Discussant: Ali Salim, M.D.

Paper 18 **4:40 PM - 5:00 PM**
FALL RISK IDENTIFICATION THROUGHOUT THE CONTINUUM OF CARE
Presenter: Meaghan Crawley, MSN, RN, TCRN Discussant: Patrick Reilly, M.D.

Paper 19 **5:00 PM - 5:20 PM**
IMPROVED MORTALITY PREDICTION WITH NSQIP COMPARED TO TRISS AND ASA IN ELDERLY TRAUMA PATIENTS UNDERGOING SURGERY
Presenter: Stephen Stopenski, M.D. Discussant: Hayatham Kaafarani, M.D.

1:40 PM - 5:20 PM

Session IIIB: Papers 20-30

Moderator: Christopher Michetti, M.D. *Recorder: Sonlee West, M.D.*

Location: Salon West

Paper 20 **1:40 PM - 2:00 PM**
INTERCOSTAL LIPOSOMAL BUPIVACAINE INJECTION FOR RIB FRACTURES
Presenter: Taylor Wallen, M.D. Discussant: Andrew Kerwin, M.D.

Paper 21 **2:00 PM - 2:20 PM**
IMPLEMENTATION OF BRAIN INJURY GUIDELINES (BIG) FOR ISOLATED TRAUMATIC BRAIN INJURY IN ADULTS DECREASES RESOURCE USE WITHOUT ADVERSELY IMPACTING OUTCOMES
Presenter: Kevin Kuruvilla, M.D. Discussant: : Lena Napolitano, M.D., M.P.H

Paper 22 **2:20 PM - 2:40 PM**
DETERIORATION INDEX IN CRITICALLY INJURED PATIENTS: A FEASIBILITY ANALYSIS
Presenter: Rebecca Fabian, B.S. Discussant: Jennifer Gurney, M.D.

Paper 23 **2:40 PM - 3:00 PM**
DOES TREATMENT DELAY FOR BLUNT CEREBROVASCULAR INJURY AFFECT STROKE RATE?: AN EAST MULTICENTER TRIAL
Presenter: Rachel Appelbaum, M.D. Discussant: Louis Magnotti, M.D.

Paper 24 **3:00 PM - 3:20 PM**
THE USE OF PREDEFINED SCALES AND SCORES WITH EYE-TRACKING DEVICES TO SYMPTOM IDENTIFICATION IN CRITICALLY ILL NON-VERBAL PATIENTS
Presenter: Christopher Ull Discussant: Jason Smith, M.D.

Paper 25 **3:20 PM - 3:40 PM**
VALIDATING THE BRAIN INJURY GUIDELINES (BIG):RESULTS OF AN AAST PROSPECTIVE MULTI-INSTITUTIONAL TRIAL
Presenter: Bellal Joseph, M.D. Discussant: A. Britton Christmas, M.D.

Paper 26 **3:40 PM - 4:00 PM**
PREDICTING ARDS EARLY IN CRITICAL SURGICAL ILLNESS: A MODEL USING SERUM INFLAMMATORY MARKERS AND CLINICAL DATA
Presenter: Felipe Lisboa, M.D. Discussant: Karyn Butler, M.D.

Paper 27 **4:00 PM - 4:20 PM**
PLATELET TRANSFUSION REDUCES PLATELET DYSFUNCTION IN TRAUMATIC BRAIN INJURY
Presenter: Victoria Miles, M.D. Discussant: Lucy Kornblith, M.D.

Paper 28 **4:20 PM - 4:40 PM**
LOW PREVALENCE BUT HIGH IMPACT OF COVID-19 + STATUS: A MULTI-INSTITUTIONAL ANALYSIS OF 28,904 PATIENTS
Presenter: Samir Fakhry, M.D. Discussant: Sheldon Teperman, M.D.

Paper 29 **4:40 PM - 5:00 PM**
RESPIRATORY COMPLICATIONS AFTER INTENSIVE CARE UNIT DISCHARGE IN TRAUMA PATIENTS: A HIGH CONSEQUENCE EVENT
Presenter: Joshua Rosen, M.D., M.H.S. Discussant: Paula Ferrada, M.D.

Paper 30 **5:00 PM - 5:20 PM**
AGITATION IN THE TRAUMA BAY AS AN EARLY INDICATOR OF SEVERE INJURY AND HEMORRHAGIC SHOCK
Presenter: Mary Bokenkamp, M.D. Discussant: Linda Ding, M.D.

5:20 PM - 5:30 PM Break
Location: Grand Ballroom

5:30 PM - 6:00 PM **Session IV: Master Surgeon Lecture**
"The Use of Ultrasound in the Acute Setting: Lessons Learned After 30 Years"
Presenter: Grace Rozycki, M.D., M.B.A.
Location: Salon East

6:00 PM - 7:00 PM Welcome Reception
Location: Grand Ballroom

THURSDAY, SEPTEMBER 30, 2021

6:15 AM - 7:15 AM Committee Meetings II
Diversity, Equity, and Inclusion Committee *Location: Room 216*
Disaster Committee *Location: Room 217*
Geriatric Trauma/ACS Committee *Location: Room 219*

7:00 AM - 8:00 AM Breakfast in Exhibit Hall
Location: Grand Ballroom

7:00 AM - 1:00 PM Exhibits
Location: Grand Ballroom

7:00 AM - 3:00 PM Registration
Location: Lobby Level

7:00 AM - 6:00 PM Donor Lounge
Location: Grand Ballroom Foyer

7:30 AM - 8:30 AM **Session VI: Papers 31-33**
Moderator: Mary Fallat, M.D. ***Recorder: David Notrica, M.D.***
Location: Salon

Paper 31 **7:30 AM - 7:50 AM**
PEDIATRIC TRAUMA IN THE CALIFORNIA-MEXICO BORDER REGION: INJURY DISPARITIES BY AREA DEPRIVATION INDEX
Presenter: Alicia Sykes, M.D. Discussant: Jeffrey Upperman, M.D.

Paper 32 **7:50 AM - 8:10 AM**
SEX DIMORPHISMS IN COAGULATION CHARACTERISTICS IN THE PEDIATRIC TRAUMA POPULATION APPEAR AFTER PUBERTY
Presenter: Katherine Hrebinko, M.D. Discussant: Chrissy Guidry, D.O.

Paper 33 **8:10 AM - 8:30 AM**
ASSOCIATION OF SOCIAL VULNERABILITY INDEX WITH RISK-ADJUSTED TRAUMA OUTCOMES
Presenter: Jonathan Scott, M.D. Discussant: Marta McCrum, M.D., M.P.H.

8:30 AM - 9:00 AM **Session VII: Master Surgeon Lecture II**
"Tailwinds & Headwinds"
Presenter: L.D. Britt, M.D., M.P.H.
Location: Salon

9:00 AM - 9:30 AM **Session VIII: Scholarship Presentations**
Moderator: David Spain, M.D.
Location: Salon

"Immunomodulatory Effects of Cellular Contamination Immunomodulatory Effects of Cellular Contaminationin Plasma Products for Transfusion"
Larry Yann-Leei Lee, M.D.

"Optimization of Re-Triage of Severely Injured Patients"
Anne M. Stey, M.D., M.Sc.

9:30 AM - 10:50 AM **Session IX: Papers 34-37**
Moderator: Kimberly Davis, M.D., M.B.A. ***Recorder: Ronald Stewart, MD***
Location: Salon

Paper 34 **9:30 AM - 9:50 AM**
RACE AND TRAUMA: THE EFFECT OF HOSPITAL BLACK-WHITE PATIENT RACE DISTRIBUTION ON MORTALITY
Presenter: Sami Kishawi, M.D. Discussant: Andre Campbell, M.D.

Paper 35 **9:50 AM - 10:10 AM**
A NATIONAL STUDY DEFINING 1.0 FULL-TIME EMPLOYMENT FOR TRAUMA/ACUTE CARE SURGERY
Presenter: Marc de Moya, M.D. Discussant: Kristan Staudenmayer, M.D., MS.c.

Paper 36 **10:10 AM - 10:30 AM**
LENGTH OF STAY AND TRAUMA CENTER FINANCES: A TALE OF TWO PAYERS
Presenter: Marin Chavez, M.D. Discussant: Michael Rotondo, M.D.

Paper 37 **10:30 AM - 10:50 AM**
INSURANCE CHURN AFTER TRAUMATIC INJURY: NATIONAL EVALUATION AMONG A LARGE PRIVATE INSURANCE DATABASE
Presenter: Sue Fu, M.D. Discussant: Adil Haider, M.D., M.P.H.

10:50 AM - 11:10 AM Break
Location: Grand Ballroom

11:10 AM - 12:10 PM **Session X: Fitts Lecture**
Tribute to J. David Richardson, M.D.
"Trauma and Acute Care Surgery: The Evolution of a Specialty"
Talk Presented by: David Livingston, M.D., AAST President-Elect
Location: Salon

12:10 PM - 1:10 PM — **Session XI: Poster Session**

Group One — *Location: Room 208*
Group Two — *Location: Room 209*
Group Three — *Location: Room 210*
Group Four — *Location: Room 211*
Group Five — *Location: Room 212*
Group Six — *Location: Room 213*
Group Seven — *Location: Room 214*

1:00 PM - 2:15 PM — **Product Theater: Alexion, AstraZeneca Rare Disease**

"The Standard of Care for the Reversal of anticoagulants in Hospitalized Patients with Life-Threatening or Uncontrolled Bleeding"
Room: Galleria (Lower Level)

1:10 PM - 2:25 PM — Lunch Sessions II

Staffing a Trauma/Acute Care Surgery Service – What is a Full-Time Employee (FTE) — *Location: Room 303*
(Acute Care Surgery Committee)

Taking your Research to the Next Level: What can CNTR do for you? — *Location: Room 302*
(Program Committee)

ACS Fellowships: Hot Topics for Program Directors — *Location: Room 301*
(Acute Care Surgery and Program Directors Committee)

2:30 PM - 3:30 PM — **Satellite Symposiums: Prytime Medical**

"Clinical Benefits of True Partial REBOA"
Room 208-211

2:30 PM - 3:45 PM — **Satellite Symposiums: DePuy Synthes**

"MatrixRIB and How to Build a Rib Fracture Program"
Room 304-305

2:30 PM - 4:00 PM — TSACO Editorial Board Meeting (Invite Only)
Location: Room 224

2:30 PM-6:00 PM — Add-on Sessions

Pediatric Trauma Update Course — *Location: Room 308*
(Pediatric Committee)

Continuous Certification: Hot Topics, Case Challenges, and Current Literature in Trauma and EGS — *Location: Salon*
(Education Committee)

4:00 PM - 7:30 PM — JTACS Editorial Board Meeting and Reception (Invite Only)
Location: Room 304-305

5:00 PM - 8:00 PM — SCCPDS Board of Directors Meeting (Invite Only)
Location: Room 205

6:00 PM - 7:00 PM — AAST Associate Member Happy Hour (Invite Only)
Location: Room 211

FRIDAY, OCTOBER 1, 2021

6:15 AM - 7:15 AM — Committee Meetings III

AAST Associate Member Council — *Location: Room 215*
Critical Care Committee — *Locaiton: Room 216*
Multi-Institutional Trials Committee — *Location: Room 218*
Military Liaison Committee — *Location: Room 219*

6:15 AM - 7:15 AM — AAST Board of Managers Meeting (Invite Only)
Location: Room 224

7:00 AM - 8:00 AM — Breakfast in Exhibit Hall
Location: Grand Ballroom

7:00 AM - 1:30 PM — Exhibits
Location: Grand Ballroom

7:00 AM - 3:00 PM — Registration
Location: Lobby Level

7:00 AM - 4:00 PM — Donor Lounge
Location: Grand Ballroom Foyer

7:30 AM - 10:10 AM

Session XII: Papers 38-45

Moderator: David Livingston, M.D.

Recorder: Karen Brasel, M.D., M.P.H.

Location: Salon

Paper 38 — **7:30 AM - 7:50 AM**
IT'S TIME TO LOOK IN THE MIRROR: INDIVIDUAL SURGEON OUTCOMES AFTER EMERGENT TRAUMA LAPAROTOMY
Presenter: Parker Hu, M.D. — Discussant: Carlos Brown, M.D.

Paper 39 — **7:50 AM - 8:10 AM**
NATIONAL ADHERENCE TO THE ASGE-SAGES GUIDELINES FOR MANAGING SUSPECTED CHOLEDOCHOLITHIASIS
Presenter: Brett Tracy, M.D. — Discussant: Caroline Reinke, M.D.

Paper 40 — **8:10 AM - 8:30 AM**
A PROSPECTIVE RANDOMIZED TRIAL COMPARING TWO STANDARD DOSES OF ENOXAPARIN FOR PREVENTION OF THROMBOEMBOLISM IN TRAUMA
Presenter: Martin Schreiber, M.D. — Discussant: Elliott Haut, M.D., Ph.D.

Paper 41 — **8:30 AM - 8:50 AM**
THE VOLUME OF THORACIC IRRIGATION AFFECTS LENGTH OF STAY IN PATIENTS WITH TRAUMATIC HEMOTHORAX
Presenter: Laura Crankshaw, M.D. — Discussant: Todd Costantini, M.D.

Paper 42 — **8:50 AM - 9:10 AM**
SUCCESSFUL NON-OPERATIVE MANAGEMENT OF ADHESIVE SMALL BOWEL OBSTRUCTION: IS IT REALLY A SUCCESS?
Presenter: William Terzian, M.D. — Discussant: Martin Zielinski, M.D.

Paper 43 — **9:10 AM - 9:30 AM**
CHARACTERISTICS AND OUTCOMES OF PRE-HOSPITAL TOURNIQUET USE FOR TRAUMA IN THE UNITED STATES
Presenter: Zain Hashmi, M.B.B.S — Discussant: D'Andrea Joseph, M.D.

Paper 44 — **9:30 AM - 9:50 AM**
EVERY MINUTE COUNTS: GEOSPATIAL ACCESS TO TRAUMA CENTER CARE PREDICTS FIREARM INJURY MORTALITY
Presenter: James Byrne, M.D., Ph.D. — Discussant: Robert Winchell, M.D.

Paper 45 — **9:50 AM - 10:10 AM**
BEYOND RECIDIVISM: HOSPITAL BASED VIOLENCE INTERVENTION IMPROVES HEALTH AND SOCIAL OUTCOMES
Presenter: Stephanie Bonne, M.D. — Discussant: Rochelle Dicker, M.D.

10:10 AM - 10:30 AM — Break
Location: Grand Ballroom

10:30 AM - 11:45 AM **Session XIII: Panel: Experts on the Hot Seat**

Moderator: Oscar Guillamondegui, M.D., M.P.H.
Presenters: Eileen Bulger, M.D.; Vanessa Ho, M.D., M.P.H.;
Lena Napolitano M.D., M.P.H.; David Skarupa, M.D.
Location: Salon

11:45 AM - 1:00 PM **Product Theater: Zimmer Biomet**

"Intrathoracic Rib Fixation"
Room: Galleria (Lower Level)

11:45 AM - 1:00 PM Lunch Sessions III

What You Need to Know About Post-ICU Syndrome *Location: Room 301*
(Palliative Care, Critical Care, and Patient Assessment Committees)

Laparoscopic CBD Exploration: When, Why, and How to Start Doing Them *Location: Room 302*
(Acute Care Surgery Committee and SAGES)

Technical Aspects of Challenging Vascular Injuries for Military and Civilian Trauma Surgeons *Location: Room 304-305*
(Military Committee)

11:45 AM - 1:00 PM Lunch with Exhibitors (AAST Sponsored)
Location: Grand Ballroom

1:00 PM - 4:40 PM **Session XIVA: Papers 46-56**

Moderator: Timothy Pritts, MD ***Recorder: Jennifer Gurney, MD***
Location: Salon East

Paper 46 **1:00 PM - 1:20 PM**
BONE MARROW ADIPOKINE EXPRESSION ASSOCIATED WITH DECREASED ERYTHROID COLONY GROWTH AFTER TRAUMA
Presenter: Lauren Kelly, M.D. Discussant: Hasan Alam, M.D.

Paper 47 **1:20 PM - 1:40 PM**
A NEW TRAUMA FRONTIER: PLATELET TRANSCRIPTOMICS
Presenter: Lucy Kornblith, M.D. Discussant: Carrie Sims, M.D.

Paper 48 **1:40 PM - 2:00 PM**
THE EFFECT OF TRANEXAMIC ACID DOSING REGIMEN ON TRAUMA/HEMORRHAGIC SHOCK RELATED GLYCOCALYX DEGRADATION AND ENDOTHELIAL BARRIER PERMEABILITY: AN IN VITRO MODEL
Presenter: Michael Carge, M.D. Discussant: John Holcomb, M.D.

Paper 49 **2:00 PM - 2:20 PM**
PLASMA AND WOUND FLUIDS FROM TRAUMA PATIENTS SUPPRESS NEUTROPHIL EXTRACELLULAR RESPIRATORY BURST
Presenter: Carl Hauser, M.D. Discussant: Jennifer Leonard, M.D.

Paper 50 **2:20 PM - 2:40 PM**
BETABLOCKADE IN TBI: DOSE DEPENDENT REDUCTIONS IN BBB LEUKOCYTE MOBILIZATION & PERMEABILITY IN VIVO
Presenter: Alfonso Lopez, M.D. Discussant: Stephen Barnes, M.D.

Paper 51 **2:40 PM - 3:00 PM**
MESENCHYMAL STEM CELL EXTRACELLULAR VESICLES MITIGATE VASCULAR PERMEABILITY AND INJURY IN MULTIPLE ORGANS IN HEMORRHAGIC SHOCK AND TRAUMA
Presenter: Mark Barry, M.D. Discussant: Rosemary Kozar, M.D., Ph.D.

Paper 52 **3:00 PM - 3:20 PM**
ADENOSINE, LIDOCAINE, AND MAGNESIUM (ALM) TO MITIGATE INJURY FROM RESUSCITATIVE ENDOVASCULAR BALLOON OCCLUSION OF THE AORTA (REBOA)
Presenter: Jace Franko, M.D. Discussant: Jacob Glaser, M.D.

Paper 53 **3:20 PM - 3:40 PMM**
CELLULAR MICRORNAS CORRELATE WITH OUTCOMES IN POLYTRAUMA PATIENTS
Presenter: Diego Vicente, M.D. Discussant Martin Schreiber, M.D.

Paper 54 **3:40 PM - 4:00 PM**
SEX DIFFERENCES ASSOCIATE WITH LATE MICROBIOME ALTERATIONS AFTER MURINE SURGICAL SEPSIS
Presenter: Philip Efron, M.D. Discussant: Susannah Nicholson, M.D.

Paper 55 **4:00 PM - 4:20 PM**
PRECISION TARGETING OF THE VAGAL ANTI-INFLAMMATORY PATHWAY ATTENUATES THE SIRS RESPONSE TO INJURY
Presenter: Todd Costantini, M.D. Discussant: Tina Palmieri, M.D.

Paper 56 **4:20 PM - 4:40 PM**
THE 35-MM RULE TO GUIDE PNEUMOTHORAX MANAGEMENT: INCREASES APPROPRIATE OBSERVATION AND DECREASES UNNECESARY CHEST TUBES
Presenter: Juan Figueroa. M.D. Discussant: Stanislaw Stawicki, M.D.

1:00 PM - 4:40 PM

Session XIVB: Papers 57-67

Moderator: Sharon Henry, M.D. *Recorder: Ajai Malhotra, M.D.*

Location: Salon West

Paper 57 **1:00 PM - 1:20 PM**
BLOOD PRODUCT RESUSCITATION MITIGATES THE EFFECTS OF AEROMEDICAL EVACUATION AFTER POLYTRAUMA
Presenter: Kathleen Singer, M.D. Discussant: Joshua Brown, M.D.

Paper 58 **1:20 PM - 1:40 PM**
DIRECT TO OR RESUSCITATION OF ABDOMINAL TRAUMA: AN NTDB PROPENSITY MATCHED OUTCOMES STUDY
Presenter: Theodore Habarth, M.D. Discussant: Laura Godat, M.D.

Paper 59 **1:40 PM - 2:00 PM**
PROSPECTIVE RANDOMIZED TRIAL OF METAL VS RESORBABLE PLATES IN SURGICAL STABILIZATION OF RIB FRACTURES
Presenter: Dennis Ashley, M.D. Discussant: Lewis Somberg, M.D.

Paper 60 **2:00 PM - 2:20 PM**
COVER WITH CAUTION: MANAGEMENT OF THE LEFT SUBCLAVIAN ARTERY IN TEVAR FOR TRAUMA
Presenter: Jeanette Patterson, M.D. Discussant: Todd Rasmussen, M.D.

Paper 61 **2:20 PM - 2:40 PM**
PRACTICAL MACHINE LEARNING APPLICATION TO CHARACTERIZE GERIATRIC TRAUMA FRAILTY
Presenter: Jeff Choi, M.D., Ms.C. Discussant: Rachael Callcut, M.D.

Paper 62 **2:40 PM - 3:00 PM**
SOCIAL DETERMINANTS OF HEALTH AND PATIENT-LEVEL MORTALITY PREDICTION AFTER TRAUMA
Presenter: Andrew-Paul Deeb, M.D. Discussant Tanya Zakrison, M.D., M.P.H.

Paper 63 **3:00 PM - 3:20 PM**
TRAUMA TRANSFERS DISCHARGED FROM THE EMERGENCY DEPARTMENT- IS THERE A ROLE FOR TELEMEDICINE?
Presenter: Amanda Celii, M.D. Discussant: Jeffrey Kerby, M.D., Ph.D.

Paper 64 **3:20 PM - 3:40 PM**
MEDICAL MANAGEMENT OF GRADE I-II SPLENIC INJURIES WITH ACTIVE EXTRAVASATION HAS A HIGH FAILURE RATE: AN EAST MCT
Presenter: Kristen Spoor, M.D. Discussant: Ben Zarzaur, M.D., M.P.H.w

Paper 65 **3:40 PM - 4:00 PM**
TIMING IS EVERYTHING: IMPACT OF COMBINED LONG BONE FRACTURE AND MAJOR ARTERIAL INJURY ON OUTCOMES
Presenter: Richard Lewis, M.D., M.A. Discussant: David Efron, M.D.

Paper 66 **4:00 PM - 4:20 PM**
TIME TO THE OR AFTER GUNSHOT WOUNDS TO THE ABDOMEN: A POTENTIAL PROCESS MEASURE TO ASSESS THE QUALITY OF TRAUMA CARE?
Presenter: Arielle Thomas, M.D., M.P.H Discussant Maria Jimenez, M.D.

Paper 67 **4:20 PM - 4:40 PM**
LONG-TERM FUNCTIONAL AND PATIENT REPORTED OUTCOMES AFTER ISOLATED RIB FRACTURES
Presenter: Patrick Heindel, M.D. Discussant: Raminder Nirula, M.D., M.P.H.

4:45 PM - 6:15 PM — AAST Annual Business Meeting
Location: Salon

7:00 PM - 7:30 PM — Pre-Banquet Reception
Location: Grand Ballroom

7:30 PM - 11:00 PM — AAST Banquet
Location: Grand Ballroom

SATURDAY, OCTOBER 2, 2021

7:00 AM - 8:00 AM — New Member Breakfast
Location: Grand Ballroom

7:30 AM - 10:00 AM — Registration (if needed)
Location: Lobby Level

7:30 AM - 8:30 AM — Breakfast
Location: Grand Ballroom

8:00 AM - 9:18 AM **Session XV: Quickshot Session I 1-13**
Moderator: Deborah Stein, M.D., M.P.H.
Location: Salon

Quickshot 1 **8:00 AM - 8:06 AM**
PREHOSPTIAL WHOLE BLOOD IS ASSOCIATED WITH IMPROVED HEMOSTASIS AND CLINICAL OUTCOMES: RESULTS OF A PROSPECTIVE RANDOMIZED PILOT TRIAL
Presenter: Francis Guyette, M.D. Discussant: Donald Jenkins, M.D.

Quickshot 2 **8:06 AM - 8:12 AM**
LIFE OVER LIMB: VASCULAR LIMB COMPLICATIONS FOLLOWING REBOA
Presenter: Robert Laverty, M.D., M.P.H Discussant: Jeffrey Nicholas, M.D.

Quickshot 3 **8:12 AM - 8:18 AM**
BALLOONS FOR KIDS: ANATOMIC CANDIDACY AND OPTIMAL CATHETER SIZE FOR PEDIATRIC REBOA
Presenter: Alicia Skyes, M.D. Discussant: Barbara Gaines, M.D.

Quickshot 4 **8:18 AM - 8:24 AM**
FOLLOW YOUR COMPASS®: REBOA MANAGEMENT GUIDED BY A NOVEL HANDHELD PRESSURE TRANSDUCER
Presenter: Michael Parsons, M.D. Discussant: Doug Schuerer, M.D.

Quickshot 5 **8:24 AM - 8:30 AM**
ADVANCED PARTIAL OCCLUSION CONTROLLER FOR REBOA IN A PORCINE MODEL OF HEMORRHAGIC SHOCK
Presenter: Alexis Lauria, M.D. Discussant: Matthew Martin, M.D.

Quickshot 6 **8:30 AM - 8:36 AM**
PROSPECTIVE VALIDATION OF THE RIB INJURY GUIDELINES (RIG) FOR TRAUMATIC RIB FRACTURES
Presenter: Adam Nelson, M.D. Discussant: Andrew Doben, M.D.

Quickshot 7 **8:36 AM - 8:42 AM**
NOT SO FAST- CHEST ULTRASOUND UNDERDIAGNOSES TRAUMATIC PNEUMOTHORAX
Presenter: Jarrett Santorelli, M.D. Discussant: Marc de Moya, M.D.

Quickshot 8 - WITHDRAWN

Quickshot 9 **8:42 AM - 8:48 AM**
RISK FACTORS FOR STROKE IN PENETRATING CAROTID TRAUMA IN THE AAST PROOVIT REGISTRY
Presenter: Leigh Ann O'Banion, M.D. Discussant: Alison Wilson, M.D.

Quickshot 10 **8:48 AM - 8:54 AM**
DELETERIOUS EFFECTS OF PLASMA-DERIVED CELLULAR DEBRIS IN A PORCINE MODEL OF HEMORRHAGIC SHOCK
Presenter: Colin Buckley, M.D. Discussant: Martin Schreiber, M.D.

Quickshot 11 **8:54 AM - 9:00 AM**
IMAGE BASED DETECTION AND ANALYSIS OF STROKE DUE TO BLUNT CEREBROVASCULAR INJURY
Presenter: Jonathan Black, M.D. Discussant: Jamie Coleman, M.D.

Quickshot 12 **9:00 AM - 9:06 AM**
HEMORRHAGE PROGRESSION IN TRAUMATIC BRAIN INJURY OCCURS EARLY AND IS NOT INCREASED BY ADMINISTRATION OF NAPROXEN
Presenter: Kayla Isbell, M.D. Discussant: Anupamaa Seshadri, M.D.

Quickshot 13 **9:06 AM - 9:12 AM**
DEVELOPMENT OF AN AI-DRIVEN POINT-OF-CARE TRAUMA BIOMARKER PANEL TO IDENTIFY INJURY PRESENCE AND SEVERITY
Presenter: Deniz Vurmaz, Ph.D. Discussant: Andrew Young, M.D.

9:12 AM - 9:40 AM Break
Location: Grand Ballroom

9:40 AM - 10:58 AM **Session XVI: Quickshot Session II 14-26**
Moderator: Walter Biffl, M.D.
Location: Salon

Quickshot 14 **9:40 AM - 9:46 AM**
SMALL BOWEL OBSTRUCTION IN THE VIRGIN ABDOMEN
Presenter: Panagiotis Liasidis, M.D. Discussant: Jose Diaz, M.D.

Quickshot 15 **9:46 AM - 9:52 AM**
BURNOUT REDUCTION IN ACUTE CARE SURGEONS: IMPACT OF A FACULTY SCHEDULE CHANGE AT A LEVEL 1 TRAUMA AND TERTIARY CARE CENTER
Presenter: Caitlin Jones, D.O. Discussant: Jennifer Hartwell, M.D.

Quickshot 16 **9:52 AM - 9:58 AM**
CODE CRITICAL AIRWAY: A COLLABORATIVE SOLUTION TO A CATASTROPHIC PROBLEM
Presenter: Amber Himmler, M.D. Discussant: Niels Martin, M.D.

Quickshot 17 **9:58 AM - 10:04 AM**
DOES PRACTICE MATCH TRAINING? CONSULTATION PRACTICES IN SURGICAL CRITICAL CARE
Presenter: Christopher Michetti, M.D. Discussant: Krista Kaups, M.D., M.Sc., M.S.

Quickshot 18 **10:04 AM - 10:10 AM**
ESTRADIOL REDUCES MORTALITY IN A SWINE MODEL OF POLY TRAUMA AND HEMORRHAGIC SHOCK
Presenter: Hossam Abdou, M.D. Discussant: Michael Goodman, M.D.

Quickshot 19 **10:10 AM - 10:16 AM**
THE INTERACTION BETWEEN β-ADRENERGIC BLOCKADE AND THE REVISED CARDIAC RISK INDEX IN RELATION TO MORTALITY AFTER TRAUMATIC HIP FRACTURE SURGERY IN GERIATRIC PATIENTS
Presenter: Ahmad Mohammad Ismail, M.D. Discussant: Mitch Cohen, M.D.

Quickshot 20 **10:16 AM - 10:22 AM**
HEMORRHAGE INCREASES CAPILLARY CONGESTION IN A PORCINE MULTIPLE TRAUMA MODEL
Presenter: S. James El Haddi, M.D., M.S. Discussant: Lawrence Diebel, M.D.

Quickshot 21 **10:22 AM - 10:28 AM**
DEFINING SEPSIS PHENOTYPES - TWO MURINE MODELS OF SEPSIS AND MACHINE LEARNING
Presenter: Allan Stolarski, M.S., M.D. Discussant: Robert Maxwell, M.D.

Quickshot 22 **10:28 AM - 10:34 AM**
IMPACT OF COVID STATUS COMPLICATIONS IN PATIENTS IN HEMORRHAGIC SHOCK
Presenter: Jason Brill, M.D. Discussant: Patricia O'Neill, M.D.

Quickshot 23 **10:34 AM - 10:40 AM**
THE NEW FACE OF WAR: CRANIOFACIAL INJURIES FROM OPERATION INHERENT RESOLVE
Presenter: Daniel Neubauer, M.D. Discussant: Joseph Galante, M.D.

Quickshot 24 **10:40 AM - 10:46 AM**
LIFE THREAT DURING ASSAULTIVE TRAUMA: CRITICAL PERI-TRAUMATIC RISK FACTORS FOR INJURED PATIENTS
Presenter: Sydney Timmer-Murillo, M.S. Discussant: Tracey Dechert, M.D.

Quickshot 25 **10:46 AM - 10:52 AM**
ACUTE STRESS DISORDER IN TRAUMA PATIENTS DISCHARGED IN 72 HOURS OR LESS
Presenter: Aaron Veenis, B.S. Discussant: Cherisse Berry, M.D.

Quickshot 26 **10:52 AM - 10:58 AM**
EARLY PREDICTORS OF POST DISCHARGE DEATH IN THE ELDERLY TRAUMA POPULATION TO GUIDE PALLIATIVE CARE DISCUSSIONS
Presenter: Andrew Chang, M.D. Discussant: Ashley Meagher, M.D., M.P.H.

11:00 AM Meeting Adjourned

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 December 1937. 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 approximately 1,700 members from 30 countries.

BOARD OF MANAGERS
2019–2021

President.....David Spain, M.D.
Stanford, California

President-Elect.....David Livingston, M.D.
Newark, New Jersey

Vice-President.....Mary Fallat, M.D.
Louisville, Kentucky

Secretary-Treasurer..... Kimberly Davis, M.D., M.B.A
New Haven, Connecticut

Recorder and Program Chairman..... Patrick Reilly, M.D.
Philadelphia, Pennsylvania

Past President 2018-2019..... Martin Croce, M.D.
Memphis, Tennessee

Past President 2017–2018.....Michael Rotondo, M.D.
Rochester, New York

Past President 2016–2017..... Raul Coimbra, M.D., Ph.D.
San Diego, California

Manager-at-Large (2020)..... Sharon Henry, M.D.
Baltimore, Maryland

Manager-at-Large (2021)..... Robert Winchell, M.D.
New York, New York

Critical Care Manager-at-Large (2022)..... Christopher Michetti, M.D.
Annandale, Virginia

Acute Care Surgery Manager-at-Large (2020).....Clay Cothren Burlew, M.D.
Denver, Colorado

REPRESENTATIVES OF THE AAST 2019–2021

REPRESENTATIVE TO THE AMERICAN BOARD OF SURGERY

Amy Goldberg, MD (2018–2024)
Philadelphia, Pennsylvania

REPRESENTATIVE TO THE BOARD OF GOVERNORS OF THE AMERICAN COLLEGE OF SURGEONS

Preston Miller, MD (2019 - 2022)
Winston-Salem, NC

Raul Coimbra, MD, PhD (2018–2024)
San Diego, California

REPRESENTATIVE TO THE GENERAL SURGERY ADVISORY COUNCIL FOR THE AMERICAN COLLEGE OF SURGEONS

Daniel Dent, MD (2019-2022)
San Antonio, Texas

THE ABS TRAUMA, BURNS & CRITICAL CARE COMPONENT BOARD

Joseph Minei, MD, MBA (2016 - 2022)
Dallas, Texas

Kimberly Davis, MD, MBA (2018 – 2024)
New Haven, Connecticut

REPRESENTATIVE TO THE WORLD HEALTH ORGANIZATION

Raul Coimbra, MD, PhD (2012–2021)
San Diego, California

REPRESENTATIVE TO THE PEDIATRIC CRITICAL CARE AND TRAUMA SCIENTIST DEVELOPMENT PROGRAM NICHD-FUNDED K-12

Kennith Sartorelli, MD (2017-2021)
Burlington, Vermont

REPRESENTATIVE TO 5TH WORLD TRAUMA CONGRESS 2020

David Spain, MD (2021)
Stanford, California

Karen Brasel, MD, MPH (2021)
Portland, Oregon

REPRESENTATIVE TO AMERICAN COLLEGE OF RADIOLOGY (ACR) COMMITTEE ON APPROPRIATENESS CRITERIA

SPINE TRAUMA-CHILD
Lillian Kao, MD, MS (2021)
Houston, Texas

CHEST WALL PAIN
Sarah Majercik, MD, MBA (2021)
Murray, Utah

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

ASSOCIATE MEMBER COUNCIL 2020–2021

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Stanford, California

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Dallas, Texas

AMC Secretary.....Linda Dultz, M.D.
Dallas, Texas

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Denver, Colorado

AMC Scholarship/Development Councilor.....William Butler, M.D.
San Diego, California

AMC Communication/Social Media Councilor....Brittany Bankhead-Kendall, M.D.
Lubbock, Texas

Education/E-Learning Committee Chair.....Navpreet Dhillon, M.D.
Los Angeles, California

Scholarship, Awards, and Development Committee Chair.....Kovi Bessoff, M.D.
Stanford, California

Communications & Social Media Committee Chair.....Julia Coleman, M.D.
Denver, Colorado

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Brandy Padilla-Jones, MD (2022)
Jennifer Knight, MD (2021)
Joseph Galante, MD (2023)
Nancy Parks, MD (2021)
Neil Parry, MD (2021)
Amy Murphy, MD (2023)
Babak Sarani, MD (2023)
Tanya Anand, MD (2023)
Nicole Stassen, MD (2021)
Patrick Murphy, MD (2022)
Paula Ferrada, MD (2021)
Preston Miller, MD (2021)
Sarah Moore, MD (2022)
Susan Rowell, MD (2021)
Thaddeus Puzio, MD (2022)
Nicole Stassen, MD (2021)
Raul Coimbra, MD, PhD, *Ex-Officio* (2021)
Marc de Moya, MD, *International Relations Committee Liaison (*2021)

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David King, MD (2023)
Dina Filiberto, MD (2022)
Douglas Fraser, MD (2022)
Jason Sciarretta, MD (2022)
Jason Sperry, MD (2021)
Raeanna Adams, MD (2021)
Alexander Lorenzo Colonna, MD (2021)
Niels Douglas Martin, MD (2021)
Thomas Carver, MD (2021)
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Jose Diaz, MD (2021)
Linda Maerz, MD (2021)
Luke Hofmann, MD (2021)
Mark Falimirski, MD (2021)
Mbaga Walusimbi, MD (2021)
Nathan Mowery, MD (20201
Rita Brintzenhoff, MD (2021)
Michael Ditillo, MD (2021)
Laura Nadine Godat, MD (2021)
Meghan Rebecca Lewis, MD (2021)
Jasmeet S Paul, MD (2021)
Ziad C. Sifri, MD (2021)
Ronald Brian Tesoriero, MD (2021)

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Dennis Kim (2022)
Bryce Robinson, MD (2021)
Stepheny Berry, MD (2022)
Stephen Kaminski, MD (2022)
Joseph Sakran, MD (2022)
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Robert Schulze, MD (2021)
Daniel Eiferman, MD (2021)
Daniel Grabo, MD (2021)
Eric Bradburn, MD (2021)
Stephanie Savage, MD (2021)
Navpreet Dhillon, MD (2022)
Lillian Kao, MD (2021)
Jeffrey Claridge, MD (2021)
Bellal Joseph, MD (2021)
Robert Winfield, MD (2022)
Melissa Hoffman, MD (2023)
Haytham Kaafarani, MD (2021)
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Jennifer Hartwell, MD (2021)
Frank Wood, MD (2022)
Rondi Gelbard, MD (2022)
Stephanie Bonnie, MD (2022)
Patrick Kim, MD (2021)
Oliver Gunter, MD (2022)
Katherine McKenzie, MD (2023)
Eric Toschlog, MD (2021)
Pedro Teixeria, MD (2022)
Hassan Mashbaria, MD (2023)
Brittany Bankhead-Kendall, MD , *AMC Committee/Social Media Councilor* (2022)
Patrick Murphy, MD, ACS Committee Represemtative (2023)
Jason Smith, MD , *Ex-Officio* (2021)
Julia R. Coleman, MD, *AMC Communications/Social Media Committtee Chair* (2023)

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John Agapian, MD (2023)
Rachel Appelbaum, MD (2023)
Dessy Boneva, MD (2022)
Andre Campbell, MD (2022)
Samuel Carmichael, MD (2022)
Joseph Cuschieri, MD (2022)
Adel Elkbuli, MD (2023)
Susan Evans, MD (2021)
Richard Gonzalez, MD (2021)
James Hoth, MD (2023)
Jeffrey Jopling, MD (2022)
Krista Kaups, MD (2023)
Lisa Knowlton, MD (2022)
Lisa Kodadek, MD (2022)
Eric Ley, MD (2022)
M. Victoria Purvis Miles, MD (2022)
Jeffry Nahmias, MD (2021)
Abhijit S Pathak, MD, *SCCPDS Representative*
(2021)
Erika Rangel, MD (2022)
Joseph Rappold, MD (2022)
Anupamaa Seshadri, MD (2022)
Forest Sheppard, MD (2021)
Melvin Stone Jr., MD (2023)
Sonlee West, MD (2021)

DISASTER COMMITTEE

Mark Gestring, MD, *Chair* (2023)
Adam Fox, MD, *Vice-Chair* (2022)
Mitchell Cohen, MD (2021)
Bradley Dennis, MD (2023)
Jay JDoucet, MD (2021), *Ex-Officio*
Lee Faucher, MD (2023)
Galina Glinik, MD (2023)
Daniel Grabo, MD (2021), *EAST Representative*
Nichole Ingalls, MD (2022)
Randeep Jawa, MD (2021)
Lewis Kaplan, MD (2022)
Jane Keating, MD (2022)
Kyle Remick, MD (2022)
Alison Smith, MD (2023)
Lewis Somberg, MD (2022)
Robert Winfield, MD (2023)

EDUCATIONAL DEVELOPMENT/MOC COMMITTEE

Nicole Stassen, MD, *Chair* (2023)
Matthew Martin, MD, *Vice-Chair* (2023)
Denis Kim, MD, *Vice-Chair* (2023)
Brittany Bankhead-Kendall, MD (2023)
Stephen Barnes, MD (2021)
Brett Tracy, MD (2022)
Bryan Collier, MD (2021)
Chrissy Guidry, MD (2022)
Elizabeth Benjamin, MD (2023)
Heena Santry, MD (2021)
Javier Romero, MD (2021)
Anastasia Kunac, MD (2023)
Bradley Thomas, MD (2023)
Navpreet Dhillon, MD, *AMC Education/E-Learning Committee Chair*
John Como, MD (2021)
Lillian Kao, MD (2021)
Marko Bukur, MD (2022)
Matthew Martin, MD (2021)
Mohammad Shaikh, MD (2022)
Raminder Nirula, MD (2022)
Stanley Kurek, Jr., MD (2022)
Stephanie D. Gordy, MD (2021)
Tanya Egodage, MD (2022)
Jawsin Sawhney, MD (2023)
Ryan Dumas, MD (2023)
Michael Nabonzy, MD (2023)
William Terzian, MD (2023)
Neil Parry, MD, *ACS Committee Representative* (2023)

EMERGENCY SURGERY COURSE SUB COMMITTEE OF EDUCATION DEVELOPMENT

Raul Coimbra, MD, PhD, *Chair* (2022)
Jose Diaz, MD (2022)
Nancy Parks, MD (2022)
Nicole Stassen, MD (2022)
Stephanie Savage, MD (2022)

GERIATRIC TRAUMA/ACS COMMITTEE

Deborah Stein, MD, *Chair* (2021)
Sasha Adams, MD, *Vice-Chair* (2023)
Jody DiGiacomo, MD, *Vice-Chair*, (2023)
Bellal Joseph, MD, *Vice-Chair*, (2023)
Robert Barraco, MD, *Consultant, Ex-Officio* (2021)
Milad Behbahaninia, MD (2023)
Tasce Bongiovanni, MD (2023)
Kevin Bradley, MD (2021)
Alexandra Briggs, MD (2022)
James Calland, MD (2021)
Todd Constantini, MD, *MIT Representative, Ex-Officio* (2021)
Vanessa Ho, MD (2021)
Jennifer Hubbard, MD (2023)
John Hwabejire, MD (2023)
D'Andrea Krista Joseph, MD (2023)
Jeremy Juern, MD (2021)
Uzer Khan, MD (2023)
Jennifer Knight, MD, *ACS Committee Representative* (2023)
Rosemary Kozar, MD (2023)
Anna Liveris, MD (2022)
Alicia Mangram, MD (2021)
Niels Martin, MD (2021)
Ashley Meagher, MD (2021)
Bryan Morse, MD (2023)
Adam Nelson, MD (2022)
Joseph Posluszny, MD (2022)
Stephanie Savage, MD (2023)

INTERNATIONAL RELATIONS COMMITTEE

Rochelle Dicker, MD, *Chair* (2023)
Marc de Moya, MD, *Vice-Chair* (2023)
A. Peter Ekeh, MD (2022)
Ara Ko, MD (2022)
Marshall Beckman, MD(2023)
Clifton Ewbank, MD (2022)
Eric Voiglio, MD, PhD (2020)
George Kasotakis, MD, MPH (2021)
Guixi Zhang, MD (2022)
Catherine Juillard, MD (2022)
Li Hsee, MD (2022)
Mamta Swaroop, MD (2021)
Mauro Zago, MD (2020)
Milos Buhavac, MD (2022)
Narong Kulvatunyou, MD (2022)
Rebecca Maine, MD (2022)
Susan Brundage, MD, MPH (2022)
Weidun Alan Guo, MD, PhD (2021)

INTERNATIONAL SOCIETY REPRESENTATIVES

of the International Relations Committee (two representatives from each)

Australian Trauma Society (ATS)
European Society for Trauma and Emergency Surgery (ESTES)
Japanese Society for the Acute Care Surgery (JSACS)
Japanese Association for the Surgery of Trauma (JAST)
International Association for the Trauma Surgery and Intensive Care (IATSIC)
Panamerican Trauma Society (PTS)
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
Trauma Society of South Africa
Indian Society for Trauma and Acute Care
World Society of Emergency Surgery
West African Congress
Cosixa

MILITARY COMMITTEE

Joseph Galante, MD, *Chair* (2021)
Jennifer Gurney, MD, *Vice-Chair* (2022)
Lisa Angotti, MD (2023)
Jason Bowie, MD (2022)
Geoffrey Douglass, MD (2023)
Dainel Eiferman, MD (2023)
Jacob Glasser, MD (2021)
Jan Jansen, MD (2021)
Jousha Jaramillo, MD (2021)
David Kauvar, MD (2022)
M. Margart Knudson, MD, *ACS Liasion*, (2023)
Matthew Martin, MD (2021)
Jason Miner, MD (2022)
A Tyler Putman, MD (2021)
Peter Rhee, MD (2021)
Anne Rizzo, MD (2023)
Matthew Tadlock, MD, *Vice-Chair* (2023)
Philbert Van, MD (2023)
Jay Yelon, MD (2021)
David Zonie, MD (2023)

MULTI-INSTITUTIONAL TRIALS COMMITTEE

Todd Costantini, MD, *Chair* (2021)
Carrie Sims, MD, *Vice-Chair* (2022)
Pual Albini, MD (2022)
Gary Bass, MD (2023)
Carlos Brown, MD, *WTA MIT Chair* (2021)
Paul Chestovich, MD (2021)
Raul Coimbra, MD, Ex-Officio (2021)
Michael Cripps, MD (2023)
Joseph DuBose, MD, *Vice-Chair* (2021)
Juan Dunchense, MD (2021)
Elliott Haut, MD (2021)
Rachel Morris, MD (2022)
Mayur Narayan, MD (2021)
Mayur Patel, MD (2023)
Neil Patel, MD (2022)
Morgan Schellenberg, MD (2022)
Thomas Schroeppel, MD (2021)
Kevin Schuster, MD (2022)
Anne Stey, MD (2022)
Martin Zielinski, MD (2021)
Johnathan Meizoso, MD, *AMC Research/ Education Councilor* (2023)

PATIENT ASSESSMENT COMMITTEE

Gail Tominaga, MD, *Chair* (2023)
Haytham Kaafarani, MD, *Vice-Chair* (2023)
Suresh Agarwal, Jr., MD (2021)
Marie Crandall, MD, *Ex-Officio* (2021)
Nina Glass, MD (2022)
Nicole Goulet, MD (2022)
Charles Harris, MD (2023)
Angela Ingraham, MD (2021)
Marta McCrum, MD (2022)
Michael O'Mara, MD (2021)
Matthew Moorman, MD (2021)
Kristan Staudenmayer, MD (2022)
Nicole Werner, MD (2022)
Cassandra White, MD (2022)
Christina Jacovides, MD (2023)
Krista Kaups, MD (2023)

PEDIATRIC TRAUMA SURGERY COMMITTEE

David Notrica, MD, *Chair* (2022)
Chris Newton, MD, *Vice-Chair* (2022)
Aaron Jensen, MD (2022)
Jeremy Johnson, MD (2022)
Robert Letton, Jr., MD (2022)
Jessica Naiditch, MD (2022)
Joseph Murphy, MD (2022)
Mary Edwards, MD (2022)
R. Todd Maxson, MD (2022)
Chad Thorson, MD (2022)

PREVENTION COMMITTEE

Ronald Stewart, MD, *Chair* (2021)
Thomas Duncan, MD, *Vice-Chair* (2021)
Michel Aboutanos, MD (2023)
Andrew Tang, MD (2022)
D'Andrea Joseph, MD (2023)
Deborah Kuhls, MD (2023)
Kazuhide Matsushima, MD (2022)
Linda Dultz, MD (2022)
Dennis Kim, MD (2022)
Parker Hu, MD (2022)
Peter Fischer, MD, MSc (2021)
Sharven Taghavi, MD (2022)
Sigrid Burruss, MD (2022)
Stephanie Bonne, MD (2021)
Terence O'Keeffe, MD (2021)
Thomas Duncan, DO (2021)
Tracey Dechert, MD (2021)
Kimberly Joseph, MD (2021)

EQUITY, DIVERSITY AND INCLUSION COMMITTEE

Karen Brasel, MD, MPH, *Chair* (2021)
Aaron Jensen, MD (2021)
Cherisse Berry, MD (2021)
Edward Cornwell III, MD (2021)
Heather Hoops, MD (2021)
Jamie Coleman, MD (2021)
Lisa Knowlton, MD (2021)
Bethany Strong, MD (2021)
Joshua Jaramillo, MD (2021)
Karyn Butler, MD (2021)
Linda Ding, MD (2021)
Michaela West, MD (2021)
S. Rob Todd, MD (2021)
Sharon Henry, MD (2021
David Spain, MD, *Ex-Officio* (2021)
David Livingston, MD, *Ex-Officio* (2021)

AD HOC COMMITTEES

HEALTHCARE ECONOMICS IN ACS AD HOC COMMITTEE

Joseph Minei, MD, *Co-Chair* (2021)
Kristan Staudenmayer, MD, MSc, *Co-Chair* (2021)
Andrew Bernard, MD (2021)
Brandon Bruns, MD (2021)
Charles Liu, MD (2021)
Jay Doucet, MD, MSc (2021)
John Scott, MD (2021)
Kimberly Davis, MD, MBA (2021)
Amy Gore, MD (2023)
L. R. Scherer III, MD, MBA (2021)
Lisa Marie Knowlton, MD (2021)
Michael Wandling, MD (2021)
Patricia Ayoung-Chee, MD (2021)
Rajan Gupta, MD (2021)
Robert Martin, MD (2021)
Ronen Elefant, MD (2021)
Samuel Ross, MD (2021)
Erica Lester, MD (2021)

JOURNALS OVERSIGHT AD HOC COMMITTEE

Michael Rotondo, MD, *Chair* (2021)
David Livingston, MD (2022)
David Spain, MD (2022)
J. Wayne Meredith, MD (2022)
Martin Croce, MD (2022)
Rosemary Kozar, MD, PhD (2022)

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Zara Cooper, MD, *Co-Chair* (2022)
Anne Mosenthal, MD, *Co-Chair* (2022)
Karen Brasel, MD, (2022)
Christine Cocanour, MD (2022)
Allyson Cook, MD (2022)
Mackenzie Cook, MD (2022)
Raquel Forsythe, MD (2022)
Ashley Hink, MD (2022)
Orlando Kirton, MD, MBA (2022)
K. Platnick, MD (2021)
Kathleen O'Connell, MD (2021)
Linda Maerz, MD (2021)
Mackenzie Cook, MD (2022)
Mark Malangoni, MD (2021)
Raquel Forsythe, MD (2021)
Richard Miller, MD (2021)
Vanessa Ho, MD, MPH (2021)
Ronald Maier, MD, *Consultant* (2021)

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David Livingston, MD, *Chair* (2021)
Ajai Malhotra, MD (2021)
Christopher Michetti, MD (2023)
Clay Cothren Burlew, MD (2021)
Ryan Dumas, MD, *AMC Vice-Chair* (2022)
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Mary Fallat, MD (2021)
Robert Winchell, MD (2022)
Sharon Henry, MD (2021)
Jermica Smith, *Ex-Officio* (2024)

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David Spain, MD (2024)
Martin Croce, MD (2023)
Michael F. Rotondo, MD (2022)

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Ali Salim, MD (2022)
Ben Zarzaur, Jr., MD (2023)
Christopher Michetti, MD (2023)
Clay Burlew, MD (2021)
David Livingston, MD (2022)
David Spain, MD (2021)
Kimberly Davis, MD, MBA (2023)
Louis Magnotti, MD (2021)
Susan Rowell, MD (2022)
Ernest Moore, MD, *Ex-Officio* (2021)
Jason Smith, MD, *Ex-Officio* (2022)
Timothy Fabian, MD, *Ex-Officio* (2022)
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Jonathan Meizoso, MD, *AMC Research/Education Councilor* (2022)

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Clay Cothren Burlew, MD (2021)
John Armstrong, MD (2021)
Jon Simmons, MD (2021)
Kimberly Davis, MD, MBA (2022)
Mary Fallat, MD (2021)
Robert Winchell, MD (2021)
Sharon Henry, MD (2021)
William Butler, MD, AMC Scholarship/Development Councilor (2022)

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Christine Toevs, MD (2021)
Fred Luchette, MD, MSc (2021)
C. William Schwab, MD (2021)
Oscar Guillamondegui, MD, MPH (2021)
Suresh Agarwal, Jr., MD (2021)
Joseph Galante, MD (2021)
Andrew Bernard, MD (2021)
Angela Ingraham, MD (2021)
Vanessa Ho, MD, MPH (2021)
Susan Evans, MD (2021)
Kovi Bessoff, MD, AMC Scholarship, Awards, and Development Committee Chair (2021)
William Buttler, MD, AMC Scholarship/Development Committee Chair (2022)

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Jermica M. Smith, Senior Manager of Operations and Member Services
Rachel Sass, Education Manager
Brea Sanders, Member Services Associate
Afia Jones, Member Services and Communications Coordinator
Bridget Lindbloom, Manager, Acute Care Surgery Committee
Erin Lillis, Design Coordinator
Kathy Madryk, ACS Senior Meeting Planner

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Rachel Hendrick, Assistant Managing Editor
Amiee DeSouza, Editorial Assistant

TRAUMA SURGERY AND ACUTE CARE OPEN JOURNAL STAFF

Timothy C. Fabian, MD, Editor
Chloe Lackey, Editorial Assistant

FUTURE AAST MEETINGS

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

2020	Virtual Meeting	David A. Spain, M.D.
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., M.B.A.
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.
1977	Detroit, Michigan	Alexander J. Walt, M.D.
1976	Colorado Springs, Colorado	Joseph D. Farrington, M.D.
1975	Scottsdale, Arizona	John H. Davis, M.D.
1974	Hot Springs, Virginia	John A. Moncrief, M.D.
1973	Chicago, Illinois	Crawford Campbell, M.D.
1972	San Francisco, California	Moore Moore, Jr., M.D.
1971	New York City, New York	Curtis P. Artz, M.D.
1970	Chicago, Illinois	Sawnie R. Gaston, M.D.
1969	Portland, Oregon	John E. Raff, M.D.
1968	Montreal, Canada	Fraser N. Gurd, M.D.
1967	Chicago, Illinois	Edwin F. Cave, M.D.
1966	Santa Barbara, California	Raymond Householder, M.D.
1965	Philadelphia, Pennsylvania	William T. Fitts, Jr., M.D.
1964	Chicago, Illinois	Rudolph J. Noer, M.D.
1963	San Francisco, California	Oscar P. Hampton, Jr., M.D.
1962	Hot Springs, Virginia	Preston A. Wade, M.D.
1961	Chicago, Illinois	Harrison L. McLaughlin, M.D.
1960	Coronado, California	James K. Stack, M.D.
1959	Bretton Woods, New Hampshire	Truman G. Blocker, M.D.
1958	Chicago, Illinois	W.L. Estes, Jr., M.D.
1957	Hot Springs, Virginia	Charles G. Johnston, M.D.
1956	Santa Barbara, California	Warren H. Cole, M.D.

1955	Chicago, Illinois	Robert H. Kennedy, M.D.
1954	Atlantic City, New Jersey	Eslie Asbury, M.D.
1953	Chicago, Illinois	Martin C. Lindem, M.D.
1952	New York City, New York	Arthur R. Metz, M.D.
1951	Montreal, Canada	R. Arnold Griswold, M.D.
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

80th 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.

Welcome

Wednesday, September 29, 2021
8:00 AM – 8:20 AM
Location: Salon
Presiding: David Spain, M.D.

Session I: Plenary Papers #1– 8

Wednesday, September 29, 2021
8:20 AM – 11:00 AM
Location: Salon
Moderator: David Spain, M.D.
Recorder: Patrick Reilly, M.D.

Session I: Plenary Papers 1-8
Paper 1: 8:20 AM - 8:40 AM

HARD, SOFT, & IRRELEVANT: HEMORRHAGIC & ISCHEMIC SIGNS BETTER DISTINGUISH IMPORTANT CHARACTERISTICS OF EXTREMITY VASCULAR INJURIES

Anna N. Romagnoli, MD; Joseph J. DuBose, MD; David S. Kauvar, MD, MPH; & the AAST PROOVIT Study Group, Brooke Army Medical Center
Invited Discussant: Mark Seamon, MD

Introduction: Hard & soft signs, developed decades ago to guide management decisions in the setting of potential extremity vascular injury, fail to distinguish optimal evaluation or management in an era of advanced imaging and capabilities. A hemorrhagic vs. ischemic distinction may be more useful in guiding the management of extremity vascular injuries.
Methods: Femoral and popliteal arterial injuries with recorded hard/soft & hemorrhagic (HEM-overt hemorrhage, expanding hematoma, hypotension)/ischemic (ISC-absent/diminished pulses, frank ischemia) signs, were compiled from the AAST PROspective Observational Vascular Injury Treatment database. Presentation, pathology, treatment, & outcome variables from records with any HEM signs were compared with those with only ISCH signs. Workups of those with any hard and only soft signs were examined.
Results: Hard signs were documented in 386 records; 35% had diagnostic CTA. Only soft signs were present in 175; 39% had operation for diagnosis w/o imaging. Of 521 eligible (284 femoral, 237 popliteal), 310 had one or more HEM; 211 had only ISC signs. HEM & ISC had distinct mechanism (Penetrating: HEM 69% vs ISC 41%, P<.0001), SBP (112±35 mmHg vs 127±29, P=.005), fracture (37% vs 53%, P<.0001), concomitant vein (50% vs 33%, P=.001) & nerve injuries (16% vs 8%, P=.008), & arterial pathology (Transection: 63% vs 39%; Occlusion: 16% vs 37%, P<.0001). HEM went to intervention sooner (20% vs 12% <1h from injury, P=.001) & more likely without imaging (63% vs 46%, P<.0001). HEM more likely to undergo damage control ligation (19% vs 9%, P=.002) & primary repair (18% vs 10%); less likely endovascular repair (3.5% vs 6.2%, P=.05). HEM used more PRBC/24h (4 vs 2u, P<.0001). Amputation similar (12%); mortality was higher in HEM (8.9% vs 1.9%, P=.001). ICU, hospital LOS, graft-related outcomes similar.
Conclusion: Hard & soft signs no longer effectively guide evaluation & management of extremity vascular injuries. A new paradigm distinguishing hemorrhagic & ischemic signs is more appropriate to guide early workup and treatment decisions in the modern era.

Session I: Plenary Papers 1-8
Paper 2: 8:40 AM – 9:00 AM

IMPACT OF TIME TO SURGERY ON MORTALITY IN HYPOTENSIVE PATIENTS WITH NON-COMPRESSIBLE TORSO HEMORRHAGE: AN AAST MULTICENTER PROSPECTIVE STUDY

Juan Duchesne, MD; Kevin Slaughter, MD; Ivan Puente, MD; Brian Yorkgitis, DO, PA-C, FACS, MD; Jason Sperry, MD; Todd W. Constantini, MD; Tulane University School of Medicine
Invited Discussant: Lawrence Lottenberg, MD

Introduction: Death from non-compressible torso hemorrhage (NCTH) may be preventable with improved pre-hospital care and shorter in-hospital times to hemorrhage control. We hypothesized that shorter times to surgical intervention for hemorrhage control would decrease mortality in hypotensive patients with NCTH.
Methods: This was an AAST-sponsored multicenter, prospective analysis of hypotensive patients aged 15+ years who presented with NCTH from to May 2018-December 2020. Hypotension was defined as an initial systolic blood pressure (SBP) ≤ 90 mmHg. Primary outcomes of interest were time to surgery and mortality.
Results: There were 242 (53.9%) hypotensive patients, of which 48 died (19.8%). The deceased cohort had higher mean age (38.8 vs 47.3;P=0.02), higher New Injury Severity Score (38 vs 29; P<0.001), lower admit SBP (68 vs 79;P<0.01) and shorter time from injury to OR start (79.8 vs 115.8; P<0.001) than did survivors. Multivariable regression controlled for confounders showed no association between time from ED arrival to OR start and mortality (P=0.65).
Conclusions: The total mean time from injury to start of surgical hemorrhage control in NCTH was 109 minutes. Patients who expired presented in greater physiological distress and had significantly shorter times to surgical hemorrhage intervention than did survivors. This suggests that even expediting a critically ill patient 35 minutes faster through the current trauma system is not sufficient time to save their lives from NCTH.

Table. Time intervals for hypotensive NCTH patients.

Time intervals, minutes	Alive (n = 194, 80.2%)	Dead (n = 48, 19.8%)	P
Injury to ED	37.4 (27.7)	35.7 (19.5)	0.71
ED time	65.1 (95.4)	39.9 (78.3)	0.06
OR prep time	22.3 (44.8)	15.9 (13.6)	0.33
ED to OR start	87.6 (118.6)	55.8 (80.1)	**0.03**
ED to end of OR	239.7 (340.8)	134.4 (102.6)	**<0.001**
Injury to OR start	115.9 (102.8)	79.8 (41.0)	**0.001**
Injury to end of OR	251.1 (269.4)	153.9 (72.1)	**0.03**

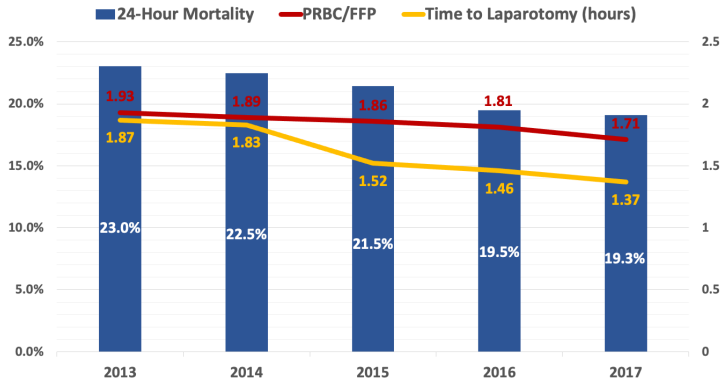
Values are mean (SD)

Session I: Plenary Papers 1-8
Paper 3: 9:00 AM – 9:20 AM

AFTER 9,000 LAPAROTOMIES FOR BLUNT TRAUMA, RESUSCITATION IS BECOMING MORE BALANCED AND TIME TO INTERVENTION SHORTER: HOW LOW CAN WE GO?

Molly Douglas, MD; Ahmad Hammad, MD; Adam Nelson, MD; Omar Obaid, MD; Letitia Bible, MD; Lourdes Castanon, DO, FACS; Michael Ditillo, MD; Mohamad Chehab, MD; Andrew Tang, MD, FACS; Bellal Joseph, MD, FACS; The University of Arizona
Invited Discussant: Bryan Cotton, MD

Introduction: Several advancements in hemorrhage control have been advocated for in the past decade, including balanced transfusions and earlier times to intervention. The aim of this study is to examine the effect of these advancements on outcomes of blunt trauma patients undergoing emergency laparotomy.
Methods: This is a 5-year (2013-2017) analysis of the Trauma Quality Improvement Program. Adult (age ≥18 years) blunt trauma patients with early (≤4 hours) PRBC and FFP transfusions and an emergency (≤4 hours) laparotomy for hemorrhage control were identified. Time-trend analysis of 24-hour mortality, PRBC/FFP ratio, and time to laparotomy was performed over the study period. The association between mortality and PRBC/FFP ratio, patient demographics, injury characteristics, transfusion volumes, and ACS verification level was examined by hierarchical regression analysis adjusting for inter-year variability.
Results: A total of 9,868 blunt trauma patients with emergency laparotomy were identified. Mean age was 44±18 years, 67.5% were male, and median ISS was 34 [24-43]. Mean SBP at presentation was 73±28 mm Hg, and median transfusion requirements were PRBC 9 [5-17] and FFP 6 [3-12]. During the 5-year analysis, time to laparotomy decreased from 1.87 hours to 1.37 hours (p<0.001), PRBC/FFP ratio at 4 hours decreased from 1.93 to 1.71 (p<0.001), and 24-hour mortality decreased from 23.0% to 19.3% (p=0.014). **(Figure)** On multivariate analysis, PRBC/FFP ratio was independently associated with 24-hour mortality (OR 1.09; p<0.001) and in-hospital mortality (OR 1.10; p<0.001).
Conclusion: Resuscitation is becoming more balanced and time to emergency laparotomy shorter in blunt trauma patients, with a significant improvement in mortality. Future efforts should be directed towards incorporating transfusion practices and timely surgical interventions as markers of trauma center quality.



Session I: Plenary Papers 1-8
Paper 4: 9:20 AM – 9:40 AM

ADMISSION THROMBOELASTOGRAPHY REFLECTS THE RELATIONSHIP BETWEEN CYTOKINES AND COAGULOPATHY: A PROPPR SUB-ANALYSIS

Stephanie Savage, MD, MS; Ben Zarzaur, MD; Erin E. Fox, PhD; Charles Wade PH.D; John Holcomb, MD; University of Wisconsin School of Medicine and Public Health
Invited Discussant: Ronald Maier, MD

Introduction: Acute traumatic coagulopathy (ATC) has many phenotypes and varying morbidity and mortality. The MA-R ratio, calculated from the admission thromboelastogram (TEG), serves as a biomarker to identify one phenotype of ATC and has previously been associate with significant derangements in the cytokine response. This study aims to evaluate outcomes related to abnormal MA-R ratios, including cytokine responses, in a heterogeneous patient population.
Methods : 660 patients from the PROPPR dataset were included. The MA-R ratio was calculated at admission utilizing TEG and a low ratio (LOW) was defined as ≤ 11. Key inflammatory mediators were identified *a priori*. Cytokine expression was assessed at admission and 24 hours using multivariable logistic regression. A similar model was utilized to assess key outcomes between LOW and HIGH (MA-R > 11) patients.
Results : At admission, LOW patients had significant elevations in IL-6, IP10, Eotaxin, MCP 1 and GM CSF. IL 13 was significantly lower (Table). Differences had resolved by 24 hours. LOW patients had significantly lower survival at all measured 24 hour timepoints (1, 3, 6, 12 and 18 hours). When excluding patients who died in the first 24 hours, LOW patients demonstrated significantly increased incidence of Adult Respiratory Distress Sydrome (1.843 (95% CI 1.103, 3.079), p=0.0195), which was associated with fewer ICU-free (LOW 18 days (IQR 2, 26) v. HIGH 23 days (10, 26), p=0.031) and fewer ventilator free days (LOW 25 (IQR 7, 28) v. HIGH 27 (17, 28), p=0.0191). LOW patients were protected against Systemic Inflammatory Response Syndrome (0.536 (95% CI 0.355, 0.807), p=0.0029).
Conclusions : The subtype of ATC identified by the low MA-R ratio is associated with significant elevates in multiple pro-inflammatory cytokines at admission. Early mortality remains elevated in the LOW group, in part due to coagulopathy. In patients who survive the first 24 hours, LOW patients have significantly increased incidence of ARDS and fewer ICU and ventilator free days. The adverse pulmonary outcomes are inversely related to SIRS however. More work is needed to understand the interaction between inflammation and coagulopathy in this subset of patients.

Session I: Plenary Papers 1-8
Paper 5: 9:40 AM – 10:00 AM

EMERGENCY GENERAL SURGERY TRANSFER TO LOWER ACUITY FACILITY: THE ROLE OF RIGHT-SIZING CARE IN EGS REGIONALIZATION

Stephanie Savage, MD; Lynnette Schiffern, MD, FACS; Hongmei Yang, PH.D.; Lauren Paton, MD, FACS Selwan Barbat, MD; Brent Matthews, MD FACS; Caroline Reinke, MD, FACS; Atrium Health – Carolinas Medical Center
Invited Discussant: Lillian Kao, MD, MS

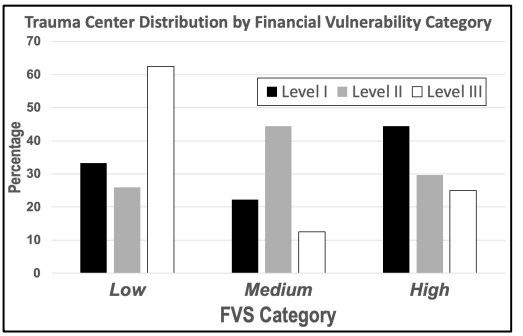
Background: Planning and resources have focused on regionalization of emergency general surgery (EGS) to expedite care of high acuity patients through interfacility transfers. In contrast, triaging low-risk patients to a non-designated trauma facility has not been evaluated. This study evaluates a one-year experience of a 5-surgeon team triaging EGS patients at a tertiary care, Level 1 (TC) to an affiliated community hospital 1.3 miles distant.
Methods: All EGS patients who presented to the Level 1 TC emergency department (ED) from 12/2019-12/2020 were analyzed. Patients were screened by EGS surgeons covering both facilities for transfer appropriateness including hemodynamics, resource need, and comorbidities. Patients were evaluated for disposition, diagnosis, comorbidities, length of stay (LOS), surgical intervention, 30-day mortality, and 30-day readmission.
Results: Of 695 patients reviewed, 229 (33.0%) were transferred to the affiliated community hospital, 112 (16.1%) were discharged home, and 354 (50.9%) were admitted to the Level 1 TC. Common diagnoses were biliary disease (18.7%), bowel obstruction (15.8%), and appendicitis (15.1%). Compared to Level I TC admissions, Charlson Comorbidity Index was lower (2.06 vs. 4.43; $p<0.001$) and LOS was shorter for transfers (2.45 vs. 5.80 days; $p<0.001$). Transfers had a higher rate of surgery (71% vs. 51%; $p<0.001$) and lower readmission and mortality (6% vs. 9%; $p<0.001$; 1% vs. 4%; $p=0.037$). Reasons not to transfer were emergency evaluation, comorbidity burden, OR availability, and established care. No transfers required transfer back to higher care (undertriage). Bed days saved at the Level 1 TC were 562 (484 inpatient). Total OR minutes saved were 18,751 (12,594 between 0700AM and 1700PM).
Conclusions: Transfer of appropriate patients maintains high quality care and outcomes, while improving OR and bed capacity and resource utilization at a tertiary care, Level 1 TC. EGS regionalization should consider triage of both high-risk and low-risk patients.

Session I: Plenary Papers 1-8
Paper 6: 10:00 AM – 10:20 AM

FINANCIAL VULNERABILITIES OF AMERICAN COLLEGE OF SURGEONS VERIFIED TRAUMA CENTERS: A STATEWIDE ANALYSIS

Derek Benham, MD; Richard Calvo, MD; Kyle Checchi, MD; Matthew Carr, MD; Jospeh Diaz, MD; Andrea Krzyzaniak, Vishal Bansal, MD
Matthew J. Martin, MD; Scripps Mercy Hospital
Invited Discussant: Grant Bochicchio, MD, MPH

Objective: Although trauma centers represent an integral part of healthcare in the United States, characterization of their financial vulnerability has not been reported. We sought to characterize the financial health/ vulnerability among California trauma centers and identify associated factors associated with high and low vulnerability.
Methods: The RAND Hospital Data financial dataset was used to evaluate all verified trauma centers in California. Financial vulnerability of each center was calculated using six metrics to calculate a composite Financial Vulnerability Score (FVS). Tertiles of the FVS were generated to classify trauma centers as High, Medium, or Low financial vulnerability. Hospital characteristics were also analyzed and compared.
Results: 44 trauma centers were identified (9 Level I, 27 Level II, 8 Level III). Level I centers had the greatest proportion of the high FVS tier (44%), while Level II and III centers were most likely to be in the middle and lower tiers, respectively (44% and 63%, see Figure for breakdown). Lower FVS centers had greater asset: liability ratios, operating margins, and days cash on hand compared to the two higher tiers, while high FVS centers showed a significantly greater proportion of uncompensated care, outpatient share rates, outpatient surgeries, and longer days in net accounts. High FVS centers were more likely to be teaching hospitals (T1=71%; T2=53%; T3=47%) and members of a larger corporate entity (T1=85%; T2=73%; T3=67%).



Conclusion: Up to 66% of trauma centers were at moderate/high risk for financial vulnerability and disparate impacts of stressor events such as the COVID-19 pandemic. There were wide disparities seen by key center characteristics, patient mix, and financial metrics that may represent targets for focused improvement and financial preparation efforts.

Session I: Plenary Papers 1-8
Paper 7: 10:20 AM – 10:40 AM

EARLY METABOLIC SUPPORT FOR CRITICALLY ILL TRAUMA PATIENTS – A PROSPECTIVE RANDOMIZED CONTROLLED TRIAL

Allan E. Stolarski, MD, MD; Lorraine Young, MS, RD; Janice Weinberg, MS, ScD; Jiyoun Kim, Ph.D; Elizabeth Lusczek, Ph.D.; Daniel G. Remick, MD; Bruce Bistrian, MD, Ph.D; Peter Burke, MD; Boston Medical Center
Invited Discussant: Alicia Mohr, MD

Introduction: There is a lack of consensus regarding the optimal timing and components of nutritional support for critically ill patients after significant trauma. Trauma patients are typically younger, often with fewer co-morbidities, and generally are well nourished at the time of their injury. We hypothesize that early post injury metabolic support focusing on adequate protein would modify the metabolic signature and alter the inflammatory environment for critically ill trauma patients.

Methods: We conducted a prospective randomized controlled pilot trial for adult patients admitted to the surgical intensive care unit (SICU) following traumatic injury. Patients were randomized to receive early metabolic support (EMS) (peripheral amino acid (AA) infusions) or standard of care (enteral nutrition as soon as feasible). In addition to routine laboratory assessments, nitrogen balance, cytokines, and metabolomics analyses were assessed at baseline and day 5 after intervention.

Results: A total of 42 trauma patients were randomized into well balanced groups with similar age (32 yrs), ISS (25), and BMI (27.4 kg/m^2) at baseline. EMS provided significantly more protein (1.43 g/kg vs. 0.35 g/kg; $p<0.0001$) and more calories (12.6 Kcal/kg vs. 7.5 g/kg; $p=0.0012$) over the first 5 days as compared to the standard of care. EMS resulted in modified protein catabolism and synthesis as demonstrated by a larger median negative nitrogen balance (-16.3 g vs. -5.3 g; $p=0.03$) and a unique metabolomic profile at day 5. The biochemical profile of patients who received EMS was defined by greater declines in circulating levels of stress hormone precursors and increased levels of AAs. The inflammatory response following EMS resulted in a greater decrease in IL-1B ($p=0.02$) and increase in sIL-6-receptor ($p=0.01$) between baseline and day 5 as compared to the standard of care. The EMS group had a decreased median length of stay (LOS) (15 vs. 22 days) and decreased SICU LOS (8 vs. 9 days), however this disappeared after adjustment for ISS in this small population.

Conclusions: Early metabolic support with AA is safe, modifies protein metabolism, and may down regulate the inflammatory state associated with significant trauma, warranting a larger trial to assess for improved outcomes.

Session I: Plenary Papers 1-8
Paper 8: 10:40 AM – 11:00 AM

ALIVE AND AT HOME: FIVE-YEAR OUTCOMES AMONG OLDER ADULTS WITH SEVERE TRAUMATIC INJURY

Matthew Guttman, MD; Phillip Williams, MD; Bourke Tillmann, MD; Avery Nathens, MD, PhD; Hannah Wunsch, MD, MSc; Damon Scales, MD, PhD; Camilla Wong, MD, MHSc; Lesley Gotlib Conn, PhD; Barbara Haas, MD, PhD; Sunnybrook Health Sciences Center
Invited Discussant: Robert Barraco, MD, MPH

Background: While the short-term risks of severe injury among older adults (age ≥ 65) are well studied, little is known about long-term functional outcomes in this population. This knowledge gap impacts clinicians' ability to counsel patients and provide care aligned with their values. The objective of this study was to evaluate the association between severe injury and the likelihood of an older adult remaining alive and at home five years later.
Methods: This was a retrospective, population-based cohort study using administrative data from a large regional trauma system (2006-2019). Community-dwelling older adults (age ≥ 65) who sustained a severe injury were hard-matched with uninjured controls from the general population based on age, sex, rurality, social determinants of health, comorbidity, and frailty. Time from injury to nursing home admission or death was compared between cases and controls using Kaplan-Meier analysis and Cox models.
Results: A total of 20,217 community-dwelling older adults admitted with severe trauma were identified and matched with controls. Mean age was 79 (±8) years, median ISS was 16 (IQR 16-21), and in-hospital mortality was 22.8%. Compared to matched controls, patients who sustained a severe injury spent fewer years alive and at home (median 2.7 years for cases vs. >5 years for controls). After five years, the probability of remaining alive and at home was 40% for cases vs. 64% for controls. While the risk of nursing home admission or death was greatest within the first 90 days after injury (HR 15.99, 95% CI 14.60-17.52), severe injury remained associated with an elevated risk for the entirety of the five-year follow up period (years 2-5, HR 1.18, 95% CI 1.13-1.24). Baseline frailty significantly impacted the time spent alive and at home after injury. Among frail injured patients (n=3,819), median time spent alive and at home was 4 months vs. 2.8 years for frail matched controls. Likewise, the probability of remaining alive and home at five years was 14% for frail cases and 33% for matched controls.
Conclusion: Most severely injured older adults survive to live in their own home for several years following injury. Nonetheless, patients who survive their admission remain at increased risk of nursing home admission or death for at least five years. Additional long-term supports are necessary to ensure that patients remain alive and independent for years following their injury.

Session II:
Presidential Address

"Be Worthy"

Wednesday, September 29, 2021

11:25 AM – 12:25 PM

Location: Salon

Presenter: David Spain, M.D.

David L. Gregg, MD Professor/Chief of Acute Care Surgery
Associate Division Chief of General Surgery
General Surgery Program Director
Department of Surgery, Stanford University Medical Center
Trauma Medical Director, Stanford Healthcare

Session IIIA:
Papers 9 -19

Wednesday, September 29, 2021
1:40 PM – 5:20 PM
Location: Salon East
Moderator: Eileen Bulger, M.D.
Recorder: Stephanie Savage, M.D.

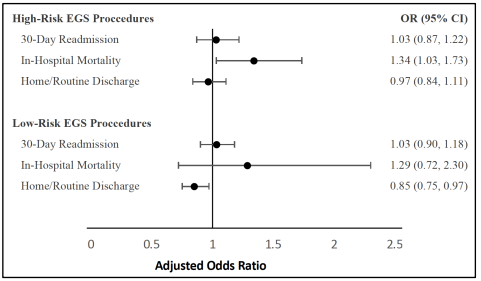
Session IIIA: Papers 9-19
Paper 9: 1:40 PM – 2:00 PM

SOCIOECONOMIC DISADVANTAGE IS ASSOCIATED WITH HIGHER MORTALITY AFTER EMERGENCY SURGERY

Brian T. Cain MD, Joshua J. Horns PhD, Lyen C Huang MD MPH, Marta L. McCrum, MD MPH; University of Utah
Invited Discussant: Cherisse Berry, MD

Introduction: Socioeconomic disadvantage (SD) is associated with worse outcomes after elective surgery, but the effect on patients seeking emergent surgical care is unknown. We examined the association of SD and outcomes after emergency general surgery (EGS) procedures and investigated whether Level-1 (L1) trauma centers, with comprehensive clinical and social services and quality improvement programs, mitigated this effect.

Methods: Adults who underwent one of the 10 most burdensome high- and low-risk EGS procedures were identified in six 2014 State Inpatient Databases. SD was assessed using Area Deprivation Index (ADI) of patient residence. Multivariable logistic regression models adjusting for patient and hospital factors were used to evaluate the association between ADI quartile (high >75%ile vs low <25%ile), in-hospital mortality, 30-day readmission and discharge disposition. Effect modification between ADI and L1 trauma status was assessed.



Results: 97,087 patients were analyzed: 69,413 (71.5%) low-risk and 27,674 (28.5%) high-risk procedures. High-SD patients had a higher proportion with ≥3 comorbidities (39.6% vs 29.9%), minority race/ethnicity (57.7% vs 33.6%) and Medicaid (28.6% vs 14.5%) and were less-likely to be treated at L1 trauma centers (18.1% vs 27.3%) p<0.01 for all. Adjusting for competing factors, high-SD patients had 34% higher risk-adjusted probability of mortality for high-risk EGS procedures (OR 1.34, 95%CI 1.03-1.73, p=0.03). SD was not associated with mortality after low-risk EGS or 30-day readmission. High-SD patients were also less likely to discharge home after low-risk procedures (OR 0.85, 0.75-0.96, p=0.012). L1 trauma status did not modify the effects of ADI on outcomes.

Conclusion: Socioeconomic disadvantage is associated with increased mortality after high-risk, but not low-risk EGS procedures. The added resources of Level-1 centers did not mitigate this effect. Interventions that extend beyond hospital walls and address social and community needs are likely needed if we are to make significant improvements in clinical outcomes for socially vulnerable EGS patients.

Session IIIA: Papers 9-19

Paper 10: 2:00 PM – 2:20 PM

A REVISED AAST GRADING SYSTEM FOR ACUTE CHOLECYSTITIS RESULTS IN SIGNIFICANTLY IMPROVED OUTCOME PREDICTIONS

Kevin M. Schuster, MD, MPH, FACS; Krista Kaups, MD, MSc; Suresh Agarwal, MD; Michael Cripps, MD, MSCS, FACS; Kali Kuhlenschmidt, MD; Luis Taveras, MD; Haytham M. Kaafarani, MD; Thomas J. Schroeppel, MD, FACS; Toby Enniss, MD; Ruchir Puri, MBBS, MS; Daniel C. Cullinane MD; Laura M Cullianane; Marie Crandall, MD, MPH; Gail Tominaga, MD

Invited Discussant: Nicole Stassen, MD

Introduction: Grading systems for acute cholecystitis are essential to compare outcomes, improve quality and advance research. The original AAST grading system for acute cholecystitis was only moderately discriminant when predicting multiple outcomes and underperformed the Tokyo guidelines and Parkland grade.

Methods: A modified Delphi approach was used to revise the AAST grading system. The revised version was assessed using prospectively collected data from an AAST multicenter study and minor adjustments were made. The revised grading system was then evaluated based on predictive capacity for conversion from laparoscopic to an open procedure, use of a surgical "bail-out" procedure, bile leak, other morbidity and discharge home. A pre-operative AAST grade was defined based on pre-operative, clinical and radiologic data and the Parkland grade was also substituted for the operative component of the AAST grade (AAST/Parkland). Discriminatory power was assessed by comparing the receiver operating characteristic curves (AUC) using the methods of Delong.

Results: Using prospectively collected data on 861 patients with acute cholecystitis the revised version of the AAST grade has an improved distribution (figure) and outperformed the original AAST grade for predicting operative outcomes and discharge disposition (table).

Conclusions: The revised AAST grade and the pre-op AAST grade demonstrated improved discrimination. Follow up validation will be necessary given new clinical and imaging variables in the revised grading system.

Session IIIA: Papers 9-19
Paper 11: 2:20 PM – 2:40 PM

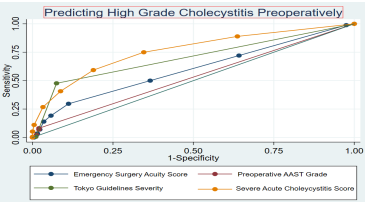
A NOVEL PREOPERATIVE SCORE TO PREDICT SEVERE ACUTE CHOLECYSTITIS

Kali Kuhlenschmidt, MD; Luis Taveras, MD; Majed El Hechi, MD; Ruchir Puri, MBBS, MD, MS, FACS; Thomas J. Schroeppel, MD, FACS; Haytham M. Kaafarani, MD, MPH; Marie Crandall, MD, MPH; Kevin M. Schuster, MD, MPH, FACS; Michael Cripps, MD, MSCS, FACS
Invited Discussant: Peter Hammer, MD

Introduction: In a multicenter trial, the Parkland Grading Scale (PGS) for acute cholecystitis outperformed other grading scales and has a positive correlation with complications but is limited by its inability to preoperatively predict high grade cholecystitis. We sought to identify preoperative variables predictive of high-grade cholecystitis (PGS 4 or 5).
Methods: In a six-month period, all patients undergoing cholecystectomy at a single institution were analyzed. Stepwise logistic regression models were constructed to predict PGS 4 or 5 and relative weight of the variables were used to derive a novel score, the Severe Acute Cholecystitis Score (SACS). This score was compared to the Emergency Surgery Acuity Score (ESS), American Association for the Surgery of Trauma (AAST) preoperative score and Tokyo Guidelines. SACS was then validated using the database from the AAST multicenter validation of the grading scale for acute cholecystitis.
Results: Of the 575 patients that underwent cholecystectomy, 172(29.9%) were classified as PGS 4 or 5. The stepwise logistic regression modeling identified 7 independent predictors of high-grade cholecystitis [Table] from which the SACS was derived. Scores ranged from 0 to 9 points with a *C* statistic of 0.76, outperforming the ESS (*C* statistic of 0.60), AAST (0.53), and Tokyo Guidelines (0.70)(*p*-value <0.001) [Figure]. A cutoff of 4 or more on the SACS correctly identifies 76.2% of cases with a specificity of 91.3% and a sensitivity of 40.7%. In the multicenter database, there were 464 patients with a prospectively collected PGS. The *C* statistic for SACS was 0.74and the cutoff of 4 correctly identifies 71.6% of cases with a specificity of 83.8% and a sensitivity of 52.2%.
Conclusions: The Severe Acute Cholecystitis Score can preoperatively predict high-grade cholecystitis. This data, used to counsel the patient and better preoperative planning, may improve outcomes in patient with severe acute cholecystitis.

Multivariate logistic regression and points for predicting high grade cholecystitis

Variable	Odds Ratio	Points	95% Confidence Interval	*p*-value
Age > 50 years	2.05	1	1.24-3.41	0.005
Male gender	2.97	2	1.90-4.62	<0.001
Presence of comorbidities	1.68	1	1.05-2.70	0.03
Duration of Pain ≥ 4 days	1.71	1	1.09-2.68	0.019
White Blood Cells ≥ 14k	2.20	1	1.35-3.59	0.002
Temperature > 37.5 C	2.18	1	1.17-4.07	0.014
Gallbladder Wall ≥ 4 mm	3.11	2	1.70-5.71	<0.001



Session IIIA: Papers 9-19
Paper 12: 2:40 PM – 3:00 PM

ANALYSIS OF REACTIVE ASCITES COLLECTED IN ACUTE APPENDICITIS OR SMALL BOWEL OBSTRUCTION

Melissa Hausburg, PH.D.; Erica Sercy, MSPH; Raphael Bar-Or, BS; Jennifer Bocker, MD; Rebecca Ryznar, PH.D.; Robert Madayag, MD; Thaddeus Liniewicz, DO; M. Jacob Ott, MD; Allen Tanner II, MD; Charles Mains, MD, FACS; David Bar-Or, MD; Swedish Medical Center
Invited Discussant: Kazuhide Matsushima, MD

Introduction: Pathological adhesions in the abdomen can cause bowel obstructions, female infertility, pain, and surgical complications. Appendicitis increases the expression of adhesion proteins, and appendix-associated adhesions may be observed during appendectomy. Acute appendicitis (AA) patients show increased oxidized proteins in serum and inflammatory cytokines in serum and reactive ascites (rA). We seek to comprehensively characterize the redox and inflammatory status of rA collected during appendectomy or fibrinolysis for small bowel obstruction (SBO) with the goal of identifying strategies to treat and prevent pathological adhesions.

Methods: This is a non-randomized, prospective observational study recruiting patients with non-perforated AA or SBO from four Level 1 trauma centers in the United States. To date, 44 AA and 7 SBO rA samples have been collected, and samples with sufficient volume were further analyzed via liquid chromatography-mass spectrometry (LC-MS) (n=20), bead-based quantification of 71 cytokines and chemokines and 14 soluble receptors (n=41), and identification of the top 200 metabolites (n=24).

Results: LC-MS of samples showed that all samples contained high levels of serum proteins, i.e., albumin, apolipoprotein A1, and transthyretin. Multiplex analyses showed that levels of 23 cytokines and chemokines and 5 soluble receptors were significantly different in AA versus SBO rA. The top proteins increased in AA rA by 59.28- and 24.63-fold, respectively, were interleukin (IL)-1R antagonist and granulocyte-colony stimulating factor. Conversely, C-X-C motif chemokine ligand (CXCL) 1 and IL-21 were more abundant in SBO rA by 18.80- and 9.51-fold, respectively. Arachidonic acid was the most decreased metabolite in AA vs SBO rA. Pathway analyses of these data predict that AA rA drives activation of leukocytes, as well as production of nitric oxide and reactive oxygen species in macrophages.

Conclusion: These data implicate oxidative stress and inflammation as major contributing factors to adhesion formation. Our goal is to further explore whether attenuation of these factors may decrease pathologic adhesion formation without compromising healing.

Session IIIA: Papers 9-19

Paper 13: 3:00 PM – 3:20 PM

THE UNEQUAL IMPACT OF INTER-HOSPITAL TRANSFERS ON EMERGENCY GENERAL SURGERY PATIENTS: PROCEDURE RISK MATTERS

Raul Coimbra, MD, PhD; Robert Barrientos, BS; Timothy Allison-Aipa, BS; Bishoy Zachary, MPH; Matthew Firek, BS;
Riverside University Health System

Invited Discussant: Angela Ingraham, MD, MS

The impact of inter-hospital transfer on outcomes of patients undergoing emergency general surgery (EGS) procedures is unclear. We set out to determine if transfer prior to definitive surgical care leads to worse outcomes in EGS patients.Using the NSQIP database (2013-2019), 9 procedures encompassing 80% of the burden of EGS diseases, performed on an urgent/emergent basis were identified and further classified as low risk (open and laparoscopic appendectomy and laparoscopic cholecystectomy) and high risk (open cholecystectomy, laparoscopic and open colectomy, lysis of adhesions, perforated ulcer repair, small bowel resection, and exploratory laparotomy). Time to intervention was recorded in days. The impact of inter-hospital transfer on outcomes (mortality, complications, reoperations, and 30-d readmissions), length of stay (LOS), and time to intervention according to procedure risk were analyzed by univariate and multivariate models. A total of 329,613 patients were included in the study (284,783 direct admission, and 44,830 transfers). Unadjusted mortality (3.1% vs. 10.4%), complications (6.7% vs. 18.9%), reoperations (3.1% vs. 6.4%), readmission rates (5.8% vs. 7.8%) and LOS (2 vs. 5) were higher in transferred patients. Delayed surgery >48h after admission was also associated with worse outcomes. Multivariate analysis revealed that inter-hospital transfer is associated with higher mortality (AOR=1.26), complications (AOR=1.34) and reoperations (AOR=1.22),although no differences regarding 30-d readmission were observed between groups. In addition, the transfer process did not affect any of the outcome measured in patients undergoing low risk procedures, whereas the outcome measures were negatively affected by the transfer process

Risk level	Post-operative outcome	Direct admission[a]	Transfer	AOR	Lower CI	Upper CI	p
High[b]	Mortality[c], n (%)	8729 (11.3)	4677 (18.7)	1.16	1.11	1.22	<.001
	N = 102283	77347	24936				
	Major complication[c], n (%)	17804 (23.0)	8333 (33.4)	1.20	1.16	1.25	<.001
	N = 102283	77347	24936				
	Reoperation[c], n (%)	6272 (8.1)	2600 (10.4)	1.13	1.08	1.19	<.001
	N = 102283	77347	24936				
	Readmission[cd], n (%)	8466 (12.1)	2703 (12.8)	1.01	0.96	1.06	.782
	N = 91232	70179	21053				

In conclusion, we have demonstrated that delays to surgical intervention affects outcomes and that inter-hospital transfer of EGS patients for definitive surgical care has a negative impact on mortality, development of post-operative complications, and reoperations in patients undergoing high risk EGS procedures. These findings may have important implications for regionalization of EGS care.

Session IIIA: Papers 9-19
Paper 14: 3:20 PM – 3:40 PM

REOPERATIVE SURGERY FOLLOWING CAWR: WE SHOULD LOOK PAST 30 DAYS

Matthew McGuirk, MD; Agon Kajmolli, MD; Abbas Smiley, MD, MSc, PhD; David Samson, MS; Kartik Prabhakaran, MD, MHS, FACS; Peter Rhee, MD; Rifat Latifi, MD, FACS, FICS; Westchester Medical Center
Invited Discussant: Preston Miller, MD

Background: Re-operation following complex abdominal wall reconstruction (CAWR) is a problem that leads to increased morbidity and mortality. The aim of this study is to assess and identify independent predictors of re-operation following CAWR.
Methods: This was a prospective cohort study consisting of 220 patients who underwent CAWR at a tertiary care center between 2016-2020. Re-operation was defined as any unplanned return to the operating room. Patient demographics of the entire cohort were compared with those who required re-operation. A multivariable logistic regression model was created to identify independent predictors of re-operation.
Results: In our group of 220 patients, 44 (20%) patients required a re-operation. Re-operation occurred after discharge 75% of the time, with an average of 40 days (2-189) after the index procedure. The majority were due to infection (54.5%), followed by seroma (11.4%), and small bowel obstruction (9.1%). On average, patients required 2.2 (1-9) re-operations following CAWR. On multivariable regression (Table 1), mesh explantation during CAWR increased the odds of re-operation by 4.23 times (p=0.001), prior surgery for diverticulitis increased the odds by 4.16 times (p=0.001), and fistula takedown during CAWR increased the odds by 6.85 times (p=0.017).
Conclusion: The majority of re-operations occur after discharge and are caused by infection, seroma, and small bowel obstruction. Mesh explantation during CAWR, prior surgery for diverticulitis, and fistula takedown during CAWR are all independent predictors of re-operation following CAWR.

Table 1. Univariable and multivariable logistic regression model showing the predictors of re-operation following CAWR.

	Univariable		Multivariable	
Variable	**OR (CI)**	**p-value**	**OR (CI)**	**p-value**
Mesh explantation during CAWR	3.99 (1.89-8.39)	<0.001	4.23 (1.87-9.57)	0.001
Prior surgery for diverticulitis	3.27 (1.47-7.26)	0.004	4.16 (1.75-9.91)	0.001
Fistula takedown	7.39 (1.69-32.25)	0.008	6.85 (1.41-33.38)	0.017
BMI≥35	2.59 (1.32-5.10)	0.006	2.06 (0.98-4.32)	0.056
VHWG class III/IV	1.53 (0.78-2.99)	0.211	REMOVED BY BACKWARDS REGRESSION	
Recurrent hernia	2.52 (1.28-4.97)	0.008		
Smoking history	1.00 (0.44-2.27)	1.000		
Urgent/Emergent setting	1.24 (0.61-2.55)	0.549		

Session IIIA: Papers 9-19
Paper 15: 3:40 PM – 4:00 PM

READY OR NOT? A COMPARISON OF IN-THEATER AND STATESIDE TRAUMA EXPOSURE AMONG MILITARY OTOLARYNGOLOGISTS

Matthew Ward, MD; Maria Alexander, BA; Travis Newberry, MD; Scott Bevans, MD; Brooke Army Medical Center
Invited Discussant: Travis Polk, MD

Introduction: Deployed otolaryngologists play a vital role in the management of complex craniofacial and laryngotracheal (CFLT) injuries. Maintaining mission readiness among non-deployed otolaryngologists is critical to supporting the Department of Defense (DoD) in its strategic objectives. To date, no analysis of military otolaryngologist exposure to CFLT injury management at Military Treatment Facilities (MTFs) has been performed.
Methods: A retrospective review of the Department of Defense Trauma Registry (DoDTR) was performed from 2003-2019, selecting for procedures done at Bagram Air Base, Afghanistan and Baghdad, Iraq. A retrospective review of procedures performed by otolaryngologists at 27 Army and Air Force MTFs from 2015-2019 was performed via query of the Military Health System Management Analysis and Reporting Tool (M2) database.
Results: The 2004-2008 timeframe recorded the greatest volume of CFLT procedures performed in Iraq and Afghanistan in a 5-year period. During this timeframe, deployed surgeons performed a total of 672 tracheostomy, 283 mandible, 160 midface, 116 orbit, and 40 laryngotracheal procedures. In comparison, approximately 90 military otolaryngologists stationed at 27 MTFs performed a total of 267 tracheostomy, 297 mandible, 221 midface, 176 orbit, and 78 laryngotracheal procedures from 2015-2019. Over half (51.1%) of these procedures were performed at Brooke Army Medical Center (BAMC), the only DoD Level 1 trauma center. Thirteen of 27 MTFs (48.2%) had 10 or fewer CFLT procedures combined, and 10 MTFs (37.0%) had no recorded tracheostomies performed by otolaryngologists during the 5-year time period.
Conclusion: CFLT procedures are commonly required of deployed otolaryngologists during the height of modern conflict. Military otolaryngologists had minimal exposure to these procedures at a majority of MTFs over the past 5 years. Access to stateside civilian trauma care greatly improves military otolaryngologists' exposure and should be considered a critical component of maintaining surgeon readiness for future conflicts.

Session IIIA: Papers 9-19

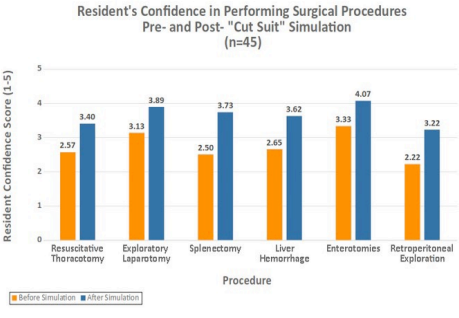
Paper 16: 4:00 PM – 4:20 PM

HYPER-REALISTIC ADVANCED SURGICAL SKILLS PACKAGE WITH CUT SUIT SURGICAL SIMULATOR IMPROVES SURGERY TRAINEE CONFIDENCE IN OPERATIVE TRAUMA

Michael Klein, MD; Anna Liveris, MD; Tricia Yusaf, MD; Gabriela Batista; Dajelyn Diaz; Juan Cruz, MICP; Alex-Sungbae Lee, RRT; Jessica Pohlman, MPA, Med; Katie Walker; Marko Bukur, MD; Spiros Frangos, MD, MPH; Sheldon Teperman, MD; Edward Chao, MD; New York University School of Medicine, Bellevue Hospital Center

Invited Discussant: Elizabeth Benjamin, MD, PhD

Introduction: Adequate exposure to operative trauma is not uniform across U.S. surgical residencies, and therefore it can be challenging to achieve competency during residency alone. We introduced a novel and high-fidelity open-surgical simulator called the "Advanced Surgical Skills Package (ASSP) / Cut Suit," which can realistically replicate traumatic organ injury and bleeding, as part of our training curriculum to address this deficit. Our objective is to evaluate the use of the ASSP as a training instrument for civilian surgeons. **Methods:** Groups of 3-5 trainees from 6 different training programs, all with level 1 trauma centers within the largest public healthcare network in the United States, participated in this prospective, observational trial. The surgery residents were of different post-graduate levels and were instructed on operative tasks including resuscitative thoracotomy, exploratory laparotomy, splenectomy, hepatorrhaphy, bowel resection, retroperitoneal exploration, arterial shunt placement, nephrectomy, and temporary abdominal closure. Pre- and post-course surveys were used to evaluate trainees' experience and confidence performing these procedures utilizing a 5-point Likert scale. **Results:** Forty-five surgery residents participated in the evaluation. The surgical scenario was rated as highly stressful and realistic, with average scores of 3.1 and 4.5 out of 5, respectively. Across all procedures, there was a 1.2 point increase in average confidence rating for all residents (from 2.7 to 3.7 out of 5). The percentage of residents who were *most* confident in performing the procedures (rating of 4 or 5) increased from 33% to 61%. **Conclusions:** The ASSP with the Cut Suit surgical simulator is a realistic and useful adjunct in training young surgeons to manage complex operative trauma. Further studies are necessary to determine the most appropriate application of this simulator in surgical residency program curricula.

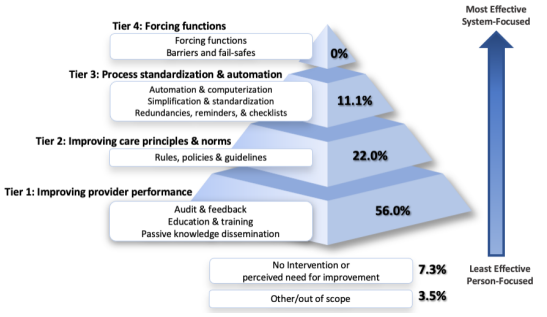


Session IIIA: Papers 9-19
Paper 17: 4:20 PM – 4:40 PM

ERROR REDUCTION IN TRAUMA CARE: LESSONS FROM AN ANONYMIZED, NATIONAL, MULTI-CENTER MORTALITY REPORTING SYSTEM

Doulia M. Hamad, MD; Samuel P. Mandell, MD; Ronald M. Stewart, MD; Bhavin Patel, MPH; Matthew P. Guttman, MD; Phillip Williams, MD; Angela Jerath, MD; Eileen M. Bulger, MD, FACS; Avery B. Nathens, MD, PhD; Sunnybrook Health Sciences Center
Invited Discussant: Ali Salim, MD

Introduction: The importance of system solutions to overcome human fallibility and prevent medical errors has been recognized as critical for a safer healthcare system. Yet over time rates of preventable deaths, particularly in trauma care, have not changed. We developed a mortality reporting system (MRS) to aggregate deaths with an opportunity for improvement from > 300 trauma centers. This study evaluates provider and system level strategies used by participating centers to prevent future harm.
Methods: Deaths are reported to the MRS if there is an identified opportunity for improvement, along with a mitigation strategy to avoid recurrence of the error. Using a validated framework based on the hierarchy of intervention effectiveness and consensus by three independent reviewers, we mapped mitigation strategy effectiveness from person-focused to system-oriented interventions.
Results: Over a 2-year period, 395 deaths were reviewed. 33.7% of mortalities were unanticipated, and frequently occurred after failure to rescue (36.1%). Errors frequently pertained to management (50.9%), clinical performance (54.7%) and communication (56.2%). Human failures were involved in 61% of errors. Person-focused strategies like education were common (56%), while more effective strategies such as automation, standardization and fail-safe approaches were seldom used. In 7% of cases, centers were unable to identify a specific strategy to prevent future harm.
Conclusion: Most strategies to reduce errors in trauma centers focus on changing the performance of providers rather than system-level interventions. Higher-level interventions may help reduce variability in clinical care. Centers require additional support to develop more effective mitigation strategies that will prevent recurrent errors and patient harm.



Session IIIA: Papers 9-19
Paper 18: 4:40 PM – 5:00 PM

FALL RISK IDENTIFICATION THROUGHOUT THE CONTINUUM OF CARE

Meaghan Crawley MSN RN, Alistair Chapman MD, Amy Koestner MSN RN, Steffen Pounders BS, Laura Krech MPH, Matt Lypka MPH, Gaby Iskander MD; Spectrum Health Medical Group, Butterworth Hospital
Invited Discussant: Alicia Mangram, MD

Introduction: Falls are the most common mechanism of injury leading to trauma admission. Identifying patients at risk for falling and initiating an intervention has the potential to reduce serious injuries and even mortality, especially in the elderly. Researchers aimed to quantify the volume of patients age 65 and older admitted to a Level 1 trauma center for a fall, who were incidentally determined to be at risk for falling in the 12 months prior to their admission.

Methods: The trauma registry was queried to identify patients age 65 and older, who sustained a ground level fall, and were admitted to an inpatient unit over 36 months. The electronic medical record (EMR) was reviewed to determine if a patient was identified as being at risk for sustaining a fall in the 12 months prior to the index fall admission. The EMR was additionally queried for repeated falls within 12 months after discharge, and to determine if formal falls prevention education was provided at discharge.

Results: 597 patients met inclusion criteria; 68.2% were female. 58.7% of patients were identified in our system as being "at risk" for falling within the 12 months before their hospital fall admission. Only 2% of these patients had documented fall prevention education at discharge. 32% of patients sustained a repeat fall within a year after discharge and 19.6% were readmitted for a fall. Patients at high risk for falls based on the Hester-Davis score were significantly more likely to be readmitted to the hospital ($p=0.004$) and expire within six months ($p=0.015$) than patients at moderate and low risk. Mortality at 12 months for all patients after initial admission was 19.4%.

Conclusion: This large study demonstrates that one out of five geriatric fall patients die within 12 months of their fall admission. Surprisingly, most patients admitted to our trauma service for a fall were identified at risk for falling in the 12 months prior to their admission. This is a startling, and novel finding that presents a major prevention opportunity for health care systems. Implementation of proven techniques to reduce falls in patients when initially identified at risk has the potential to change the course for a patient who may not only fall but fall again. This proactive approach could significantly impact the fall epidemic in our elderly population.

Session IIIA: Papers 9-19
Paper 19: 5:00 PM – 5:20 PM

IMPROVED MORTALITY PREDICTION WITH NSQIP COMPARED TO TRISS AND ASA IN ELDERLY TRAUMA PATIENTS UNDERGOING SURGERY

Stephen Stopenski MD, Catherine Kuza MD, Xi Luo MD, Babatunde Ogunnaike MD, Jeffry Nahmias MD MHPE, et al. for the Trauma Risk Study Group; UC Irvine Medical Center
Invited Discussant: Hayatham Kaafarani, MD

Introduction: The Trauma and Injury Severity Score (TRISS) utilizes injury and physiologic variables to prognostication outcomes. For a given TRISS, elderly (≥ 65 years old) trauma patients undergoing surgery have increased morbidity and mortality compared to younger patients. However, functional status and comorbidities are noticeably absent from TRISS, but are incorporated within the National Surgical Quality Improvement Program Surgical Risk-Calculator (NSQIP) and the American Society of Anesthesiologists Physical Status (ASA) both of which are validated for non-trauma general surgery patients. We hypothesize NSQIP is superior at predicting mortality, length of stay (LOS) and complications in elderly trauma patients undergoing surgery.

Methods: A secondary analysis of a prospective multicenter observational study was performed. All trauma patients ≥ 65 years-old undergoing surgery within 24 hours of admission at four Level-I trauma centers were included. Using logistic regression, we compared five scoring models: ASA vs. NSQIP vs. TRISS vs. TRISS + ASA vs. TRISS + NSQIP. Brier scores and AUROC curve were calculated to compare predictive ability for mortality. We used the adjusted R^2 and root mean squared error (RMSE) to evaluate each scoring model's ability to predict LOS and number of complications.

Results: From 122 trauma patients ≥ 65 years-old, 9 died (7.4%) during index hospitalization. NSQIP was superior to ASA and TRISS at predicting mortality (AUROC 0.978 vs 0.768 vs 0.903, p=0.007). Adding TRISS to NSQIP had no additional benefit to predict mortality. The overall cohort median LOS was 12.9 days and number of complications was 0.88. NSQIP was the most accurate at predicting LOS (R^2: 25.9% vs 13.3% vs 20.5%) and number of complications (R^2: 34.0% vs. 22.6% vs 29.4%) compared to TRISS and ASA respectively. The addition of TRISS to NSQIP improved the predictive ability compared to NSQIP alone for number of complications (R^2 35.5% vs 34.0%, p=0.046).

Conclusion: NSQIP, which includes comorbidities and functional status, had superior ability to predict mortality, LOS, and complications compared to TRISS or ASA alone. Future incorporation of NSQIP to better prognosticate elderly trauma patients undergoing surgery is warranted.

Session IIIB:
Papers 20-30

Wednesday, September 29, 2021

1:40 PM – 5:20 PM

Location: Salon West

Moderator: Christopher Michetti, M.D.

Recoder: Sonlee West, M.D.

Session IIIB: Papers 20-30
Paper 20: 1:40 PM – 2:00 PM

INTERCOSTAL LIPOSOMAL BUPIVACAINE INJECTION FOR RIB FRACTURES

Taylor E Wallen MD; Kathleen E Singer MD; Amy T Makley MD; Krishna Athota MD; Christopher F Janowak MD; Ann Salvator MS; Richard Strilka MD; Christopher A Droege PharmD; Michael D Goodman MD; University of Cincinnati
Invited Discussant: Andrew Kerwin, MD

Introduction: Blunt chest wall injury accounts for 10% of trauma related admissions. Previous studies have shown that the number of rib fractures predicts inpatient opioid requirement, raising concerns for pharmacologic effects including hypotension, delirium, and opioid dependence. The aim of our study was to evaluate the use of liposomal bupivacaine as a regional analgesic to improve early pulmonary function and reduce opioid use.
Methods: A prospective, double-blinded, randomized placebo-control study was conducted at a Level 1 trauma center as an FDA investigational new drug study. Enrollment criteria included patients ≥18 years admitted to the ICU with blunt chest wall trauma who could not achieve greater than 50% goal inspiratory capacity. Patients were randomized to receive either targeted intercostal liposomal bupivacaine injection or subcutaneous saline in up to six intercostal spaces. Patients were monitored with incentive spirometry and a non-invasive thoracic impedance device to determine respiratory rate, tidal volume, and minute ventilation. Pain scores and breakthrough pain medications were recorded for 96 hours.
Results: 100 patients were enrolled with 50 in each cohort. Enrolled patients had a mean age of 60.5 ± 18.1 years, 47% were female, and cohorts had similar demographics and comorbidities. Rib fracture number (mean 6.8 bupivacaine, 7.7 saline), distribution, and bilateral targets for intercostal injection were similar between groups. The bupivacaine group achieved higher incentive spirometry volumes over days 1 (1095.3 mL bupivacaine vs. 900.3 mL saline) and 2 (1063.1 mL bupivacaine vs. 866.3 mL saline). There was no change in daily mean pain scores in either group, but both groups showed a decrease in opioid use over time. Hospital and ICU lengths of stay were similar between groups. Also, there were no differences in post-injection pneumonia, use of epidural catheters, or adverse events.
Conclusion: While intercostal liposomal bupivacaine injection is a safe method for rib fracture-related analgesia, it was not effective in reducing pain scores, opioid requirement, or hospital length of stay compared to placebo. Intercostal injection did transiently improve incentive spirometry volumes, however, without a reduction in the development of pneumonia.

Session IIIB: Papers 20-30
Paper 21: 2:00 PM – 2:20 PM

IMPLEMENTATION OF BRAIN INJURY GUIDELINES (BIG) FOR ISOLATED TRAUMATIC BRAIN INJURY IN ADULTS DECREASES RESOURCE USE WITHOUT ADVERSELY IMPACTING OUTCOMES

Ken Kuruvilla, MD; James Clark II, BS; Oscar Estrada Munoz, MD; Allison McNickle, MD, FACS; Douglas R. Fraser, MD, FACS; Deborah A. Kuhls, MD, FACS, FCCM; John Fildes, MD, FACS; Paul J. Chestovich, MD, FACS; University of Nevada Las Vegas
Invited Discussant: Lena Napolitano, MD, MPH

Background: Traumatic brain injury (TBI) is a potentially life-threatening clinical condition with ~3 million hospital visits to trauma centers annually. The published Brain Injury Guidelines (BIG) have shown that patients at low risk for bleed progression can be safely managed without intensive care unit (ICU) admission or neurosurgery consultation. The purpose of this study is to compare the management and outcomes of patients with TBI before and after the implementation of BIG.
Methods: A retrospective cohort study was performed comparing pre- and post-BIG implementation at a Level 1 Trauma Center between 2014 and 2019. BIG was implemented in June 2017. Patients were stratified into three groups, BIG 1 (mild),2 (moderate), or 3 (severe). Primary outcome measures were hospital and ICU length of stay, repeat Head CT, neurosurgery consultation, and in-hospital mortality
Results: A total of 927 (Pre-BIG: 663, Post-BIG: 264) patients with isolated TBI were identified and had similar baseline characteristics except ISS which was higher in Pre-BIG patients. Overall adherence to BIG was 82.5%. Implementation of BIG resulted in significant reduction in ICU admissions (69% vs 53%, p<0.001), ICU length of stay (2.4 vs. 1.8, p=0.046), neurosurgery consultations (70% vs. 52%, P<0.001), and repeat imaging (74% vs. 60%, p<0.001). There was no increase in death, need for neurosurgical intervention, or upgrade to the ICU.
Conclusions: Implementation of BIG resulted in decreased neurosurgery consultations, repeat imaging, and ICU admission in patients without increase in mortality or need for neurosurgical intervention.

	Pre-BIG (N=663)	Post-BIG (N=264)	P-value
Groups			
BIG 1	87 (13)	43 (16)	
BIG 2	80 (12)	69 (26)	
BIG 3	496 (75)	152 (58)	
Age	57.2 ±21.3	59.0±20.6	
ISS	14.6 (0.28)	12.2 (0.45)	0.00
BIG 1	9.9 (0.49)	8.2 (0.62)	0.04
BIG 2	10.9 (0.53)	8.5 (0.45)	0.00
BIG 3	16 (0.33)	15 (0.64)	0.14
GCS on admission	13.36 ± 0.15	13.68 ± 0.22	0.23
BIG 1	13.85 ± 0.3	13.98 ± 0.45	0.81
BIG 2	13.26 ± 0.44	13.34 ± 0.44	0.90
BIG 3	13.28 ± 0.17	13.75 ± 0.30	0.19

Table 1: Demographic features of pre- and post-BIG patients

	Pre-BIG	Post-BIG	P-value
ICU Length of stay	2.4 ± 0.1	1.8 ± 0.2	0.05
BIG 1	0.8 ± 0.1	0.02 ± 0.02	<0.001
BIG 2	0.7 ± 0.1	0.4 ± 0.1	0.1
BIG 3	2.9 ± 0.2	3 ± 0.2	0.76
Neurosurgery consultation	461 (70)	138 (52)	<0.001
BIG 1	59 (68)	2 (5)	<0.001
BIG 2	33 (41)	14 (20)	0.01
BIG 3	369 (74)	122 (80)	0.14
Repeat head CT	519 (80)	182 (69)	<0.001
BIG 1	53 (61)	10 (23)	<0.001
BIG 2	54 (65)	26 (38)	0.001
BIG 3	411 (86)	147 (97)	<0.001
Alive at discharge	605 (91)	254 (96)	0.01
BIG 1	87 (100)	43 (100)	
BIG 2	80 (100)	69 (100)	
BIG 3	438 (88)	142 (93)	0.07

Table 2: Outcomes of patients pre- and post-BIG implementation

Session IIIB: Papers 20-30
Paper 22: 2:20 PM – 2:40 PM

DETERIORATION INDEX IN CRITICALLY INJURED PATIENTS: A FEASIBILITY ANALYIS

Rebecca Fabian, BS; Alison Smith, MD, PhD; Tommy Brown, MD; John P. Hunt, MD, MPH, FACS; Patrick Greiffenstein, MD; Alan Marr, MD, FACS; Lance Stuke, MD, MPH, FACS; Sharven Taghavi, MD, MPH; Rebecca Schroll, MD; Chrissy Guidry, DO; Jonathan Schoen, MD; Patrick McGrew, MD; Olan Jackson-Weaver, PhD; Juan Duchesne, MD; Tulane University School of Medicine
Invited Discussant: Jennifer Gurney, MD

Introduction: The emergence of continuous prediction surveillance modeling could give dynamic insight into a patient's condition with potential mitigation of adverse events (AE) and failure to rescue. The Epic™ Electronic Medical Record developed a Deterioration Index (DI) algorithm that generates a prediction score every 15 minutes using pre-determined objective clinical data. A previous validation study determined by the Matthews Correlation Coefficient showed rapid increases in DI score ($\geq$14) predicted a worse prognosis. The aim of this study was to demonstrate the utility of DI scores in the trauma ICU population. **Methods:** A prospective, single-center study of Trauma ICU patients in a Level 1 Trauma Center was conducted during a three-month period, ending in January 2021. Charts were reviewed every 24 hours for minimum and maximum DI score, largest score change (Δ), and adverse events. Patients were grouped as Low Risk (ΔDI <14) and High Risk (ΔDI $\geq$14). **Results:** 224 patients were evaluated. Patients with increasing DI scores were more likely to experience adverse events (95.6% vs. 62.5%, p<0.01). No patients with DI scores < 30 were re-admitted to the ICU after being stepped down to the floor. Patients that were re-admitted and subsequently died all had DI scores of $\geq$60 when first stepped down from the ICU. **Conclusion:** This study demonstrates that DI scores predict decompensation risk in the trauma ICU, not readily apparent to providers. This can be used to identify ICU patients at risk of AE when transferred to the floor. Employing the DI model could alert providers to increase surveillance in high risk patients to minimize returns to the ICU and failure to rescue.

	Low Risk (ΔDI <14) n=64	**High Risk** (ΔDI $\geq$14) n=160	**p value**
ICU LOS, avg. days (SEM)	3.0 (0.3)	5.8 (0.5)	< *0.01*
ICU Re-admission, n (%)	3 (4.7)	32 (20.0)	< *0.01*
Re-admission Deaths n (%)	0 (0)	6 (3.8)	< *0.01*
Unplanned OR Trip, n (%)	7 (14.0)	42 (21.3)	< *0.01*
Adverse events, n (%)	40 (62.5)	153 (95.6)	< *0.01*
Death, n (%)	10 (15.6)	40 (25.0)	< *0.01*

Session IIIB: Papers 20-30
Paper 23: 2:40 PM – 3:00 PM

DOES TREATMENT DELAY FOR BLUNT CEREBROVASCULAR INJURY AFFECT STROKE RATE?: AN EAST MULTICENTER TRIAL

Rachel Appelbaum, MD; Rovinder Sandhu, MD; Emily Esposito, DO; Timothy Wolff, DO; M. Chance Spaulding, DO, PhD, FACS; Joshua P Simpson, MD; Julie Dunn, MD; Linda B Zier, RN; Sigrid Burruss, MD; Paul P Kim, BS Lewis E Jacobsen, MBChB; Jamie M Williams, MSML, BSN, RN, CCRP; Jeffry Nahmias, MD; Areg Grigorian, MD; and EAST BCVI Trial Group; Wake Forest Baptist Medical Center
Invited Discussant: Louis Magnotti, MD

Introduction: The purpose of this study was to analyze injury characteristics and stroke rates between blunt cerebrovascular injury (BCVI) with delayed vs non-delayed medical therapy. We hypothesized there would be increased stroke formation with delayed medical therapy.
Methods: This is a sub-analysis of a 16 center, prospective, observational trial on BCVI. Delayed medial therapy was defined as initiation >24 hrs after admission. BCVI which did not receive medical therapy were excluded. Subgroups for injury presence were created using Abbreviated Injury Scale (AIS) score >0 for AIS categories.
Results: 636 BCVI were included. Median time to first medical therapy was 62 hours in the delayed group and 11 hours in the non-delayed group ($p<0.001$). The injury severity score (ISS) was greater in the delayed group (25.6 vs the non-delayed group 22.3, $p< 0.001$) as was the median AIS head score (2.0 vs 1.0, $p< 0.001$). The overall stroke rate was not different between the delayed vs non-delayed groups respectively (5.0% vs 4.6%, $p=1.00$). Further evaluation of carotid vs vertebral artery injury showed no difference in stroke rate. Additionally, within all AIS categories there was no difference in stroke rate between delayed and non-delayed therapy, Table 1.
Conclusion: Modern BCVI therapy is administered early. BCVI with delayed therapy were more severely injured. However, a higher stroke rate was not seen with delayed therapy, even for BCVI with head or spine injuries. This data suggests with contraindications there is not an increased stroke rate with necessary delays of medical treatment for BCVI.

Table 1. Two AIS categories and stroke rate with delayed vs non-delayed therapy

Variable (AIS)	Delayed, Stroke, n (%)	Non-delayed, Stroke, n (%)	P value
AIS Head >0	29 (7.80%)	15 (4.00%)	0.20
AIS Spine >0	25 (6.10%)	17 (4.10%)	0.63

Session IIIB: Papers 20-30
Paper 24: 3:00 PM – 3:20 PM

THE USE OF PREDEFINED SCALES AND SCORES WITH EYE-TRACKING DEVICES TO SYMPTOM IDENTIFICATION IN CRITICALLY ILL NON-VERBAL PATIENTS

Christopher Ull, Oliver Jansen, Uwe Hamsen, Christina Weckwerth, Robert Gaschler, Thomas Schildhauer, Christian Waydhas;
Berufsgenossenschaftliches Universitätsklinikum Bergmannsheil
Invited Discussant: Jason Smith, MD

Introduction: Eye-tracking (ET) may be a novel tool to enable non-verbal communication with intubated and mechanically ventilated critically ill patients. We hypothesized that ET could be used successfully by intensive care unit (ICU) patients with artificial airways to express their levels of pain and mood, quality of life and self-esteem with predefined scales and scores.
Methods: Prospective, monocentric, observational study including patients between February and November 2020 with an endotracheal tube or tracheostomy tube and a history of mechanical ventilation of more than 48 hours, who were at least 18 years of age and without delirium. The ICU-patient´s pain was assessed with an 11-point numeric rating scale (NRS), their mood was tested with a 6-item smiley analogue scale (SAS). Quality of life and self-esteem were measured with the European quality of life-5 dimensions-5 levels-score (EQ-5D-5L) and the visual analogue self-esteem scale (VASES). The investigations were performed by a physician with the support of a psychologist following a standardized study protocol.
Results: A total of 75 patients with a mean age of 58.3 years were included. Main diagnoses for ICU admission were major trauma (45.3%), non-abdominal sepsis (22.6%), and acute abdomen (13.3%). Mean time from ICU admission to ET examination was 17.8 days. All patients showed moderate levels of pain and sadness with a mean of 3.9 points on the NRS and a mean of 3.6 points on the SAS. The general health status on the EQ-5D-5L was rated as poor in our study collective (0.06). On the VASES, most of the included patients felt trapped (90.7%) and not confident (72%), were frustrated (64%) or felt not being understood (56%). However, despite their severe illness, the patients classified themselves as intelligent (30.6%), not mixed up (38.6%), outgoing (38.6%) and optimistic (44%).
Conclusion: The use of ET in ICU patients with impaired communication is feasible, allowing them to express their levels of pain and mood, quality of life and self-esteem with predefined scales and scores. The results of our study may provide guidance for improvement measures in the care of patients in the ICU who are unable to speak. We believe that ET is useful to symptom identification and therefore may be capable of improving patient-medical team interaction and patient satisfaction.

Session IIIB: Papers 20-30
Paper 25: 3:20 PM – 3:40 PM

VALIDATING THE BRAIN INJURY GUIDELINES (BIG): RESULTS OF AN AAST PROSPECTIVE MULTI-INSTITUTIONAL TRIAL

Bellal Joseph, MD, FACS; Muhammad Kuhurrum, MD; Linda Dultz, MD, MPH, FACS; George Black, MD; Marc Campbell, DO; Todd Costantini, MD; Allison Berndtson, MD, FACS; Andrew Kerwin, MD; David Skarupa, MD; Xian Luo-Owen, MD; Mario Gomez, DO; Robert Winfield, MD, FACS; Daniel C. Cullinane, MD; & the AAST BIG Multi-Institutional Group; University of Arizona
Invited Discussant: A. Britton Christmas, MD

Introduction: BIG was developed to effectively utilize healthcare resources including repeat head CT (RHCT) scan and neurosurgical (NSG) consultation in traumatic brain injury (TBI) patients **(Table).** The aim of this study is to prospectively validate BIG at a multi-institutional level. **Methods:** This is a prospective, observational, multi-institutional trial across 9 Level I and II trauma centers. Adult (age ≥16 years) blunt TBI patients with a positive finding on initial head CT-scan were identified. Patients were categorized into BIG 1, BIG 2, and BIG 3 based on their neurologic exam, alcohol intoxication, anti-platelet/anti-coagulant use, and head CT-scan findings **(Figure).** Primary outcome measure was NSG intervention. Secondary outcome measures were neurologic exam worsening, progression on RHCT, post-discharge ED visit, and 30-day readmission.
Results: A total of 2,432 patients met inclusion criteria, of which 2,033 had no missing information and were categorized into BIG 1 (301; 14.8%), BIG 2 (295; 14.5%), and BIG 3 (1437;70.7%). In BIG 1, no patient worsened clinically, 4/301 (1.3%) patients had progression on RHCT with no subsequent change in management, and no patient required NSG intervention. In BIG 2, 2/295 (0.7%) patients worsened clinically, and 21/295 (7.1%) patients had progression on RHCT. Overall, 7/295 (2.4%) patients would have required upgrade from BIG 2 to BIG 3 due to neurologic exam worsening or progression/new bleed on RHCT, but no patient required NSG intervention. There were no TBI-related post-discharge ED visits or 30-day readmissions in BIG 1 and BIG 2 patients. All patients who required NSG intervention were BIG 3 (280/1437; 19.5%). The agreement between the assigned and final BIG categories was excellent (κ=99%). In this cohort, implementing BIG would have decreased CT-scan utilization and NSG consultation by 29% overall, with a 100% reduction in BIG 1 patients and a 98% reduction in BIG 2 patients.
Conclusion: BIG is safe and defines the management of TBI patients by acute care surgeons without the routine need for RHCT and NSG consultation.

Variables	BIG 1	BIG 2	BIG 3
LOC	Yes/No	Yes/No	Yes/No
Neurologic Examination	Normal	Normal	Abnormal
Intoxication	No	No/Yes	No/Yes
CAMP	No	No	Yes
Skull Fracture	No	Non-displaced	Displaced
SDH	≤ 4 mm	5-7 mm	≥ 8 mm
EDH	≤ 4 mm	5-7 mm	≥ 8 mm
IPH	≤ 4 mm	5-7 mm; 2 locations	≥ 8 mm; multiple locations
SAH	Trace	Localized	Scattered
IVH	No	No	Yes

Management Plan	BIG 1	BIG 2	BIG 3
Hospitalization	Observation (6hrs)	Yes	Yes
RHCT	No	No	Yes
NSG Consultation	No	No	Yes

BIG: brain injury guidelines; LOC: loss of consciousness; CAMP: Coumadin, Aspirin, Plavix; SDH: subdural hemorrhage; EDH: epidural hemorrhage; IPH: intraparenchymal hemorrhage; SAH: subarachnoid hemorrhage; IVH: intraventricular hemorrhage; RHCT: repeat head CT; NSG: neurosurgical consultation

Session IIIB: Papers 20-30
Paper 26: 3:40 PM – 4:00 PM

PREDICTING ARDS EARLY IN CRITICAL SURGICAL ILLNESS: A MODEL USING SERUM INFLAMMATORY MARKERS AND CLINICAL DATA

Felipe A. Lisboa, MD; Diego Vicente, MD; Rathnayaka Gunasingha, MD; Seth A. Schobel, PhD; Henry Robertson, MD; Desiree Unselt, MD; Christopher J. Dente, MD; April A. Grant, MD; Timothy G. Buchman, PhD, MD; Allan Kirk, MD, PhD; Eric A. Elster, MD, FACS, CAPT, MC, USN;
Uniformed Services University of the Health Sciences
Invited Discussant: Karyn Butler, MD

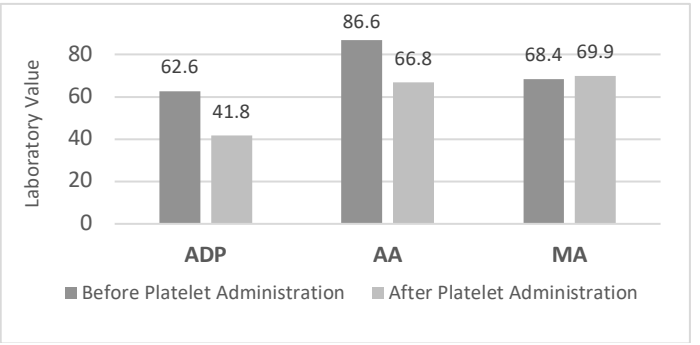
Introduction: Acute respiratory distress syndrome (ARDS) remains a common and serious complication of critical injury and illness. While increasing evidence supports an association between ARDS and various systemic markers of inflammation, their prognostic value remains uncertain. We hypothesized that an accurate predictive model for ARDS could be developed using clinical and systemic markers of inflammation.
Methods: We examined the records of 181 (136 trauma, 45 non trauma) critically ill surgical patients and used machine learning to estimate the development of ARDS during hospitalization. Clinical data and 46 systemic markers of inflammation were evaluated as possible predictors of ARDS. Models were trained using the least absolute shrinkage and selection operator (LASSO) and performance after cross-validation was evaluated by the area under the receiver operating characteristic curve (AUC), sensitivity, and specificity.
Results: Seventy-two patients developed ARDS (50 trauma, 22 non-trauma) and the mean time to diagnosis was 4.4 days. Analysis showed MIG ($p<0.01$), IL-6 ($p=0.02$) and IL-16 ($p<0.01$) were the strongest individual predictors of ARDS upon admission in trauma, non-trauma and all patients respectively. By hospital day 2, the strongest predictor for ARDS in all patients was MCP-1 ($p<0.01$). A model was trained using data from the same hospital day 2 for both trauma and non-trauma patients based on MCP-1, MIP-1beta, HGF and systolic blood pressure revealing an AUC of 0.93, sensitivity of 0.97 and specificity of 0.89 to predict the development of ARDS during the hospital stay (Figure).
Conclusion: Systemic markers of inflammation were strong predictors of ARDS at hospital admission and patients with a high risk for the developing ARDS may be identified as early as hospital day 2 per our model. This highly performing model may be utilized to develop a clinical decision support tool.

Session IIIB: Papers 20-30
Paper 27: 4:00 PM – 4:20 PM

PLATELET TRANSFUSION REDUCES PLATELET DYSFUNCTION IN TRAUMATIC BRAIN INJURY

Victoria P. Miles MD; Chace Hicks MD; Caroline Brown BA; Abigail Edwards BS; Kathryn Stewart RN-BSN; Robert Maxwell MD
Invited Discussant: Lucy Kornblitth, MD

Introduction: Platelet dysfunction occurs after traumatic brain injury (TBI) and early correction may prevent progression of brain hemorrhage. We hypothesized that transfusion of platelets would improve ADP and AA inhibition and maximum amplitude as measured by thromboelastography (TEG) with platelet mapping assay and reduce brain hemorrhage after TBI.
Methods: A practice management guideline was established calling for the collection of a routine TEG with platelet mapping on all trauma patients with intracranial bleed associated with TBI. If ADP or AA inhibition was noted to be > 60%, 1 unit of platelets was administered, and a repeat platelet mapping assay was performed. Demographics, hospital data and platelet assay results were recorded. Using Wilcoxon-Mann-Whitney, chi-square, and Fisher's exact tests where appropriate, analyses were performed.
Results: Protocol adherence of 71.8% over the 8-month study period resulted in 73 patients receiving platelets for ADP and/or AA inhibition. With the administration of platelets, ADP (median 62.60 to 41.80, p=0.0001), AA (86.60 to 66.80, p=0.0001) and MA (68.40 to 69.60, p=0.0006) all improved as demonstrated below. If ADP improved, mortality (median 6 to 2, p=0.0163) and neurosurgical intervention (7 to 3, p=0.0141) decreased. If AA or MA improved, no significant change was appreciated in terms of mortality, neurosurgical intervention, LOS, discharge GCS nor progression.
Conclusion: Patients with TBI and platelet inhibition may benefit from the administration of platelets to correct platelet dysfunction.



Session IIIB: Papers 20-30
Paper 28: 4:20 PM – 4:40 PM

LOW PREVALENCE BUT HIGH IMPACT OF COVID-19 POSITIVE STATUS IN ADULT TRAUMA PATIENTS: A MULTI-INSTITUTIONAL ANALYSIS OF 28,904 PATIENTS

Samir M. Fakhry MD; Jennifer L. Morse MS; Jonathan B. Perlin MD; Gina M. Berg PhD; Adel Elkbuli MD; Katherine McBride MD; Amanda L. Miller DMSc; Matthew Carrick MD; Chris Fisher MD; William Shillinglaw DO; Kaysie Banton MD; Saptarshi Biswas MD; David Plurad MD; Mark Lieser MD; Dorraine D. Watts PhD; Center for Trauma and Acute Care Surgery Research, Clinical Operations Group, HCA Healthcare, Nashville, TN
Invited Discussant: Sheldon Teperman, MD

INTRODUCTION: Few large investigations have addressed the prevalence and impact of COVID-19 infection in trauma patients. The purpose of this study was to estimate COVID prevalence among trauma patients on arrival and during hospitalization and determine its impact on morbidity and mortality.

METHODS: Adults admitted 4/1/20 to 10/31/20 were selected from the registries of 46 level I/II Trauma Centers and grouped by COVID status as "+Day1", "+Day2-6", "+Day≥7", "Negative" or "Unknown". Groups were compared on outcomes (TQIP complications) and mortality using univariate analysis and adjusted logistic regression.

RESULTS: There were 28,904 patients (60.7% male, mean age 56.4, mean ISS 10.54). Of 13,274 (46%) with known COVID status, 266 (2%) were +Day1, 119 (1%) were +Day2-6, 33 (0.2%) were +Day≥7, and 12,856 (97%) tested Neg. The Pos. group had significantly worse outcomes than the Neg. group, with a longer mean LOS, higher rates of ICU stay, Vent use, ARDS, and Mortality (Table). Adjusted OR (for age & ISS) showed COVID+ patients had increased mortality odds (3.0, 95% CI:2.0-4.4) and ARDS (6.1, 95% CI:2.5-15.1) compared to Neg. patients.

VARIABLE	COVID-19 STATUS					
	Day of First + Test			All (+) Pts	All (-) Pts	Not known
	Day1	Day2-6	Day≥7			
	n=266 (2.0 %)	n=119 (0.9 %)	n=33 (0.2%)	n=418 (3.1%)	n=12,856 (96.9%)	n=15,630
ISS (mean)	11.5	11.3	11.8	11.5	11.5	9.7*
Age (mean)	56.0*	64.7*	59.5	58.5	60.5	53.0*
Male (%)	59.8	48.7	60.6	57.1	57.1	63.7*
LOS (mean)	8.1	11.3*	33.4*	11.2*	7.4	3.7*
ICU (%)	56.4*	54.6	78.8*	58.1*	45.7	34.4*
Vent (%)	21.8*	20.2	36.4*	22.9*	16.9	8.5*
VTE (%)	1.9	0.8	6.1*	1.7	1.5	0.3*
DVT (%)	1.1	0.8	3.0	1.0	1.1	0.3*
ARDS (%)	1.5*	0.8	6.1*	1.7*	0.4	0*
Died (%)	8.3*	8.4*	6.1	8.4*	3.4	3.0

*Indicates group differs statistically significantly from Negative group at p<.05

CONCLUSION: In this large, multicenter study, few trauma patients were COVID+, suggesting relatively low exposure risk to trauma care providers. COVID+ status was associated with significantly higher mortality and morbidity. Further analysis of associations with poorer outcomes is needed with consideration for care guidelines specific to COVID+ trauma patients.

Session IIIB: Papers 20-30
Paper 29: 4:40 PM – 5:00 PM

RESPIRATORY COMPLICATIONS AFTER INTENSIVE CARE UNIT DISCHARGE IN TRAUMA PATIENTS: A HIGH CONSEQUENCE EVENT

Joshua E. Rosen, MD, MHS; Eileen M. Bulger, MD; Joseph Cuschieri, MD;
University of Washington
Invited Discussant: Paula Ferrada, MD

Introduction: The period after transfer from the ICU to the acute-care ward is a vulnerable time for trauma patients to experience respiratory complications. However, relatively little is known about the epidemiology of these events. This study focused on the timing, outcomes, and risk factors associated with respiratory events after transfer from the ICU.
Methods: This is a retrospective cohort study of all trauma patients age > 18, transferred to the ward after initial ICU admission in a Level 1 trauma center from 2015-2019. Respiratory events were defined as 1) escalation in oxygen therapy beyond nasal cannula or facemask for >= 3 consecutive hours, or 2) unplanned intubation for a primary pulmonary cause. All intubation events were adjudicated to identify those of primary pulmonary etiology. Patient factors associated with events were analyzed using logistic regression.
Results: 6,561 patients met inclusion criteria with a mean age of 52.3 (SD=21.3) years and median injury severity score of 18 (IQR=13-26). 262 patients (4.0%) experienced a respiratory event, 58 requiring intubation. Respiratory events occurred early after transfer (median day 2, IQR 1-5), were associated with high mortality (16% vs. 1.8%, p<0.001) and long length of stay (19 vs 8 days, p<0.001).

Covariate	Odds Ratio (95% CI)	p-value
Age >= 65	1.67 (1.19-2.35)	0.003
Female Sex	0.66 (0.49– 0.91)	0.011
Alcohol use disorder	1.61 (1.14 – 2.27)	0.007
Congestive Heart Failure	2.16 (1.34 – 3.49)	0.002
Chronic Obstructive Pulmonary Disease	1.69 (1.09 – 2.62)	0.018
Diabetes	1.79 (1.25 – 2.57)	0.001
Injury Severity Score >16 (vs. <10)	2.51 (1.41 – 4.48)	0.002
Intubated at Admission	1.74 (1.30 – 2.33)	<0.001
>=3 Rib Fractures or Flail Chest	1.90 (1.40 – 2.57)	<0.001
Pulmonary Contusion or Laceration	1.38 (1.01 – 1.91)	0.046

Conclusions: Respiratory events after floor transfer occur close to the time of transfer and are associated with poor outcomes. Older patients with more severe chest injury are at higher risk. Efforts to reduce respiratory complications should focus on these high-risk groups at the time of floor transfer for maximum impact.

Session IIIB: Papers 20-30
Paper 30: 5:00 PM – 5:20 PM

AGITATION IN THE TRAUMA BAY AS AN EARLY INDICATOR OF SEVERE INJURY AND HEMORRHAGIC SHOCK

Mary E. Bokenkamp, MD; Pedro Teixeira, MD; Marc Trust, MD; Tatiana Cardenas, MD, MS; Jayson Aydelotte, MD; Marielle Ngoue, BS; Emilio Ramos, BS; Sadia Ali, MPH; Chloe Ng, MPH; Calos V. Brown, MD; Dell Seton Medical Center at the University of Texas
Invited Discussant: Linda Ding, MD

Introduction: Agitation on arrival in trauma patients may be attributed to head injury or intoxication. We hypothesized that agitation in the trauma bay is an early indicator for hemorrhage in trauma patients. The specific aim of this study is to compare trauma patients who present in an agitated state to those who do not.
Methods: We performed a prospective study from September 2018 to December 2020 that included any trauma patient who arrived agitated, defined as a Richmond Agitation-Sedation Scale (RASS) of +1 to +4. Variables collected included demographics, admission physiology, and injury severity. The primary outcomes were need for emergent therapeutic intervention for hemorrhage control and massive transfusion (>10 units).
Results: Of 4657 trauma admissions, 77 (1.6%) arrived agitated. Agitated patients were younger (42 vs. 48, p=0.01), more often male (94% vs. 66%, p<0.0001) sustained more penetrating trauma (31% vs. 12%, p<0.0001), more often arrived tachycardic (107 vs. 88, p<0.0001) and hypotensive (13% vs. 3%, p<0.0001), and had a higher injury severity score (19 vs. 10, p<0.0001).

	Agitation	No Agitation	p-value
Transfusion	57%	15%	<0.0001
Massive Transfusion	19%	4%	<0.0001
Emergent Intervention	29%	5%	< .0001

After logistic regression controlling for other variables, agitation was independently associated with massive transfusion (OR: 3.0 [95% CI 1.4-6.6, p=0.006) and emergent therapeutic intervention (OR: 3.2 [95% CI 1.7-6.2, p=0.0005). When looking only at patients who arrived hemodynamically stable, agitation remained independently associated with emergent therapeutic intervention (OR: 2.5 [95% CI 1.2-5.3, p=0.01).
Conclusions: Agitation in trauma patients is uncommon but may serve as an early indicator of severe injury and hemorrhagic shock, as agitation is independently associated with a three-fold increase in the need for massive transfusion and emergent therapeutic intervention for hemorrhage control.

Session IV:
Master Surgeon Lecture

""The Use of Ultrasound in the Acute Setting: Lessons Learned After 30 Years""

Wednesday, September 29, 2021

5:30 PM – 6:00 PM

Location: Salon East

Presenter:

Grace Rozycki, M.D., M.B.A.

Professor Of Surgery
John Hopkins University

Session VI:
Papers 31 -33

Thursday, September 30, 2021

7:30 AM – 8:30 AM

Location: Salon

Moderator: Marry Fallat, M.D.

Recorder: David Notrica, M.D.

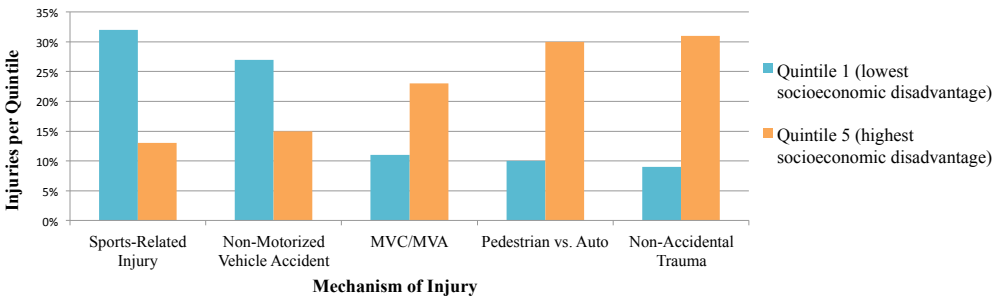
Session VI: Papers 31-33
Paper 31: 7:30 AM – 7:50 AM

PEDIATRIC TRAUMA IN THE CALIFORNIA-MEXICO BORDER REGION: INJURY DISPARITIES BY AREA DEPRIVATION INDEX

Alicia Sykes, MD; Alexandra Rooney, MPH; Kevin Smith, BSN; Andrew Avila, BS; Claudio Ghetti, BA; William Sisson, MD; Matthew Martin, MD; Vishal Bansal, MD, FACS; Michael Sise, MD, FACS; Romeo Ignacio, Jr., MD, MSc, FACS; Scripps Mercy Hospital
Invited Discussant: Jeffrey Upperman, MD

Introduction: The California-Mexico border region (CA-MX) is a high-volume trauma area with populations of widely disparate socioeconomic status. We analyzed differences in demographics and mechanism of injury in children using the Area Deprivation Index (ADI), a composite measure of 17 markers of neighborhood disadvantage/disparities.
Methods: Retrospective review of pediatric patients in the CA-MX region evaluated at our Level I Pediatric Trauma Center (2008-2018). Data included demographics, injury characteristics, and health care outcomes. Patient address was correlated to neighborhood disadvantage level using ADI quintiles, with higher quintile representing greater socioeconomic disadvantage.
Results: 9,715 children were identified, of which 4,307 (44%) were Hispanic. Hispanic children were more likely to live in more disadvantaged neighborhoods than non-Hispanic children ($p<0.001$). There were markedly different injury mechanisms in neighborhoods with greater socioeconomic disadvantage (higher ADI) compared to those with less socioeconomic disadvantage (Figure 1). Sports-related and non-motorized vehicular trauma predominated in less disadvantaged neighborhoods, while higher ADI quintiles were strongly associated with pedestrian vs vehicle, motorized vehicle crashes, and non-accidental/abusive trauma ($p<0.001$).
Conclusion: This analysis represents the first study to characterize pediatric traumatic injury patterns based upon the neighborhood ADI metric. ADI can be a useful resource in identifying disparities in pediatric trauma and those at increased risk for vehicular and abusive injury who may benefit from increased resource allocation, social support, and prevention programs.

Figure 1. Mechanism of Injury by Area Deprivation Index (ADI) Quintile



Session VI: Papers 31-33
Paper 32: 7:50 AM – 8:10 AM

SEX DIMORPHISMS IN COAGULATION CHARACTERISTICS IN THE PEDIATRIC TRAUMA POPULATION APPEAR AFTER PUBERTY

Katherine Hrebinko, MD, Stephen Strotmeyer, PhD, Ward Richardson, MD, Barbara A. Gaines, MD, Christine M. Leeper, MD, MSc; University of Pittsburgh Medical Center
Invited Discussant: Chrissy Guidry, DO

Introduction: Observational studies have demonstrated a relative survival benefit in premenopausal female patients following severe trauma. Animal studies implicate a potential role of sex hormones in mediating coagulation characteristics. We hypothesize that thromboelastography (TEG) profiles are equivalent across genders in younger children and diverge after puberty.
Methods: Consecutive pediatric trauma patients were identified from a university-affiliated, level I, pediatric trauma center (2016-2020). Demographics, injury characteristics, and TEG parameters were collected by review of the electronic medical record. Children were categorized by sex and age (younger: <=11 years, older: >11 years). Baseline characteristics, outcomes, and TEG parameters were compared using nonparametric tests as appropriate.
Results: 647 subjects were identified, of which 70.2% were male. Among 395 younger children (<=11 years), there were no differences in TEG characteristics between sexes. Among 252 adolescents (> 11 years) males had greater K times (1.8 vs 1.4 min, $p<0.001$), decreased alpha angles (69.6 vs73.7 deg, $p<0.001$), lower maximum amplitudes (59.4 vs 61.5 mm, $p=0.01$) and higher fibrinolysis at 30 minutes (1.0% vs 0.4%, $p=0.02$) compared to females. Comparing within each sex, there were no differences in TEG profiles between younger and older female children except for fibrinolysis, which was decreased in older females (0.4% vs. 1.5%, $p<0.001$). Compared to younger male children, adolescent males had greater K times (1.8 vs 1.4, $p<0.001$), decreased alpha angles (73.5 vs. 69.6 deg, $p<0.001$), lower maximum amplitudes (59.4 vs 62 mm, $p<0.001$) and lower fibrinolysis (1.0% vs 1.3%, $p=0.03$). There were no differences in length of stay, disability, or mortality between age groups or sexes.
Conclusions: Sex dimorphisms in TEG coagulation profiles, appear after puberty. This divergence appears to be driven by a shift in male coagulation profiles to a relatively hypocoagulable state after puberty, suggesting a potential important role of testosterone in mediating coagulation.

Session VI: Papers 31-33
Paper 33: 8:10 AM – 8:30 AM

ASSOCIATION OF SOCIAL VULNERABILITY INDEX WITH RISK-ADJUSTED TRAUMA OUTCOMES

Jonathan Scott, MD; Zhaohui Fan, MD MPH; Naveen F. Sangji, MD MPH; Mark R. Hemmila, MD; John W. Scott, MD MPH; University of Michigan Medical Center
Invited Discussant: Marta McCrum, MD, MPH

Introduction: Social determinants of health (SDOH) are known to impact patient-level outcomes, though are often difficult to measure. The Social Vulnerability Index (SVI) was created by the CDC to identify vulnerable communities using population metrics. Trauma patients represent a high-risk group with known SDOH needs, however, the relationship between SVI and trauma outcomes remains poorly understood.
Methods: SVI data from the CDC was merged with statewide trauma collaborative quality initiative data at the census tract level. Three analytic models evaluated the association between SVI quartile and inpatient trauma mortality: (i) an unadjusted model, (ii) a model using only covariates available to claims-based datasets, and (iii) a model incorporating robust clinical detail in line with the National Trauma Data Standard (see **Table**).
Results: 85,986 trauma patients were identified. Higher SVI was associated with worse mortality in the unadjusted and claims-based adjusted models. This association was no longer present in the fully adjusted model. (**Table**)
Conclusion: Patients living in communities with greater social vulnerability were more likely to die after trauma admission. While some differences remain after adjusting with claims data, the association became insignificant after risk adjustment with robust clinical covariates. These findings suggest that improving trauma survival among vulnerable communities will require policies that impact upstream, pre-admission factors.

Table. Association of SVI with Inpatient Mortality among Trauma Admissions

SVI Quintile	Unadjusted (95%CI)	Claims-based* (95%CI)	Clinical-based** (95%CI)
Lowest quintile (least vulnerable)	*Reference*	*Reference*	*Reference*
2nd quintile	**1.18 (1.04-1.34)**	1.08 (0.93-1.25)	1.10 (0.91-1.32)
3rd quintile	**1.26 (1.11-1.42)**	1.16 (1.00-1.34)	1.12 (0.93-1.35)
4th quintile	**1.53 (1.35-1.74)**	**1.35 (1.16-1.57)**	1.26 (1.04-1.54)
Highest quintile (most vulnerable)	**1.72 (1.48-2.00)**	**1.40 (1.16-1.70)**	1.07 (0.82-1.38)

*Claims-based covariates: Age, gender, race/ethnicity, Abbreviated Injury Scale (6 body regions), Injury Severity Score group, 16 comorbidity flags, insurance type, bed size, teach, profit, urban, RN-to-bed ratio, trauma level

**Clinical-based covariates: As above plus prior meds (beta blocker, steroid, statin, chemo, anticoagulant/antiplatelet), vitals (BP, pulse, GCS motor score), transfer, pre-CPR, ventilation

Session VII:
Master Surgeon Lecture II

"Tailwinds & Headwinds"

Thursday, September 30, 2021

8:30 AM – 9:00 AM

Location: Salon

Presenter:

L.D. Britt, M.D., M.P.H.

Henry Ford Professor
Edward J. Brickhouse Chairman
Department of Surgery
Eastern Virginia Medical School

Session VIII:
Scholarship Presentations

Thursday, September 30, 2021
9:00 AM – 9:30 AM
Location: Salon
Presenter: David A. Spain, M.D.

9:01 AM - 9:10 AM

Larry Yann-Leei Lee, M.D.
University of South Alabama
AAST Research and Education Fund (2019-2020)
"Immunomodulatory Effects of Cellular Contamination in Plasma Products for Transfusion"

9:15 AM - 9:25 AM

Anne M. Stey, M.D., M.Sc.
Northwestern Memorial Hospital
AAST Research and Education Fund (2019-2020)
"Optimization of Re-Triage of Severely Injured Patients"

Session IX:
Papers 34 -37

Thursday, September 30, 2021

9:30 AM – 10:50 AM

Location: Salon

Moderator: Kimberly A. Davis, M.D., M.B.A.

Recorder: Ronald Stewart, M.D.

Session IX: Papers 34-37
Paper 34: 9:30 AM – 9:50 AM

RACE AND TRAUMA: THE EFFECT OF HOSPITAL BLACK-WHITE PATIENT RACE DISTRIBUTION ON MORTALITY

Sami K. Kishawi MD; Esther S. Tseng MD; Victoria J. Adomshick BS; Christopher W. Towe MD; Vanessa P. Ho MD MPH; MetroHealth Medical Center
Invited Discussant: Andre Campbell, MD

Introduction: Research on institutional-level disparities has demonstrated that in some medical settings, Black patients have better outcomes in high Black-serving hospitals. We hypothesized that Black patients would have lower mortality after trauma in high Black-serving hospitals.
Methods: We identified all adult patients with Black or White race and with an injury severity score (ISS) of 4 or more from the 2017 National Inpatient Sample. We collected hospital identifier, penetrating mechanism, age, sex, Elixhauser comorbidities, urban-rural location, insurance, zip code income quartile, and calculated ISS from ICD-10 codes. We used a published hospital service ranking system to group hospitals by proportion of Black trauma patients served: high Black-serving (H-BS, top 5%), medium (M-BS, >5% and <25%), and low (L-BS, bottom 75%). Adjusted logistic regression using an interaction variable between race and hospital service rank (reference group = White patients in H-BS) was used to identify factors associated with mortality. Median [IQR], chi-square p-values, and odds ratios (OR [95% CI]) are shown.
Results: We analyzed 184,080 trauma patients (age 72 [55-84], ISS 9 [4-10]), of whom 11.7% were Black. 4% of patients died. Of 2,376 hospitals, 126 (5.3%) were H-BS and 469 (19.7%) M-BS. 29.8% of Black and 3.6% of White patients were treated at H-BS hospitals, while 71.7% of White and 23.6% of Black patients were treated at L-BS hospitals ($p<0.001$). Black patients had the lowest mortality at H-BS hospitals (OR 0.76 [0.64-0.92]) and the highest mortality (OR 1.42 [1.13-1.80]) at L-BS hospitals. White patients had the lowest mortality at L-BS hospital (OR 0.76 [0.64-0.92]).
Discussion: After adjusting for injury and hospital factors, disparities exist in the treatment of Black and White patients such that the best outcomes occur in hospitals that treat those patients most frequently. This is suggestive of racial bias at the institutional level. Further efforts must be made to promote equitable treatment at all hospitals and reduce these racial disparities.

Session IX: Papers 34-37
Paper 35: 9:50 AM – 10:10 AM

A NATIONAL STUDY DEFINING 1.0 FULL-TIME EMPLOYMENT FOR TRAUMA/ACUTE CARE SURGERY

Patrick Murphy, MD, MSc, MPH; Jamie Coleman, MD; Basil S. Karam, MD; Juan F. Figueroa, MD; David Deshpande, BS; Marc de Moya, MD, FACS; Medical College of Wisconsin
Invited Discussant: Kristan Staudenmayer, MD, MSc

Introduction: Trauma and acute care surgery (ACS) staffing models vary widely across the USA, resulting in large discrepancies in staffing, compensation, schedule, and clinical/non-clinical expectations. An urgent need exists to define clinical, academic, and schedule expectations for a full-time equivalent (FTE) of a trauma and ACS surgeon in the US.
Methods: A survey was distributed to departmental leaders at Level I, II, III trauma centers across the US regarding current workload. Variables concerning the responsibilities of surgeons, compensation models, and clinical expectations were collected. This was followed by virtual semi-structured interviews of agreeable respondents. A thematic analysis was used to describe current staffing challenges and 'ideal' staffing and compensation models of trauma centers.
Results: 68 of 483 Division Chiefs/Medical Directors responded (14%), the majority (66%) representing Level I centers. There were differences in clinical responsibilities, elective surgery coverage as well as number of and reimbursement for call (Table 1). In our qualitative interviews we identified themes of administration/surgeon conflict and difficulty balancing staff needed for both call and daytime clinical activities.
Conclusion: Defining the workload of a full-time trauma and ACS surgeon depends upon the type and frequency of call and the number of duties during the day. The average clinical coverage is 26 weeks of service a year, 5 in-house call shifts or 8 home call shifts and 4 elective operative days per month. Leaders in ACS had difficulty defining the service and described conflict between covering call and having enough day-time clinical volume.

Table 1: Survey responses by Trauma Center Level

Trauma Center Level	I (n=45)	II (n=15)	III (n =8)	p-value
SICU Coverage (%)	98%	73%	38%	<0.001
Elective Surgery (%)	67%	93%	88%	0.08
Number of Service Weeks	26 (12)	17 (20)	22 (9)	0.09
Shifts (12 hrs) / month	5 (6)	12 (6)	20 (7)	<0.001
Call Stipend (%)	42%	53%	75%	0.21

Session IX: Papers 34-37
Paper 36: 10:10 AM – 10:30 AM

LENGTH OF STAY AND TRAUMA CENTER FINANCES: A TALE OF TWO PAYERS

Marvin Chavez, MD; Kristina Chapple, PH.D.; James Bogert, MD; Jordan Jacobs, MD; Hahn Soe-Lin, MD; Jordan A. Weinberg, MD; St. Joseph's Hospital and Medical Center
Invited Discussant: Michael Rotondo, MD

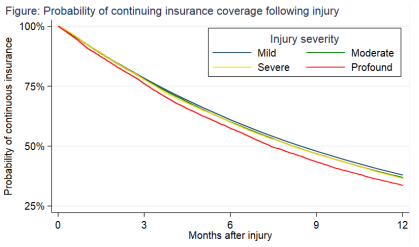
Background: In an effort to reduce costs, hospitals focus efforts on reducing length of stay (LOS) and often benchmark LOS against the geometric LOS (GMLOS) as predicted by the assigned diagnosis-related group (DRG) used by the Centers for Medicare and Medicaid Services. The objective of this study was to evaluate the impact of exceeding GMLOS on hospital profit/loss with respect to payer source.
Methods: Contribution margin for each insured patient admitted to a level 1 trauma center between July 1, 2016 and June 30, 2019 was determined. LOS, DRG (surgical vs medical), ISS, complications, illicit drug/alcohol screen, discharge disposition, and exceeding GMLOS were regressed on contribution margin to determine significant predictors of profitability. Frequency of exceeding GMLOS was compared among patients according to payer source.
Results: Among 2,449 insured trauma patients, the distribution of payers was Medicaid (54.6%), Medicare (24.0%), and commercial (21.4%). 35% (n=867) of patient length of stays exceeded GMLOS. Exceeding GMLOS by 10 or more days was significantly more likely for Medicaid and Medicare patients in stepwise fashion (Commercial 2.7%, Medicaid 4.5%, Medicare 6.0%; P=.030). Median contribution margin was positive for commercially insured patients ($16,913) and negative for Medicaid (-$8,979) and Medicare (-$2,145) patients. Adjusted multivariate modeling demonstrated that exceeding GMLOS was inversely associated with contribution margin for both Medicaid (P<.001) and Medicare (P<.001) patients, but was not associated with contribution margin for commercially insured patients (P=.203).
Conclusion: Government insured patients, despite having a payer source, are a financial burden to a trauma center. Excess length of stay among government insured patients, but not the commercially insured, exacerbates financial loss. A shift toward a greater proportion of government insured patients may result in a significant fiscal liability for a trauma center.

Session IX: Papers 34-37
Paper 37: 10:30 AM – 10:50 AM

INSURANCE CHURN AFTER TRAUMATIC INJURY: NATIONAL EVALUSATION AMONG A LARGE PRIVATE INSURANCE DATABASE

Sue Fu, MD; Katherine Arnow, MS; Nicolas Barreto, PH.D.; Marion Aouad, PH.D.; Amber Trickey, PH.D.; David Spain, MD; Arden Morris, MD; Lisa Knowlton, MD; Stanford School of Medicine
Invited Discussant: Adil Haider, MD, MPH

Introduction: Traumatic injury can lead to significant disability, with injured patients often requiring substantial healthcare resources to return to work and baseline health. Inability to work can result in loss of employer-based insurance coverage, which in turn may significantly impact healthcare access and outcomes. Among privately insured patients, we hypothesized worsening instability in coverage based upon severity of injury.
Methods: Patients presenting to a hospital with traumatic injury were evaluated for insurance churn using Optum Clinformatics® Data Mart private-payer claims. Insurance churn was defined as cessation of enrollment in an Optum health insurance plan. Using injury severity score (ISS), we compared insurance churn over the year following injury between patients with mild (ISS 0-8), moderate (ISS 9-15), severe (ISS 16-25), and profound (ISS>26) injuries. We excluded patients who did not present to an emergency department or require hospital admission, and those who died in the year following injury. Kaplan-Meier analysis was used to compare time to insurance churn by ISS category. Cox proportional-hazards regression was used to estimate hazard ratios for insurance churn.
Results: Among 788,163 privately insured hospitalized trauma patients, 62% dropped insurance within 1 year after injury. Compared to patients who remained on their insurance plan, patients who dropped insurance were younger (39 vs 43 years, p<0.001) and more likely non-white (42% vs 38%, p<0.001). The median time to insurance churn was 11.0 months (IQR 4.3-24.3 months) for those with mild traumatic injury, 10.8 (4.3-23.6) for moderate, 10.8 (4.1-23.1) for severe, and 9.6 (3.8-21.5) for those with profound injuries (log rank p<0.001 [Figure]). In multivariable analysis, all ISS categories had increasingly higher rates of insurance churn compared with mild injury: moderate ISS (HR 1.04, 95% CI 1.03-1.05), severe ISS (1.05, 1.03- 1.07), and profound ISS (1.11, 1.09-1.14).



Conclusion: Increasing severity of traumatic injury is associated with higher levels of health coverage churn amongst the privately insured. Lack of access to health services may prolong recovery and further aggravate the medical and social impact of significant traumatic injury.

Session X:
Fitts Lecture
Tribute to J. David Richardson, M.D.

"Trauma and Acute Care Surgery: The Evolution of a Specialty"

Thursday, September 30, 2021

11:10 AM – 12:10 PM

Location: Salon

Talk Presented By:

David Livingston, M.D.,
President Elect

Wesley J. Howe Professor
Chief of Trauma, Surgical Critical Care and Acute Care Surgery
Rutgers-New Jersey Medical School
Director, New Jersey Trauma Center

46TH WILLIAM T. FITTS, JR., M.D., LECTURE

William T. Fitts, Jr., M.D.
October 6, 1915 - June 17, 1984

William T. Fitts, Jr. was born on October 6, 1915, in Jackson, Tennessee. He received his A.B. degree from Union University in Jackson in 1937 and his M.D. degree from the University of Pennsylvania in 1940. He was an intern resident, Harrison Fellow in Surgical Research, Rockefeller Foundation Fellow in Surgery and Instructor in Surgery at the University of Pennsylvania from 1940-1942 and from 1945-1947. From 1942-1945, he was a Surgical Ward Officer in the Affiliated Unit of the University of Pennsylvania, the 20th General Hospital, in the China-Burma-India Theatre of World War II. He became an Assistant Professor of Surgery in 1949, Associate Professor of Surgery in 1952, and was John Rhea Barton Professor of Surgery and Chairman, Department of Surgery, University of Pennsylvania, from 1972-1975. He spent his entire career at the University of Pennsylvania. Because of his long service to the organization, the Fitts Lecture was established by the American Association for the Surgery of Trauma in 1974 and first presented by Curtis P. Artz, M.D. at the 35th AAST Meeting in Scottsdale, Arizona.

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American Association for the Surgery of Trauma:
Secretary, Vice-President, President-Elect, 1957-1964
President, 1964-1965
Editor, Journal of Trauma, 1968-1974

American College of Surgeons:
Vice-Chairman, Committee on Trauma, 1965-1966
Chairman, Pennsylvania Committee on Trauma, 1955-1967
National Safety Council Surgeon's Award for Distinguished Service to Safety, 1971

American Trauma Society:
President, 1972-1973

PREVIOUS FITTS ORATORS

1. 1975 Curtis P. Artz, M.D.
Charleston, SC
2. 1976 Francis D. Moore, M.D.
Boston, MA
3. 1977 G. Tom Shires, M.D.
New York, NY
4. 1978 Lloyd D. MacLean, M.D.
Montreal, Quebec, Canada
5. 1979 Mr. Peter S. London
Birmingham, England
6. 1980 Carl T. Brighton, M.D.
Philadelphia, PA
7. 1981 John W. Kinney, M.D.
New York, NY
8. 1982 Thomas W. Langfitt, M.D.
Philadelphia, PA
9. 1983 Col. Robert Scott, L/RAMC
London, England
10. 1984 F. William Blaisdell, M.D.
Sacramento, CA
11. 1985 Donald P. Becker, M.D.
Los Angeles, CA
12. 1986 Sheng Chih-Yong, M.D.
Woods Hole, MA
13. 1987 Paul Dudley Hart
Woods Hole, MA
14. 1988 Roderick A. Little, M.D.
Manchester, United Kingdom
15. 1989 Prof. Martin Allgower, M.D.
Switzerland
16. 1990 Philip R. Lee, M.D.
San Francisco, CA
17. 1991 Donald D. Trunkey, M.D.
Portland, OR
18. 1992 Basil A. Pruitt, Jr., M.D.
Fort Sam Houston, TX
19. 1993 John H. Davis, M.D.
Burlington, VT
20. 1994 John R. Border, M.D.
Buffalo, NY
21. 1995 Jonathan E. Rhoads, M.D.
Philadelphia, PA
22. 1996 Susan P. Baker, M.P.H.
Baltimore, MD
23. 1997 George F. Sheldon, M.D.
Chapel Hill, NC
24. 1998 Leonard Evans, Ph.D.
Warren, MI
25. 1999 Barbara Barlow, M.D.
New York, NY
26. 2000 Johannes A. Sturm, M.D.
Hannover, Germany
27. 2001 Janet Reno
Washington, DC (Cancelled)
28. 2002 C. James Carrico, M.D.
Dallas, TX
29. 2003 Ellen J. MacKenzie, Ph.D.
Baltimore, MD
30. 2004 Colonel John Holcomb, M.D.
Ft. Sam Houston, TX
31. 2005 Sylvia D. Campbell, M.D.
Tampa, FL
32. 2006 Sten E.V. Lennquist, M.D., Ph.D.
Linkoping, Sweden
33. 2007 Thomas M. Scalea, M.D.
Baltimore, MD
34. 2008 Charles E. Lucas, M.D.
Detroit, MI
35. 2009 Frederick P. Rivara, M.D., M.P.H
Seattle, WA
36. 2010 Charles N. Mock, M.D., Ph.D., M.P.H.
Seattle, WA
37. 2011 H. Leon Patcher, M.D
New York, NY
38. 2012 David B. Hoyt, M.D.
Chicago, IL

39. 2013 Frank R. Lewis, Jr., M.D.
Philadelphia, PA

40. 2014 Ronald G. Tompkins, M.D.
Boston, MA

41. 2015 L.D. Britt, M.D., M.P.H.
Norfolk, VA

42. 2016 M. Margaret Kundson, M.D.
San Francisco, CA

43. 2017 Ronald Maier, M.D.
Seattle, WA

44. 2018 C. William Schwab, M.D.
Philadelphia, PA

45. 2019 Timothy C. Fabian, M.D.
Memphis, TN

Session XI:
Poster Session

Thursday, September 30, 2021

12:10 PM – 1:10 PM

Location: Room 208-214

Group I	*Location: Room 208*
Group II	*Location: Room 209*
Group III	*Location: Room 210*
Group IV	*Location: Room 211*
Group V	*Location: Room 212*
Group VI	*Location: Room 213*
Group VII	*Location: Room 214*

**AAST has combined poster sessions this year to reduce the spread of the delta variant, please check the AAST App for the more up to date room assignments*

Session XII:
Papers 38 -45

Friday, October 1, 2021

7:30 AM – 10:10 AM

Location: Salon

Moderator: David Livingston, M.D.

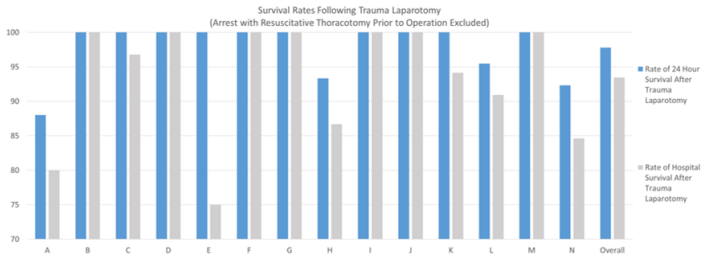
Recoder: Karen Brasel, M.D., M.P.H.

Session XII: Papers 38-45
Paper 38: 7:30 AM – 7:50 AM

IT'S TIME TO LOOK IN THE MIRROR: INDIVIDUAL SURGEON OUTCOMES AFTER EMERGENT TRUMA LAPAROTOMY

Parker Hu, MD; Rondi Gelbard, MD; Daniel Cox, MD; Jan Jansen, MBBS, PhD; Jeffrey Kerby, MD, PhD; John Holcomb, MD; University of Alabama at Birmingham
Invited Discussant: Carlos Brown, MD

Introduction: Multiple quality indicators are utilized by trauma programs to decrease variation and improve outcomes. However, little if any provider level outcomes related to surgical procedures are reviewed. Emergent trauma laparotomy (ETL) is arguably the signature case that trauma surgeons perform on a regular basis, but few data exist to facilitate benchmarking of individual surgeon outcomes. As part of our comprehensive performance improvement program, we examined outcomes by surgeon for those who routinely perform ETL.
Methods: Retrospective review of patients undergoing ETL directly from the trauma bay by trauma faculty from 12/2019-2/2021. Patients were excluded from mortality analysis if they required resuscitative thoracotomy (RT) for arrest prior to ETL. Surgeons were compared by rates of damage control (DCL) and mortality at multiple time points.
Results: There were 242 ETL ((7-32 ETL)/surgeon) performed by 14 faculty. RT was performed in 7.0% (n=17) prior to ETL. Six patients without RT died intraoperatively and DCL was performed on 31.9% (n=72/226). Mortality was 4.0% (n=9) at 24 hours and 7.1% (n=16) overall. Median ISS (p=0.21), NISS (p=0.21), and time in ED were similar overall among surgeons (p=0.15) while operative time varied significantly (40-469 minutes; p=0.005). There were significant differences between rates of individual surgeon's mortality (Range (Hospital Mortality): 0-25%) and DCL (Range: 14-63%) in ETL.
Conclusion: Significant differences exist in outcomes by surgeon after ETL. Benchmarking surgeon level performance is a necessary natural progression of quality assurance programs for individual trauma centers. Additional data from multiple centers will be vital to allow for development of more granular quality metrics to foster introspective case review and quality improvement.



Session XII: Papers 38-45
Paper 39: 7:50 AM – 8:10 PM

NATIONAL ADHERENCE TO THE ASGE-SAGES GUIDELINES FOR MANAGING SUSPECTED CHOLEDOCHOLITHIASIS

Brett M. Tracy, MD; Benjamin K. Poulouse, MD MPH; Andrew Young, MD; Cameron J. Paterson, MD; Daniel Dante Yeh, MD, MHPE; April Mendoza, MD; Apostolos Gaitanidis, MD; Jonathan Saxe, MD; Martin D. Zielinski, MD; Rondi Gelbard, MD; Ohio State University
Invited Discussant: Caroline Reinke, MD

Introduction: The ASGE-SAGES provides guidelines for diagnosing and managing choledocholithiasis (CDL). We sought to evaluate adherence to these guidelines using a national sample of patients undergoing cholecystectomy (CCY) for CDL and gallstone pancreatitis (GSP).
Methods: We prospectively identified patients who underwent same stay cholecystectomy (CCY) for CDL and/or GSP from 2016-2019 at 12 U.S. medical centers. Patients presenting with cholangitis and those with a history of ERCP were excluded. ASGE-SAGES predictors of CDL were abstracted: very strong (common bile duct [CBD] stone on transabdominal US; bilirubin > 4), strong (CBD > 6 mm; bilirubin ≥ 1.8 to ≤ 4); moderate (abnormal LFTs other than bilirubin; age > 55 years; clinical GSP). Patients were then grouped by likelihood of CDL: high (≥ 1 very strong predictor or both strong predictors), low (no predictors present), or intermediate (any other combination of predictors). The actual management of each group was compared to ASGE-SAGES guidelines, i.e. low (CCY only), intermediate (CCY + IOC and/or endoscopic ultrasound [EUS] OR CCY + preoperative EUS/MRCP), and high (preoperative ERCP). The primary outcome was deviation from guidelines.
Results: The cohort was comprised of 844 patients; 2.3% (n=19) had low likelihood of CDL, 53.9% (n=455) had intermediate, and 43.8% (n=370) had high. In the low likelihood group, 78.9% (n=15/19) patients deviated; in the intermediate group, 41.8% (n=190/455) patients deviated; in the high group, 39.7% (n=147/370) patients deviated. After adjusting for all predictors, only GSP increased the risk of deviation in the high likelihood group (OR 2.9, 95% CI 1.6-5.3, p<.001) and only age > 55 y increased risk of deviation in the intermediate group (OR 1.9, 95% CI 1.1-3.3, p=0.02).
Conclusion: In a nationally representative sample of patients with CDL, >40% were managed differently than ASGE-SAGES guidelines. Future studies in this population are needed to better understand deviation in guidelines in patients with GSP and age > 55 years.

Session XII: Papers 38-45
Paper 40: 8:10 AM – 8:30 AM

A PROSPECTIVE RANDOMIZED TRIAL COMPARING TWO STANDARD DOSES OF ENOXAPARIN FOR PREVENTION OF THROMBOEMBOLISM IN TRAUMA

Martin Schreiber, MD; Heather Hamilton, MS; Samantha Underwood, MS; Cassie Barton, PharmD, BCCP, FCCM; Elizabeth Dewey, MS; Alex Schlitt, DO; Laura Martin, BS; Christopher Connelly, MD; Jeffrey Barton, MD, FACS, FASCRS; Mackenzie Cook, MD; Martin A. Schreiber, MD, FACS, FCCM; Oregon Health & Science University
Invited Discussant: Elliott Haut, MD, PhD

Introduction: Deep venous thrombosis (DVT) and related complications are a preventable source of morbidity and mortality in hospitalized trauma patients. The optimal dosing schedule of subcutaneous enoxaparin for prevention of DVT is debated. We hypothesize that a single daily dose (QD) of 40mg enoxaparin is equally as efficacious and safe as 30mg twice daily (BID) in preventing DVT in our hospitalized trauma patients.
Methods: Trauma patients at least 15 years of age admitted to a Level 1 trauma center between 2014 and 2020 were prospectively randomized to receive 40mg enoxaparin QD or 30mg BID. Those who had bleeding risk precluding prophylaxis, were already receiving prophylactic enoxaparin outside of the study protocol, were receiving therapeutic anticoagulation or antiplatelet therapy, had CrCl <30 mL/min, or were not able to consent were excluded. Whole leg duplex was performed weekly for screening. Demographic data included age, sex, body mass index (BMI), injury severity score, and mechanism of injury. Primary outcome measured was DVT incidence. Secondary outcomes were rates of missed doses, bleeding complications, and hospital length of stay. Power analysis performed on pilot data determined that our sample size was adequate.
Results: Of the 267 randomized patients who met criteria, 139 (52%) received 40mg enoxaparin QD. The QD arm had 99 (71%) male patients versus 90 (70%) in the BID arm, with an average age of 49 years and average BMI of 28 in both groups. DVT developed in 15 patients (11%) in the QD arm and 12 (9%) in the BID arm. Bleeding complications were present in 26 patients (19%) versus 18 (14%), QD versus BID. Median hospital length of stay was 7 days in the QD arm versus 7.5 days in the BID arm. There were no significant differences in all above comparisons ($p>0.05$). Only 26 (19%) patients in the QD arm missed one or more doses of prophylaxis versus 41 (32%) in the BID arm ($p<0.05$).
Conclusion: The QD dose of 40mg enoxaparin was similar to the BID dose of enoxaparin for prevention of DVT and rate of bleeding complications. Notably, significantly fewer patients had missed doses in the daily arm. Enoxaparin 40mg QD appears equally efficacious and safe as 30mg BID while reducing the number of missed doses of prophylaxis per patient.

Session XII: Papers 38-45
Paper 41: 8:30 AM – 8:50 PM

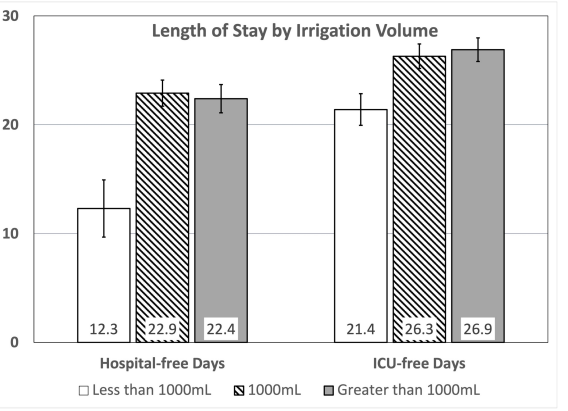
THE VOLUME OF THORACIC IRRIGATION AFFECTS LENGTH OF STAY IN PATIENTS WITH TRAUMATIC HEMOTHORAX

Laura Crankshaw, MD; Allison G. McNickle, MD; Kavita Batra, PhD; Deborah A. Kuhls, MD; Paul J. Chestovich MD; Douglas R. Fraser; MD;
UNLV School of Medicine
Invited Discussant: Todd Constantini, MD

Introduction: Irrigation of the thoracic cavity at tube thoracostomy (TT) placement may decrease the rate of retained hemothorax; however, other resource utilization outcomes have not yet been quantified. This study evaluated the effect of thoracic irrigation during TT on length of stay and outcomes in patients with traumatic hemothorax (HTX).

Methods: A retrospective chart review was performed of patients ≥18 years of age receiving a TT for HTX at a single, urban Level 1 Trauma Center from January 2019 – July 2020. Those who underwent irrigation during TT were compared to a control of standard TT without irrigation. Death within 30 days as well as TTs placed at outside hospitals, during arrest, or for isolated pneumothoraces were excluded. Primary outcomes include hospital-free, ICU-free, and ventilator-free days (30-day benchmark). Subgroup analysis by irrigation volume was conducted using one-way ANOVA testing with $p<0.05$ considered statistically significant.

Results: Seventy (39.5%) out of 177 patients underwent irrigation during TT placement. Secondary interventions, complications and TT duration were not different in the irrigated cohort. ICU-free days were significantly higher in the irrigated patients (25.1±1.35) than the controls (20.0±2.14, p=0.02). Groups irrigated with ≥1000mL had significant more hospital-free (p=0.01) and ICU-free (p=0.03) days than those receiving less than 1000mL. (Figure)



Conclusion: Patients with traumatic HTX who underwent thoracic irrigation at the time of TT placement had decreased ICU days compared to standard TT placement alone. Furthermore, irrigation volumes ≥1000mL resulted in fewer days in the hospital compared to lower irrigation volumes.

Session XII: Papers 38-45
Paper 42: 8:50 AM – 9:10 AM

SUCCESSFUL NON-OPERATIVE MANAGEMENT OF ADHESIVE SMALL BOWEL OBSTRUCTION: IS IT REALLY A SUCCESS?

W. T. Hillman Terzian, MD; Rachel D. Appelbaum, MD; Lindsay Duy, MD; Michael Y. Chen, MD; Raymond B. Dyer, MD; Preston R. Miller III, MD; Nathan T. Mowery, MD; Wake Forest School of Medicine
Invited Discussant: Martin Zielinksi, MD

Background: Water soluble contrast challenge (WSCC) has become the standard in differentiating operative from non-operative adhesive small bowel obstructions (ASBO). Literature has shown that shorter periods (8 hours) are as predictive as longer periods (24 hours) in determining the need for acute surgical intervention, but the long-term outcomes are unknown. We hypothesized that patient who require longer transit times to the colon have a higher recidivism of ASBO.
Methods: This was a 4-year review of patients with presumed ASBO undergoing successful NOM. Those requiring immediate operation or those with a SBO due to something other than ASBO were excluded. The patients were divided into two groups (8hr and 24hr) based on when contrast reached their right colon. Our protocol is 24 hours of nasogastric decompression followed by a WSCC. Abdominal films are obtained at 8 and 24 hours. Those without contrast in the colon by 24 hours undergo exploration.
Results: 137 patients underwent successful NOM; 112 in the 8hr group and 25 in the 24hr group. Demographics were similar between the two groups. One-year recurrence rate was 21.4% in the 8hr group and 40% in the 24hr group (p=0.047). Of those who recurred, the median time to recurrence was 113 days (IQR 14-236) in the 8hr group and 13 days (IQR 10-82) in the 24hr group. Of those that recurred in the 24hr group, 60% recurred within 30 days (vs. 33% in the 8hr group) (see figure). The relative risk of ASBO recurrence within one year for the 24hr group compared to the 8hr group was 1.8667 (1.0277-3.3907 95% CI, p=0.04).
Conclusions: ASBO patients undergoing NOM who required 24 hours for contrast to reach the colon had a recurrence rate nearly twice that of patients with colonic contrast by 8 hours with the majority recurring in the first 30 days. Patients who require more than 8 hours may benefit from an operative intervention at the index hospitalization. Contrast in the colon at 24 hours may define resolution of that particular episode of ASBO but discharge may be delaying the inevitable.

Session XII: Papers 38-45
Paper 43: 9:10 AM – 9:30 AM

CHARACTERISTICS AND OUTCOMES OF PRE-HOSPITAL TOURNIQUET USE FOR TRAUMA IN THE UNITED STATES

Zain G. Hashmi, MBBS; Jan Jansen, MBBS, PhD; Eric Bank, LP, NRP; Jeffrey Kerby, MD, PhD; John Holcomb, MD; University of Alabama at Birimingham
Invited Discussant: D'Andrea Joseph, MD

Introduction: The use of extremity tourniquets in military environments have reduced preventable deaths due to exsanguinating hemorrhage, leading to their increased adoption in the civilian setting. However, the characteristics and outcomes of contemporary pre-hospital tourniquet use in the civilian setting are not well-described at a national level. The objective of this study was to describe the characteristics and outcomes following pre-hospital tourniquet use by Emergency Medical Services (EMS) in the US.
Methods: All trauma activations reported to the National Emergency Medical Services Information System 2019 (NEMSIS) were included. Patients who received ≥1 tourniquets were identified. Descriptive analyses were used to compare characteristics between tourniquet and no-tourniquet cohorts. Coarsened exact matching (CEM) was then performed to generate a k2k match (on age, sex, lowest-systolic blood pressure, initial patient acuity, provider's initial impression, mechanism of injury and presence of upper and/or lower extremity injuries) and used to compare outcomes.
Results: A total of 7,161 tourniquets were applied among 4,571,379 trauma activations identified in the NEMSIS (1.6 per 1000 activations). Patients in the tourniquet cohort were younger (40±18 vs 52±26 mean±sd years, $p<0.01$), male (79% vs 48%, $p<0.01$), more hypotensive (16% vs 3%, $p<0.01$) and had higher initial acuity (65% critical/emergent vs 21%, $p<0.01$). Stab/cut/pierce (27% vs 3%, $p<0.01$), firearm injuries (19% vs 1%, $p<0.01$), upper extremity (23% vs 12%, $p<0.01$) and lower extremity injuries (25% vs 8%, $p<0.01$) were the most common mechanisms and injury patterns in the tourniquet cohort. Matched analysis revealed that the patients in tourniquet cohort had a higher final acuity (79% critical/emergent vs 72%, $p<0.01$), lower scene time (15±13 vs 17±15 mean±sd minutes, $p<0.01$) and higher survival-to-hospital (84% vs 77%, $p<0.01$).
Conclusion: Pre-hospital tourniquet use by EMS in the US is associated with lower scene-time and improved survivability to hospital. It appears there are many patients that might benefit from wider tourniquet use in the civilian pre-hospital setting.

Session XII: Papers 38-45
Paper 44: 9:30 AM – 9:50 AM

EVERY MINUTE COUNTS: GEOSPATIAL ACCESS TO TRAUMA CENTER CARE PREDICTS FIREARM INJURY MORTALITY

James P. Byrne MD, PhD; Elinore Kaufman MD, MS; Dane Scantling DO; Niels Martin MD; Shariq Raza MD; Jeremy W. Cannon MD, SM; CW Schwab MD; Patrick Reilly MD; Mark J. Seamon, MD; University of Pennsylvania
Invited Discussant: Robert Winchell, MD

Introduction: The epidemic of gun violence is a public health crisis. Firearm injuries frequently require life-saving care at level 1 or 2 trauma centers (TCs). However, access to TCs in US cities is variable and delays to care might impact survival. We hypothesized that the geographic proximity of firearm injury to the nearest TC is associated with risk of mortality.

Methods: Adult shooting victims injured in Philadelphia county (2015-2020) were identified using police data. Self-inflicted injury was excluded. Shooting locations and TCs were mapped. The exposure was the optimal ground transport time (TT) along public roads to the nearest TC (reflecting quickest-possible access-to-care), estimated for each shooting victim using geographic information systems. Two analytic approaches were then used. First, the risk-adjusted association between TT and mortality was measured. Second, the case fatality rate (CFR) and attributable proportion of deaths due to increasing TT was calculated for concentric 1-minute service areas (ranging <1 min to >14 min from TC). The population attributable fraction was calculated to estimate the number of shooting deaths that could be attributed to increasing delays in access to TC care.

Results: 8,783 adult shooting victims were identified and 19% died. Median TT was 5.5 mins (IQR 3.8-7.1 mins). There was a significant near-linear relationship between increasing TT and risk of death [**Figure A**]. Each minute increase in TT was associated with 3% increase in risk of death (OR 1.03; 95%CI 1.01-1.05). Head injury (OR 38; 95%CI 26-56), torso injury (OR 11; 95%CI 8-16) and injury indoors (OR 2.1; 95%CI 1.6-2.7) were associated with increased mortality risk. The risk-adjusted CFR for shooting victims increased from 12% (TT <1 min) to 29% (TT >14 min) with greater delay to nearest TC [**Figure B**]. After risk-adjustment, an estimated 38% of firearm deaths could be attributed to the cumulative effect of incremental increases to delay in access-to-care, or 647 fatalities during the study period (equivalent to a decrease in annual firearm homicide rate from 18 to 11 deaths/100,000 people). Sensitivity analysis excluding patients with head injury yielded similar results.

Figure A

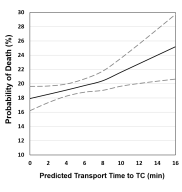
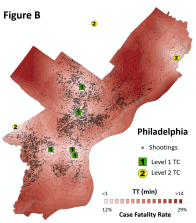


Figure B



Conclusion: In a major US city where gun violence is common, each additional minute of delay in access to a TC negatively impacts shooting victim survival. These data highlight the potentially-preventable nature of deaths following firearm injury with prompt access to trauma care.

Session XII: Papers 38-45
Paper 45: 9:50 AM – 10:10 AM

BEYOND RECIDIVISM: HOSPITAL BASED VIOLENCE INTERVENTION IMPROVES HEALTH AND SOCIAL OUTCOMES

Elizabeth Gorman, MD; Zachary Coles, BA; Nasza Baker, PhD; Ann Tufariello, MPH; Desiree Edemba, BA; Michael Ordonez, MPCS; Patricia Walling, DNP, APN, TCRN; David H. Livingston, MD; Stephanie Bonne, MD; Rutgers New Jersey Medical School
Invited Discussant: Rochelle Dicker, MD

Introduction: Hospital Based Violence Intervention Programs (HVIP) use recidivism to measure efficacy, which may be unmeasurable and subject to social factors that do not reflect the efficacy of the HVIP. We hypothesized HVIP intervention is best measured in the ability to meet the immediate health and social needs of patients following violent injury.
Methods: At an urban, level 1 trauma center's HVIP, a threefold approach to the assessment of patient needs and achievement of goals was undertaken: retrospective review of case management records, a validated, propensity-matched patient survey, and qualitative interviews. Logistic regression identified differences on each outcome; interviews were assessed by NVivo software for consistent codes, themes and iterative comparison.
Results: Of 295 HVIP patients, 89 (30%) had early disengagement from the program and 44 are within 6 months of enrollment and would not yet be expected to achieve goals, leaving 162 for evaluation. Median age was 29 years, 86% are male and 82% African American. 61 (21%) had unstable housing, and 98 (33%) were unemployed. 146 patients (90%) achieved at least one stated goals within 6 months (Figure 1). 68 patients participated in the survey arm of the study (32 HVIP, 36 non-HVIP). HVIP engagement resulted in less PTSD ($p<0.05$), higher positive affect, improved compliance with medical follow up (90% vs 60%), and early positive health and social outcomes. Prominent qualitative themes included satisfaction with program involvement, valuable personal relationship with case managers, achievement of goals, and hope for the future success.
Conclusion: HVIP patients successfully achieved short term health and social goals in 90% of patients who remained engaged. Improved relationship building with the HVIP team would decrease disengagement. Health and social outcomes should be used as a metric for efficacy of HVIP programs.

Session XIII:
Panel: Experts on the Hot Seat

Friday October 1, 2021
10:30 AM – 11:45 AM
Location: Grand Ballroom

Moderator:

Oscar Guillamondegui, M.D., M.P.H.

Panelists

Eileen Bulger, M.D.

Lena Napolitano, M.D., M.P.H.

Vanessa Ho, M.D., M.P.H.

David Skarupa, M.D.

Session XIVA:
Papers 46-56

Friday, October 1, 2021

1:00 PM – 4:40 PM

Location: Salon East

Moderator: Hayato Kurihara, M.D.

Recorder: Timothy Pritts, M.D.

Session XIVA: Papers 46-56
Paper 46: 1:00 PM – 1:20 PM

BONE MARROW ADIPOKINE EXPRESSION ASSOCIATED WITH DECREASED ERYTHROID COLONY GROWTH AFTER TRAUMA

Lauren Kelly, LS; Kolenkode B. Kannan, PhD; Erick E. Pons, BS; Diojia B. Darden, MD; Philip A. Efron, MD, FACS, FCCM; Alicia M. Mohr, MD, FACS, FCCM; University of Florida College of Medicine
Invited Discussant: Hasam Alam, MD

Introduction: Severe trauma is associated with an inflammatory response that is linked to erythroid progenitor growth suppression. Proinflammatory adipokines like visfatin and the immunomodulatory adiponectin have been linked to inflammatory processes in critically ill patients. We hypothesized that severely trauma would lead to higher adipokine expression and an inverse correlation with bone marrow (BM) erythroid progenitor growth.
Methods: A prospective cohort study enrolled trauma patients (ISS>15) with hemorrhagic shock and a pelvic or femur fracture. BM was assessed for erythroid progenitor (CFU-GEMM, BFU-E, and CFU-E) growth and BM RNA for quantitative PCR (n=25). Differences in gene expression versus controls were detected using ANOVA and correlated with erythroid progenitor growth using simple linear regression on GraphPad Prism v9.0.
Results: There was increased transcription of both adiponectin and visfatin after trauma ($p<0.05$). Increased adiponectin (Fig 1) and visfatin (Fig 2) expression were associated with decreased CFU-GEMM, BFU-E and CFU-E colony growth following trauma. There was no correlation between erythroid colony growth, adiponectin, or visfatin with age or gender.
Conclusion: Following trauma, expression of adiponectin and visfatin negatively correlate with erythroid progenitor colony growth. These findings implicate adipokines in erythropoietic dysfunction after injury. Further study is needed to determine the mechanistic role of adipokines in BM dysfunction after trauma.

Fig 1.

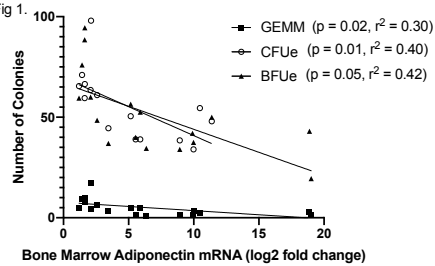
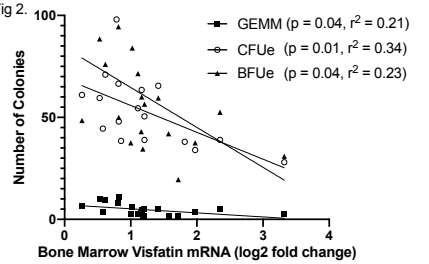


Fig 2.



Session XIVA: Papers 46-56
Paper 47: 1:20 PM – 1:40 PM

A NEW TRAUMA FRONTIER: PLATELET TRANSCRIPTOMICS

Alexander T. Fields, PH.D.; Man-Cheung Lee, MD, PHD; Fahima Mayer, PH.D.; Cedric M. Bainton, Zachary A. Matthay, MD; Rachel A. Callcut, MD, MSPH, FACS; Nasima Mayer, BS; Joseph Cuschieri, MD, FACS; Kord M. Kober, PH.D.; Roland J. Bainton, MD, PhD; Lucy Z. Kornblith, MD; University of Claifornia San Francisco
Invited Discussant: Carrie Sims, MD

Introduction: Platelets are endowed with precursor messenger ribonucleic acid (RNA) that is differentially spliced to support diverse platelet functions in response to physiologic signals. Altered platelet function following injury may be decipherable by transcriptomic platelet profiling. Supported by our prior work, we sought to characterize the platelet spliceform transcriptome and build platelet gene module networks associated with injury.

Methods: Pre-resuscitation platelets purified from trauma patients (n=11) and controls (n=6) were assayed using deep RNA sequencing. Differential alternative splicing (DAS) and gene coexpression network analysis were performed.

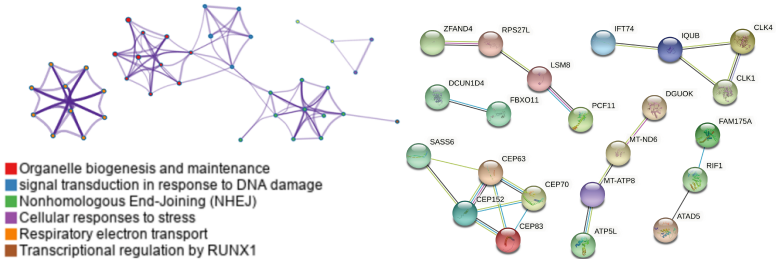
Table. Replicate multivariate analysis of transcript splicing (RMATs)

Gene Symbol	Gene Function
MFN2	Mitochondrial fusion
ENKUR	Tethers signal transduction proteins to cation channels
FAXDC2	Megakaryopoiesis, modulation of runt-related transcription factor (RUNX1)
GPD2	Regulates macrophage inflammatory responses
KIF2A	Microtubule-associated motor proteins
LIMS1	Adaptor protein likely involved in integrin signaling
MAX	bHLHZ family of transcription factors
MBNL1	RNA splicing protein
NAP1L1	Chromatin modulation
PTMA	Component of Thymosin Fraction 5
RGS18	Regulator of G-protein signaling family
RUFY1	Interacts with tyrosine kinases

All with false discovery rate (FDR)<0.05

Results: Twelve transcripts showed DAS (FDR<0.05, Table) in trauma vs. control platelets. Six pathways of cellular stress, metabolism, and megakaryopoiesis regulation (i.e., RUNX1) (Fig.1a) and protein-protein interactions (Fig.1b) were enriched between co-expressed genes.

Figure 1. Weighted gene coexpression analysis: (a) pathway enrichment, and (b) protein-protien interactions.



Conclusions: This is the first study to identify differentially spliced transcripts and molecular pathways of higher-order cellular stress, metabolism, and regulation of megakaryopoiesis in post-injury platelets. Further investigations of this platelet homeostatic governance may uncover treatment targets of post-injury coagulopathy and organ failure.

Session XIVA: Papers 46-56
Paper 48: 1:40 PM – 2:00 PM

THE EFFECT OF TRANEXAMIC ACID DOSING REGIMEN ON TRAUMA/HEMORRHAGIC SHOCK RELATED GLYCOCALYX DEGRADATION AND ENDOTHELIAL BARRIER PERMEABILITY: AN IN VITRO MODEL

Michael Carge, MD; David Liberati, MS; Lawrence Diebel, MD; Wayne State University
Invited Discussant: John Holcomb, MD

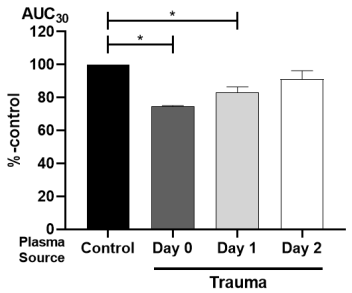
Introduction: Survival benefits of early Tranexamic Acid (TXA) administration has been demonstrated in trauma patients in both civilian and military settings. Overall survival benefit was most apparent in patients with shock and only with "early" administration (within 3 hours of injury). TXA has been shown to have anti-inflammatory properties as well. "Early" TXA administration protects against trauma hemorrhagic shock (T/HS), endothelial barrier dysfunction and glyxcocalyx (EGX) degradation. An important property of an intact EGC is modulation of adherence of neutrophils (PMN) and platelets to the endothelium. We hypothesized that TXA administration would protect the EGX from T/HS degradation and limit PMN transmigration through the endothelial cell barrier. This was studied in vitro using a microfluidic flow platform. **Methods:** Human umbilical vein endothelial cell (HUVEC) monolayers were established in microfluidic plates and subjected to flow under control or "shock" (hypoxia + reoxygenation and epinephrine) conditions. Normal media or media + TXA at 20μM or 150μM was added after 90 minutes (early TXA addition) or after 3hr delay (late TXA addition). EGC degradation was determined by supernatant hyaluronic acid (HLA), syndecan-1 (syn-1) and heparan sulfate (HS). Endothelial permeability was indexed by the relative concentrations (ratio) of angiopoietin 2 and 1 (Ang2/1). PMN transmigration in all HUVEC groups was indexed under flow conditions (ratio of transmigrated/adherent PMNs). **Results:** Mean ± SD (N = 6 for each group).
*$p<0.05$ vs. HUVEC control, #$p<0.05$ vs. HR + epi, \$$p<0.05$ vs. HR + epi + TXA 20 and 150μM early **Conclusions:** There was a concentration and temporal effect of TXA administration on EGC degradation. This was associated with "vascular leakiness" as indexed by the relative ratio of Ang2/1 and PMN transmigration. TXA if administered in patients with T/HS should be administered "early"; this includes in the prehospital setting.

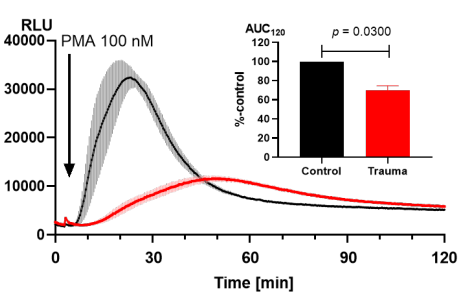
Session XIVA: Papers 46-56
Paper 49: 2:00 PM – 2:20 PM

PLASMA AND WOUND FLUIDS FROM TRAUMA PATIENTS SUPPRESS NEUTROPHIL EXTRACELLULAR RESPIRATORY BURST

Hyo In Kim, PH.D.; Jinbong Park, PH.D.; Barbora Konecna, PH.D.; Wei Huang, PH.D.; Ingred Riça, PH.D.; David Gallo, BS; Christopher D. Barrett, MD; Leo E. Otterbein, Kiyoshi Itagaki, PH.D.; Carl J. Hauser, MD;
Beth Israel Deaconess Medical Center
Invited Discussant: Jennifer Leonard, MD

Background: Trauma increases susceptibility to secondary infections but the root causes of suppressed antimicrobial function are unclear. Neutrophils (PMN) use DNA extracellular traps to ensnare bacteria and then to kill them with respiratory burst (RB). We studied the effects of plasma and wound fluids from trauma patients on PMN extracellular RB. **Methods:** Total and intracellular luminometry were used to assess receptor-dependent (fMLF) and independent (PMA) RB generated by volunteer PMN incubated 25 min in 10% plasma (Day 0, 1, 2) or 10% wound fluid (Day 1, 2) from 15 blunt trauma patients. For controls, PMN were incubated in 10% volunteer plasma (n=10). Cells were washed and studied in luminol with or without SOD + catalase for 30min. RB is reported as area under the curve (AUC) for relative light units (RLU). To ascertain if tissue necrosis plays a role in RB regulation by trauma plasma, we compared pig PMN incubated in 10% control plasma to 10% plasma from pigs who had undergone intra-peritoneal *(i.p.)* instillation of liver slurry (10% of liver weight) 1 day prior. **Results:** PMN incubation with clinical plasma or wound fluids suppressed total RB in response to fMLF or PMA. Intracellular RB was unchanged. In all cases, maximal RB suppression was caused by fluids present soon after injury and suppression decayed over time **(Fig 1)**. Tissue necrosis (modeled by *i.p.* liver slurry) resulted in similar plasma-induced deficits in receptor-dependent (LTB_4, not shown) and receptor-independent RB **(Fig 2)**. **Conclusion:** Trauma plasma and wound fluids suppress extracellular PMN RB. The causative agents can be derived from necrotic tissues, suggesting how retained necrotic tissues place the host at risk for systemic infections.





*$p < 0.05$ ANOVA/Tukey
Tukey

Session IXVA: papers 46-56
Paper 50: 2:20 PM – 2:40 PM

BETABLOCKADE IN TBI: DOSE DEPENDENT REDUCTIONS IN BBB LEUKOCYTE MOBILIZATION & PERMEABILITY IN VIVO

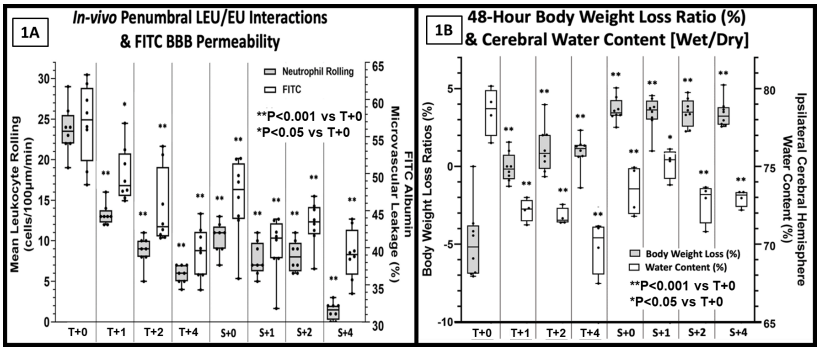
AJ Lopez, MD; M ElSaadani, MD; C Jacovides, MD; A Georges, BS; SM Ahmed, MD; LJ Kaplan, MD; DH Smith, MD; JL Pascual, MD, PhD; Penn Presbyterian Medical Center
Invited Discussant: Stephen Barnes, MD

Introduction: Traumatic brain injury (TBI) is associated with a hyperadrenergic catecholamine surge that can cause penumbral neuroinflammation. Prospective human studies demonstrate improved TBI survival with betablockade (bb), although mechanisms are unclear. We hypothesized that penumbral BBB leukocyte mobilization and permeability after TBI are altered by bb administration.

Methods: CD1 male mice (n=64) were randomly assigned to severe TBI (T) - controlled cortical impact: 6m/sec velocity, 1mm depth, 3mm diameter - or sham craniotomy (S), and IP injection of either saline (0) or propranolol (1, 2 or 4mg/kg) q12hours X 48h. At 48hrs, *in-vivo* pial intravital microscopy visualized live endothelial-leukocyte (LEU) interactions and BBB microvascular leakage. Twice daily clinical recovery was assessed by recovery of body weight loss and the Garcia Neurological Test (GNT: motor, sensory, reflex, balance assessments).

Results: Propranolol after TBI reduced both *in-vivo* LEU rolling and BBB permeability in a dose-dependent fashion when compared to no treatment (Figure 1A: P<0.001). Propranolol also reduced cerebral edema (P<0.001) and hastened recovery of body weight loss at 48hrs (Fig 1B: P<0.01). Compared to no treatment (14.9+/-0.2), 24-hour GNT scores were improved with 2 (15.8+/-0.2, P=0.02) and 4 (16.1+/-0.1, P=0.001) but not 1mg/kg propranolol.

Conclusion: Propranolol reduces LEU mobilization and microvascular permeability in the murine post-TBI penumbral neurovasculature. This is associated with reduced cerebral edema and post-injury weight loss as well as improved neurologic recovery. The apparent dose-dependence, favors a mechanistic relationship between bb therapy and improved human outcomes after TBI.



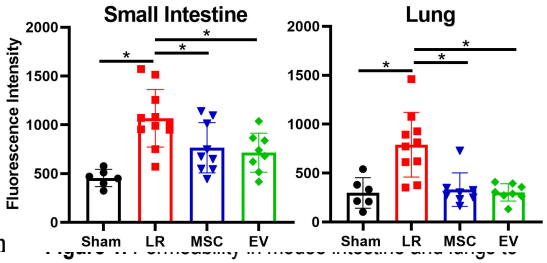
Session XIVA: Papers 46-56
Paper 51: 2:40 PM – 3:00 PM

MESENCHYMAL STEM CELL EXTRACEULLULAR VESICLES MITIGATE VASCULAR PERMEABILITY AND INJURY IN MULTIPLE ORGANS IN HEMORRHAGIC SHOCK AND TRAUMA

Mark Barry, MD; Byron Miyazawa, BS; Alpa Trivedi, PhD; Praneeti Pathipati, PhD; Deborah Stein, MD, MPH; Shibani Pati, MD, PhD; UCSF
Invited Discusant: Rosemary Kozar, MD, PhD

Introduction: Hemorrhagic shock and trauma (HS/T)-induced gut injury may play a critical role in the development of multi-organ failure. Novel therapies that target gut injury and vascular permeability early after HS/T could have substantial impacts on trauma patients. In this study we investigate the therapeutic potential of human mesenchymal stem cells (MSCs) and MSC-derived extracellular vesicles (MSC-EVs) in HS/T. We hypothesize that MSC-EVs will recapitulate the protective effects of MSCs and decrease vascular permeability and injury in both the small intestine and lungs of mice subjected to HS/T.

Methods: Using a mouse model of HS/T, vascular permeability to a 10 kD dextran dye is measured in the small intestine and lungs among four groups: (1) sham, (2) HS/T + lactated Ringer's (LR) resuscitation, (3) HS/T + MSCs, and (4) HS/T + MSC-EVs. MSCs and EVs are infused intra-arterially. Histopathological injury, inflammation, and vascular integrity are assessed in all groups.



10kD dextran after treatment. *p<.05.

Results: Following HS/T all groups had similar mean arterial pressures. MSCs and MSC-EVs significantly decreased HS/T-induced vascular permeability in the small intestine (**Fig 1.** Dextran fluorescence intensity units: Sham 456±88, LR 1067±295, MSCs 765±258, MSC-EVs 715±200) and lungs (Sham 297±155, LR 791±331, MSCs 331±172, MSC-EVs 303±88). Organ injury was attenuated by MSCs and MSC-EVs.

Conclusions: MSCs and MSC-EVs reduce vascular permeability and injury in the small intestine and lungs, suggesting MSC-EVs may be a potential cell-free therapy targeting multi-organ failure in HS/T. This is the first study to demonstrate that MSC-EVs improve both gut and lung injury in an animal model of HS/T.

Session XIVA: Papers 46-56
Paper 52: 3:00 PM – 3:20 PM

ADENOSINE, LIDOCAINE, AND MAGNESIUM (ALM) TO MITIGATE INJURY FROM RESUSCITATIVE ENDOVASCULAR BALLOON OCCLUSION OF THE AORTA (REBOA)

Jack Franko, MD; Michael Vu, MD; Michael Parsons, MD; Jeffrey Conner, MD; Daniel Lammers, MD; Jason Bingham, MD; Matthew Eckert, MD
Invited Discussant: Jacob Glaser, MD

Introduction: Minimally invasive REBOA following non-compressible hemorrhage results in significant ischemia reperfusion injury (IRI), and can result in profound hemodynamic and molecular compromise. Here we assess physiologic outcomes and targeted molecular analysis of inflammation-associated cytokines/chemokines following REBOA-associated IRI in the context of ALM-based resuscitation using a porcine model.
Methods: Animals underwent a 20% controlled hemorrhage followed by 45 minutes of supraceliac balloon occlusion. They were randomized into two groups: control (n=9) and ALM intervention (n=10) to include a post-hemorrhage, pre-REBOA bolus (200cc of 3% NaCl ALM) followed by a continuous drip (2cc/kg/hr of 0.9% NaCl ALM) during the 4 hour resuscitative period. Primary outcomes included hemodynamic parameters and putative biomarkers of inflammation.
Results: The ALM cohort demonstrated a significant reduction in heart rate at 2, 3, and 4 hours post REBOA deflation relative to 1 hour after deflation (-26.5, p=<0.01; -23, p=<0.01; and -27, p=<0.01, respectively) whereas heart rate did not vary significantly at these time points in control animals. Plasma concentrations of inflammatory proteins IL-1α, IL-2, IL-4, and IL-10 were significantly lower 3 hours post-REBOA in animals treated with ALM ($p<0.05$, $p<0.02$, $p<0.02$, and $P<0.03$, respectively). IL-1α and IL-4 levels were also significantly lower at 4 hours post-REBOA ($p<0.04$ and $p<0.02$, respectively).
Conclusion: ALM therapy may attenuate the IRI hemodynamic response seen from REBOA as evidenced by a reduction in heart rate early during post-REBOA resuscitation, and a significant reduction in inflammation-associated cytokines/chemokines IL-1α, IL-2, IL-4, and IL-10.

Session XIVA: Papers 46-56
Paper 53: 3:20 PM – 3:40 PM

CELLULAR MICRORNAS CORRELATE WITH OUTCOMES IN POLYTRAUMA PATIENTS

Diego Vicente, MD; Seth A. Schobel, PhD; Simone Anfossi, PhD; Hanna Hensman, BS; Felipe A. Lisboa, MD; Henry Robertson, PhD; Vivek Khatri, MHS; Matthew Bradley, MD; Masayoshi Shimizu, BS; Timothy G. Buchman, PhD, MD; Thomas Davis, PhD; Christopher Dente, MD; Allan Kirk, MD, PhD; George Calin, MD; Eric Elster, MD; Uniformed Services University of thee Health Sciences
Invited Discussant: Martin Schreiber, MD

Introduction: The mechanisms of the inflammatory response in polytrauma patients (PtP) have not been completely elucidated. Study of infection-mediated immune pathways have demonstrated that cellular microRNAs (CmiRs) may potentiate the inflammatory response. The authors hypothesize that the expression of CmiRs correlate to complicated recoveries (CR) in PtPs.

Methods: PtPs enrolled in the prospective observational Tissue and Data Acquisition Protocol, with Injury Severity Score (ISS) >15 were selected for this study. PtP were divided into CR and uncomplicated recovery (UR) groups. CR patients included PtPs with ICU admission >14 days, mechanical ventilation > 14 days, or mortality within 28 days. PtP plasma samples were obtained at the time of admission (T0). Established mediators of systemic inflammation, including cytokines and chemokines, and novel CmiRs were measured in plasma samples using separate multiplexed Luminex-based methods.

Results: PtPs (n = 180) had high ISS (26 [20-34]) and CR rate of 33%. CmiRs were differentially expressed in PtPs at T0 compared to healthy controls, and univariate analysis demonstrated that lower levels of CmiRs were associated with PtPs of older age and African America race as well as PtPs with acute respiratory distress syndrome, ventilator associate pneumonia, CR, and mortality within 28 days. Positive correlations were noted between CmiRs and IL-10, APACHE, and SOFA scores. Multivariate LASSO analysis of predictors of CR based on CmiRs, cytokines and chemokines, revealed that miR21.3p and MCP-1 were predictive of CR with an AUC of 0.78.

Conclusion: Systemic CmiRs were associated with poor outcomes in PtPs, and the results are consistent with previously described trends in critically ill patients. These early changes in CmiRs might provide predictive value for CR in PtPs. Given the known mechanisms of CmiRs in the inflammatory response, the findings in this study suggest that CmiRs may provide potential targets for immunomodulation in trauma patients.

Session XIVA: Papers 46-56
Paper 54: 3:40 PM – 4:00 PM

SEX DIFFERENCES ASSOCIATE WITH LATE MICROBIOME ALTERATIONS AFTER MURINE SURGICAL SEPSIS

Philip A. Efron, MD, FACS, FCCM; Dijoia B. Darden, MD; Eric Li, MS; Lauren Kelly, MD; Brittany Fenner, MD; Dina Nanionales, MD; Ricardo Ungaro, BS; Marvin Dirain, BS; Christiaan Leeuwenburg, PH.D.; Frederick Moore, MD, FACS, MICCM; Scott brakenridge, MD, FACS; Lyle Moldawer, PH.D.; Alicia M. Mohr, MD, FACS, FCCM; Ryan Thomas, MD, FACS;
University of Florida
Invited Discussant: Susannah Nicholson, MD

Introduction: Sepsis-induced gut microbiome alterations have been shown to contribute to sepsis-related morbidity and mortality. We have previously demonstrated that older adult mice fail to recover gut microbiome alterations compared to their young counterparts immediately after sepsis. Given improved sepsis survival in females compared to males, we hypothesized that female mice maintain microbiome stability vs. their male counterparts which may explain these sex-based differences.

Methods: Mixed-sex C57BL/6 mice aged 3-5 months or 18-22 months underwent cecal ligation and puncture (CLP) with resuscitation that included 3 days intraperitoneal imipenem, 2 days saline resuscitation, followed by 2 hours daily cone stress (DCS) to recapitulate post-trauma stress and compared to naïve (non-sepsis) control. Mice were sacrificed at day 7 and 14 and 16S rRNA gene sequencing was performed on bacterial DNA isolated from stool. Alpha-and beta-diversity was determined by Shannon index and Bray-Curtis with principle coordinate analysis, respectively. False discovery rate (FDR) correction was implemented to account for potential housing (i.e. cage) effect.

Results: At baseline, there was no difference in alpha or beta-diversity for male vs. female mice (FDR=0.76 and 0.99, respectively). Further, there was no difference in beta-diversity between these cohorts (FDR=0.99). However, with the implementation of CLP+DCS, male mice had a decrease in microbiota alpha-diversity at 7 days post-CLP (Shannon FDR=0.005) which was sustained at 14 days post-CLP (Shannon FDR=0.001), compared to baseline. In contrast, female mice had a decreased microbiota alpha-diversity at 7 days post-CLP (Shannon FDR=0.03) but recovered this lost diversity by post-CLP day 14 (Shannon FDR=0.5). Similarly, beta-diversity was statistically different between female naïve vs. post-CLP day 7 (FDR=0.02) but reverted to a pre-sepsis microbiota by day 14 (FDR=0.07). Male mice maintained beta-diversity differences even at day 14 compared to naïve control (FDR<0.0001).

Conclusions: Although perturbations of the intestinal microbiota occur initially in both male and female C57BL/6 mice after a model of sepsis and stress, only females recover these changes to a pre-sepsis level (day 14). This recovery may play a role in outcome differences between sexes after sepsis.

Session XIVA: Papers 46-56
Paper 55: 4:00 PM – 4:20 PM

PRECISION TARGETING OF THE VAGAL ANTI-INFLAMMATORY PATHWAY ATTENUATES THE SIRS RESPONSE TO INJURY

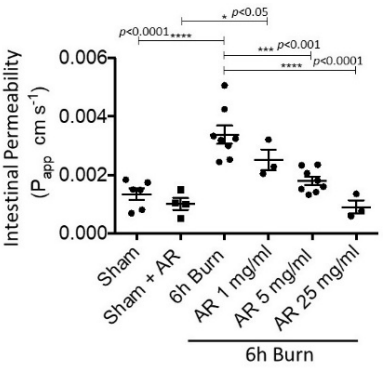
Todd W. Costantini, MD; Jessica L.Weaver, MD, PhD; Raul Coimbra, MD, PhD; Brian P. Eliceiri, PhD; University of California San Diego Health
Invited Discussant: Tina Palmieri, MD

Background: The systemic inflammatory response (SIRS) drives late morbidity and mortality after injury. The α7 nicotinic acetylcholine receptor (α7 nAchR) expressed on immune cells regulates the vagal anti-inflammatory pathway that prevents an overwhelming SIRS response to injury. Non-specific pharmacologic stimulation of the vagus nerve has been evaluated as a potential therapeutic to limit SIRS, unfortunately results of clinical trials have been underwhelming. We hypothesized that directly targeting the α7 nAchR would more precisely stimulate the vagal anti-inflammatory pathway on immune cells and decrease gut and lung injury after severe burn.

Methods: C57BL/6 mice underwent 30% total body surface area steam burn. Mice were treated with an intraperitoneal injection of a selective agonist of the α7 nAchR (AR-R17779) at 30 minutes post-burn. Intestinal permeability to 4kDa FITC-Dextran was measured at multiple time-points post-injury. Lung vascular permeability was measured 6 hours after burn injury. Behavioral assessments were performed serially to quantify activity levels.

Results: Intestinal permeability peaked at 6 hours post-burn. AR-R17779 decreased burn-induced intestinal permeability in a dose-dependent fashion ($p<0.001$, see Figure). There was no difference in gut barrier function between sham and burn injured animals treated with 5 mg AR-R17779. While burn injury increased lung permeability 10-fold, AR-R17779 prevented burn-induced lung permeability with no difference compared to sham ($p<0.01$). Post-injury activity levels were significantly improved in burned animals treated with AR-R17779.

Conclusion: Directly stimulating the α7 nAchR prevents burn-induced gut and lung injury. Precision targeting of the vagal anti-inflammatory pathway should be considered as a therapy to limit SIRS-associated morbidity after severe injury.



Session XIVA: Papers 46-56
Paper 56: 4:20 PM – 4:40 PM

THE 35-MM RULE TO GUIDE PNEUMOTHORAX MANAGEMENT: INCREASES APPROPRIATE OBSERVATION AND DECREASES UNNECESARY CHEST TUBES

Juan F. Figueroa, MD; Basil S. Karam, MD; Jose Gomez, BS; Patrick Murphy, MD, MSc, MPH; Rachel Morris, MD; Thomas W. Carver, MD, FACS; Anuoluwapo Elegbede, MD; David Milia, MD; Christopher Dodgion, MD; Libby Schroeder, MD, FACS; Marc de Moya, MD, FACS;
Medical College of Wisconsin/Froedtert
Invited Discussant: Stanislaw Stawicki, MD

Introduction: Pneumothorax (PTX) management has changed due to more objective means of guiding criteria for drainage using the 35mm-rule on CT-Scan (CT). In 2017, our trauma center created a policy to observe any PTX ≤ 35mm. We hypothesize that this rule would decrease unnecessary chest tubes without affecting failure rates.

Methods: This is a single-center, retrospective review of all adult trauma patients who had a PTX diagnosed on CT before (2015-2016) and after (2018-2019) policy implementation. We excluded patients with chest tubes inserted before CT, concurrent moderate/large hemothoraces, mechanical ventilation, or mortality on the first 24 hours. Descriptive and logistic regression analyses were performed.

Results: 266 patients met our inclusion criteria. Ninety-nine (37.2%) and 167 (62.7%) patients were admitted before and after 2017, respectively. On subgroup analysis of patients with PTX ≤35mm, compliance rates were higher, chest tube usage and observation failure rates declined after policy implementation (Table). On logistic regression, patients with PTX ≤35mm admitted after 2017 were more than twice as likely to be observed (OR 2.1 95% [CI 1.1-5.5]). There were no statistically significant changes in hospital or ICU length-of stay, complications, or mortality.

Conclusion: Adherence to the 35-mm rule for PTX on CT resulted in a 2-fold increase in observation and decreased the number of unnecessary CTs.

Variable	Before 2017 n= 93	After 2017 n= 154	p-value
Chest tube use	19 (20,4%)	16 (10,4%)	0.02
Compliance with rule	76 (81,7%)	141 (91,6%)	0.02
Median Length of stay	4 (±2.9)	4 (26.18)	0.85
Complications, n (%)	3 (3,2%)	9 (5,8%)	0.54
Observation	76 (81,7%)	141 (91,6%)	0.02
Observation Failure	5 (5,4%)	5 (3,2%)	0.04

Session XIVB:
Papers 57 - 67

Friday, October 1, 2021

1:00 PM – 4:40 PM

Location: Salon West

Moderator: Sharon Henry, M.D.

Recorder: Ajai Malhotra, M.D.

Session XIVB: Papers 57-67
Paper 57: 1:00 PM – 1:20 PM

BLOOD PRODUCT RESUSCITATION MITIGATES THE EFFECTS OF AEROMEDICAL EVACUATION AFTER POLYTRAUMA

Taylor E Wallen, MD; Kathleen E Singer, MD; Mackenzie C Morris, MD; Thomas Blakeman; MSc, RRT; Sabre M Stevens-Topie, BS; Richard Strilka, MD; Michael D Goodman, MD; University of Cincinnati
Invited Discussant: Joshua Brown, MD

Introduction: The combined injury of traumatic brain injury (TBI) and hemorrhagic shock has been shown to worsen coagulopathy and systemic inflammation thereby increasing posttraumatic morbidity and mortality. Aeromedical evacuation to definitive care may exacerbate post-injury morbidity due to the inherent hypobaric hypoxic environment. We hypothesized that blood product resuscitation may mitigate the adverse physiologic effects of post-injury flight.
Methods: An established porcine model of controlled cortical injury was used to induce TBI. Intracerebral monitors were placed to record intracranial pressure (ICP), brain tissue oxygenation, and cerebral perfusion. Each of the 42 pigs were then hemorrhaged to a goal mean arterial pressure of 40±5 mmHg for 1 hour. Pigs were grouped according to resuscitation strategy utilized - (Lactated Ringer's (LR) or shed whole blood (WB) - then placed into an altitude chamber for 2 hours at ground level, 8,000ft, or 22,000ft, and then observed for 4 hours. Hourly blood samples were analyzed for pro-inflammatory cytokines and lactate. Internal jugular vein blood flow was monitored continuously for microbubble formation with altitude changes.
Results: Cerebral perfusion, tissue oxygenation, and ICP were unchanged among the 6 groups. No internal jugular venous microbubbles were observed with differing altitude or resuscitation strategy. Serum lactate levels from hour-2 of flight to the end of the 4-hour observation were significantly elevated in 22,000+LR compared to both 8,000+LR and 22,000+WB. Serum IL-6 levels were significantly elevated in 22,000+LR compared to 22,000+WB from hour-1 of flight to end of observation. Serum TNF-α was significantly elevated hour-1 of flight in 8,000+LR vs ground+LR, and 8,000+WB vs ground+WB. IL-1b levels were not significantly different over time or between groups.
Conclusion: Crystalloid resuscitation during aeromedical transport may cause a prolonged lactic acidosis and pro-inflammatory response that can predispose polytrauma patients to secondary injury. This physiologic insult may be prevented by utilizing blood product predominant resuscitation strategies.

Session XIVB: Papers 57-67
Paper 58: 1:20 PM – 1:40 PM

DIRECT TO OR RESUSCITATION OF ABDOMINAL TRAUMA: AN NTDB PROPENSITY MATCHED OUTCOMES STUDY

Theodore Habarth, BA; Arturo Rios-Diaz, MD; Stephen P. Gadomski, MD; Tiffani Stanley; Julie P. Donnelly, MSN, RN, TCRN; George J. Koenig, Jr., DO; Murray J. Cohen, MD; Joshua A. Marks, MD; Thomas Jefferson University
Invited Discussant: Laura Godat, MD

Introduction: Direct to operating room resuscitation (DOR) is employed by some trauma centers for severely injured trauma patients. It is unknown whether this results in favorable outcomes. We hypothesized that utilization of an emergency department operating room (ED-OR) for resuscitation of patients with abdominal trauma at an urban level-1 trauma center would be associated with decreased time to laparotomy and improved outcomes.
Methods: We identified patients >15 years old with abdominal trauma who underwent emergent laparotomy within 120 minutes of arrival at our institution between 2013-2016. Patients were matched from NTDB using 1:1 propensity score matching based on age, gender, mechanism of injury, ISS, and abdominal AIS score. The primary outcome was time to laparotomy incision. Secondary outcomes included blood transfusion requirement, ICU length of stay (LOS), ventilator days, hospital LOS, and in-hospital mortality.
Results: There were 128 patients in each cohort, 84.4% presented with penetrating trauma. Patients were 28 years old (IQR 23-39.5), 91% male, 30.5% white, with a median ISS 16.5 (IQR 9-29), initial SBP 97 mmHg (IQR 86-140), and AIS abdominal score 3 (IQR 2-4). These characteristics did not differ between groups (p>0.05). Treatment in the ED-OR was associated with decreased time to incision (40 vs. 25 min; p=<0.001), ICU LOS (4 vs. 2 days; p=0.001), transfusion requirement within 24 hours (4 vs. 2 units packed red blood cells; p=0.016), and ventilator days (2 vs. 1; p=<0.001). There were no significant differences in hospital LOS or in-hospital mortality.
Conclusion: The use of an ED-OR is associated with decreased time to hemorrhage control as evidenced by the decreased time to incision, blood transfusion requirement, ICU LOS, and ventilator days.

Table 1. Results of statisitcal analyses on matched samples from instutional and NTDB cohorts.

Factor	NTDB (N=128)	ED-OR (N=128)		ED-OR (Ref. NTDB)		
	median (IQR) / n (%)	median (IQR) / n (%)	p-value	Odds Ratio / Predicted mean diffference	95% CI	p-value
Time to Incision, min; median (IQR)	40.0 (28.0, 58.0)	25.0 (19.0, 38.0)	<0.001	-13.6	(19.4 - -7.8)	<0.001
In-Hospital Mortality	26 (20.3%)	30 (23.4%)	0.55	1.2	(0.66 - 2.2)	0.546
Units of Blood within 24 Hours, median	4.0 (2.0, 14.0)	2.0 (0.0, 8.0)	0.016	-2.3	(-6.9 - 2.3)	0.327
Hospital Length of Stay, d, median (IQR)	7.0 (4.0, 14.0)	5.5 (3.0, 14.5)	0.29	0.41	(-3.2 - 4.0)	0.822
ICU Length of Stay, d, median (IQR)	4.0 (2.0, 9.0)	1.0 (0.0, 3.0)	<0.001	-3.6	(-7.2 - -0.1)	0.044
Ventilator Dependent Days, d, median (IQR)	2.0 (1.0, 5.0)	1.0 (0.0, 1.0)	<0.001	-2.0	(-5.4 - 1.4)	0.256

Session IXVB: Papers 57-67
Paper 59: 1:40 PM – 2:00 PM

PROSPECTIVE RANDOMIZED TRIAL OF METAL VS RESORBABLE PLATES IN SURGICAL STABILIZATION OF RIB FRACTURES

Dennis W. Ashley, MD; Dudley B. Christie III, MD; Eric Long, MD; Rajani Adiga, MS; Tracy J. Johns, MSN; Josephine Fabico-Dulin, RN; Anne Montgomery, PhD; The Medical Center, Navicent Health
Invited Discussant: Lewis Somberg, MD

Introduction: Surgical stabilization of rib fractures has gained popularity as both metal and resorbable plates have been approved for fracture repair. The objective of this study was to determine if resorbable plates would provide the same rib fracture alignment, hardware stability, control of pain, and quality of life scores as compared to metal fixation.
Methods: Eligible patients (pts) included ≥ 18 years with one or more of the following rib fracture patterns: flail chest, one or more bi-cortical displaced fractures (3 -10), nonunion and non-displaced fractures managed non operatively with failure of medical management. Pts were randomized to either metal (DePuy Synthes titanium) or resorbable plate (Acute Innovations BioBridge) fixation. Standard post-op pain control protocol (multimodal) was used in both groups. Primary objectives were fracture alignment and hardware failure. Secondary objectives were pain scores and opioid use in the hospital and outpatient setting. Quality of life (QOL SF-36) was assessed at 3 and 6 months.
Results: 30 pts were randomized (15 metal/15 resorbable). Total ribs plated 174 (95 metal/79 resorbable). Mean number ribs fractured per pt metal 6.6 vs resorbable 5.5. Mean number of plates per pt metal 6.3 vs resorbable 5.3. Number of pts with rib displacement at day of discharge (DOD) defining baseline displacement post-surgery metal 0/14 (1 pt died, not from plating) vs resorbable 9/15 or 60% (p=.001). Number of ribs displaced per pt at DOD metal 0/88 vs resorbable 22/79 or 28% (p<.001). Number of pts with additional rib displacement 3-6 months: metal 0/11 vs resorbable 3/9 or 33% (p=.038). Number of ribs with additional displacement 3-6 months metal 0/67 vs resorbable 10/49 or 20% (p<.001). Hardware failures: one screw dislodgement (metal)/5 plates broken after repeat trauma post discharge (resorbable). Pain scores & narcotic use at post-op day 1, 2, 3, DOD, 2 wks, 3 and 6 months showed no statistically significant difference between metal vs resorbable. QOL scores were similar between groups at 3 and 6 months.
Conclusion: Metal plates provided better initial alignment with no displacement over time compared to resorbable. This did not negatively affect clinical outcomes with regards to pain, narcotic use or QOL scores.

Session XIVB: Papers 57-67
Paper 60: 2:00 PM – 2:20 PM

COVER WITH CAUTION: MANAGEMENT OF THE LEFT SUBCLAVIAN ARTERY IN TEVAR FOR TRAUMA

AN Romagnoli, MD; A Dua, MD, MS, MBA; DS Kauvar, MD, MPH; N Saqib, MD; C Miller; BW Starnes; A Azizzadeh, MD; JJ DuBose, MD;
Massachusetts General Hospital
Invited Discussant: Todd Rasmussen, MD

Introduction: Elective Thoracic Endovascular Aortic Repair (TEVAR) with left subclavian artery coverage (LSA-C) without revascularization is associated with increased rates of ischemic stroke. However, in patients with blunt thoracic aortic injury (BTAI) undergoing TEVAR, LSA-C is frequently required in over 1/3 of patients. This study aimed to evaluate outcomes of TEVAR in BTAI patients with and without subclavian coverage.

Methods: The largest existing international multicenter prospective registry of BTAI, developed and implemented by the Aortic Trauma Foundation, was utilized to evaluate all BTAI patients undergoing TEVAR from March 2016-January 2021. Patients with uncovered left subclavian artery (LSA-U) were compared to patients who had left subclavian artery coverage (LSA-C) without revascularization. Outcomes included early and late ischemic strokes.

Results: Three hundred sixty-five patients with BTAI who underwent TEVAR were identified during the 5-year study period. Of these, 97 (26.6%) underwent LSA-C without revascularization, 10 (2.7%) underwent left subclavian artery coverage with revascularization (LSA-R), and 258 (70.7%) underwent TEVAR where the left subclavian artery was left uncovered (LSA-U).

Late and all ischemic strokes were more common in LSA-C patients than LSA-U patients ($p=0.01$, $p<0.05$). In the LSA-C group, the median age of IS patients was 29 [29,66], which was not different than stroke-free patients. While there was a higher rate of cervical spine fracture in ischemic stroke patients (43% vs 10%, $p=0.03$), no blunt cerebrovascular injuries were reported in this group.

Outcome	LSA-C N=97	LSA-U N=258	p
Early ischemic stroke	2, (2.1%)	0, (0%)	0.07
Late ischemic stroke	6, (6.2%)	2, (0.78%)	0.01
All ischemic stroke	8, (8.2%)	2, (0.98%)	0.007

Conclusion: While prior studies have suggested the relative safety of LSA-C in BTAI, preliminary multicenter prospective data suggests there is a significant increase in ischemic events when the left subclavian artery is covered and not revascularized. Additional prospective study and more highly powered analysis is necessary.

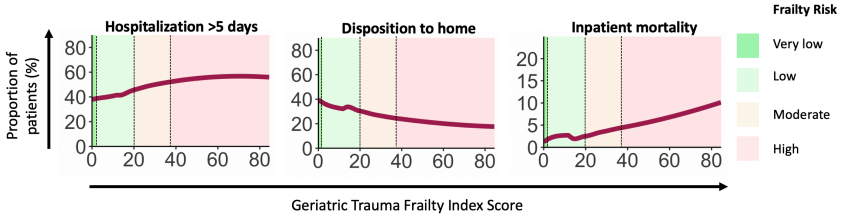
Session XIVB: Papers 57-67
Paper 61: 2:20 PM – 2:40 PM

PRACTICAL MACHINE LEARNING APPLICATION TO CHARACTERIZE GERIATRIC TRAUMA FRAILTY

Jeff Choi, MD MSc; Lakshika Tennakoon, MD; David A. Spain, MD;
Joseph D. Forrester, MD, MSc; Stanford University
Invited Discussant: Rachael Callcut, MD

Introduction: A geriatric trauma frailty index that captures only baseline conditions, facilitates rapid bedside calculation, and is validated nationwide remains underexplored. We developed and validated a practical prognostication tool, the geriatric trauma frailty index (GTFI).
Methods: We developed GTFI according to *Transparent Reporting of a Multivariable Prediction Model for Individual Prognosis* guidelines. Using nationwide US admissions of geriatric patients from 2016-2017 (10% development, 90% validation), partitioning around medoids clustering identified development subcohorts with previously-validated frailty characteristics. Ridge regression with penalty for multicollinearity aggregated baseline conditions most prevalent in the frail subcohort into GTFI scores. Jenks natural breaks classification delineated four frailty risk strata. Regression with adjustment for age, injury severity, and sex assessed associations between frailty risk strata and outcomes (OR [95%CI]).
Results: Our data compromised 1.6 million geriatric trauma admission encounters. Clustering and ridge regression on the development cohort identified 15 baseline conditions constituting GTFI. Among the validation cohort, increasing frailty risk (very low [reference group], low, moderate, high) was associated with stepwise worsening adjusted odds of mortality (2.2[2.0-2.4], 3.4 [3.1-3.7], 4.6 [4.2-5.0]), prolonged hospitalization (1.3[1.3-1.3], 1.6 [1.6-1.6], 2.0 [1.9-2.0]), and disposition to home (0.7[0.7-0.7], 0.6[0.6-0.6], 0.5[0.5-0.5]). We found direct correlations between increasing GTFI scores and worse outcomes (Figure).
Conclusion: Machine learning-generated GTFI predicts inpatient outcomes using 15 baseline conditions. We are developing a mobile application to facilitate clinical application and real-time GTFI use.

Figure. Locally Weighted Scatterplot Smoothing line showing association between Geriatric Trauma Frailty Index and outcomes of injured geriatric patients.

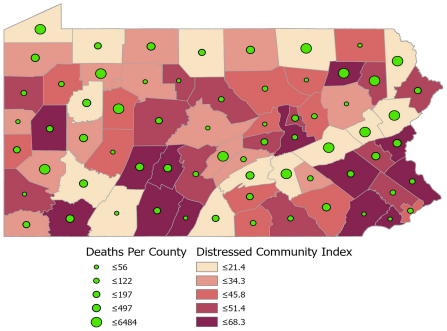


Session XIVB: Papers 57-67
Paper 62: 2:40 PM 3:00 PM

SOCIAL DETERMINANTS OF HEALTH AND PATIENT-LEVEL MORTALITY PREDICTION AFTER TRAUMA

Andrew-Paul Deeb, MD; Andrew-Paul Deeb, MD; Joshua B Brown, MD, MSc; University of Pittsburgh
Invited Discussant: Tanya Zakrison, MD, MPH

Introduction: Social determinants of health (SDOH) impact patient outcomes in trauma. Census data are often used to account for SDOH; however, there is no consensus on which variables are most important. Social vulnerability indices offer the advantage of combining multiple constructs into a single variable. Our objective was to determine if social vulnerability indices have comparable performance to multiple individual SDOH variables in patient-level mortality models after injury.
Methods: We evaluated 2 social vulnerability indices at the zip code level: Distressed Community Index (DCI), National Risk Index (NRI). Individual variable combinations from AHRQ's SDOH Dataset were used for comparison. Patients we included from Pennsylvania Trauma Outcomes Study (PTOS) 2000-17. These measures were added to a validated PTOS base mortality prediction model with AUC and Bayesian information criterion (BIC) compared. Geospatial analysis identified geographic variation and spatial autocorrelation.



Results: 449,541 patients were included with 22,304 deaths (5%). The DCI and NRI both improved the base model (AUC: DCI 0.9494; NRI: 0.9493 vs Base Model: 0.9493 & BIC: DCI 86608; NRI 86609 vs Base Model 86623). Best performance was backward selection that included 7 AHRQ variables (representing housing, income, transportation, insurance, and employment domains) with the same BIC and marginal AUC increase over DCI (AUC 0.9495). There is significant geographic variation in DCI and deaths across PA counties (Figure), but no significant spatial autocorrelation at the county level (DCI; Moran's I 0.11, p=0.11; mortality; Moran's I -0.003, p=0.70).
Conclusions: The DCI and NRI perform well at the patient-level, accounting for SDOH in trauma outcome research while minimizing the number of variables added to prediction models. These indices may also be useful in patient-centered assessments of trauma outcomes to identify community risk factors.

Session XIVB: Papers 57-67
Paper 63: 3:00 PM – 3:20 PM

TRAUMA TRANSFERS DISCHARGED FROM THE EMERGENCY DEPARTMENT – IS THERE A ROLE FOR TELEMEDICINE

Amanda Celii, MD; Lindsay Lindsey, MD; Lindsey Rasmussen, RN; Landon Hendrickson, Ryan Kennedy, MD, FACS; Alisa Cross, MD; Roxie Albrecht, MD; Oklahoma University Health Sciences Center
Invited Discussant: Jeffrey Kerby, MD, PhD

Objective: As the only level one trauma center (TC) in the state, our hospital has seen an increase in the number of traumas requiring transfer for a higher level of care, placing strain on an already strained health care system. Traumas that are transferred to our facility and subsequently discharged back home indicate a subset of patients who may not be appropriate to transfer. The aim of this study is to identify commonalities of the patients who were transferred for a higher level of care but do not require inpatient status and assess patients who may benefit from a telemedicine evaluation.
Methods: A two-year retrospective review of a prospective collected database of patients who were discharged from the ED following transfer to a Level 1 TC was conducted. Data included demographics, injuries, transferring facility, method of transport, activation criteria and level, additional imaging, consulting services, procedures and disposition.
Results: A total of 2350 patients were transferred. Of those, 27% (628) were discharged home directly from the trauma bay. The three most common injury patterns were face 51% (324), hand 31% (196), and isolated orthopedic injuries 8.5% (54). 36% (230) required a bedside procedure prior to discharge, of which 53% required a laceration repair, 24% an ophthalmology exam, 18% splinting, and 5% joint reduction. The top 10 transferring facilities accounted for 40% (948) of our transfer volume.
Conclusion: Our study demonstrates that patients who are transferred to our facility and subsequently discharged have a common pattern of injuries; typically isolated to hand and face/ophthalmology. This is likely attributed to the lack of resources in rural facilities to evaluate and develop treatment plans for these injuries; however, only 36% of discharged patients required a bedside procedure. Development and implementation of a telemedicine system could potentially reduce the transfer and ED discharge rate, thereby improving efficiency and allow for reallocation of resources as appropriate.

Session XIVB: Papers 57-67
Paper 64: 3:20 PM – 3:40 PM

MEDICAL MANAGEMENT OF GRADE I-II SPLENIC INJURIES WITH ACTIVE EXTRAVASATION HAS A HIGH FAILURE RATE: AN EAST MCT

Kristen Spoor, MD; John Cull, MD; Banan Otaibi, BS; Joshua Hazelton, DO; John Chipko, MD; Claire Pederson, MD; Linda Zier, RN, BS; Lewis Jacobson, MBChB; Jamie Williams, MSML, BSN, RN, CCRP; Daniel Cullinane, MD; University of South Carolina
Invited Discussant: Ben Zarzaur, MD, MPH

Introduction: Numerous studies suggest that hemodynamically stable patients with high grade splenic injuries and active extravasation/ contrast blush (CB) should undergo splenic embolization; however, there is little evidence to guide the management of low grade traumatic splenic injuries (grade I-II) with CB. The aim of this study is to determine the failure rate of non-operative/angiographic intervention (NOM) of grade I-II splenic injuries with CB in hemodynamically stable patients.
Methods: A multicenter, retrospective, observational study examining all grade I-II splenic injuries with CB was performed at 25 institutions from January 1, 2014 to October 31, 2019. Inclusion criteria was patients > 18 years and grade I-II splenic injury due to blunt trauma with CB on CT scan. Patients with hemodynamic instability or medically-induced coagulopathy were excluded. The primary outcome was failure of NOM requiring angioembolization or surgery. Data collection included age, gender, mechanism of injury, co-morbidities, and outcomes such as hospital, ICU length of stay, discharge disposition, and mortality.
Results: A total of 236 patients from 25 institutions were included. There were 157 males, 78 females, and one patient not classified by gender. The median Injury Severity Score was 17. A majority of patients (159, 67%) had a BMI greater than 30. Motor vehicle collision was the most common cause of injury. There was a 22% failure rate for grade I and a 31% failure for grade II injuries**.** The combined rate of failure for grade I-II injuries was 28%. There was no statistical difference in failure of NOM between grade I and II injuries. Age > 47 years was significant (p 0.005) for failure of NOM. There was an increase in mean ICU ($p=0.031$) and hospital length of stay ($p=0.008$) as well as need for blood transfusion ($p<0.001$) and massive transfusion ($p=0.009$) in the failure of NOM patients. There was no difference in discharge disposition or death between the two groups. In total, 18 patients (7.6%) died and 155 (65.7%) were discharged home.
Conclusion: Non-operative management of grade I-II splenic injuries with AE fails in 28% of patients. Hemodynamically stable patients with grade I-II splenic injuries with CB should be considered for immediate angioembolization.

Session XIVB: Papers 57-67
Paper 65: 3:40 PM – 4:00 PM

TIMING IS EVERYTHING: IMPACT OF COMBINED LONG BONE FRACTURE AND MAJOR ARTERIAL INJURY ON OUTCOMES

Richard H. Lewis, Jr., MD, MA; Meredith Perkins, MS; Peter E. Fischer, MD, FACS; Michael J. Beebe, MD; Louis J. Magnotti, MD, MS, FACS;
University of Tennessee - Memphis
Invited Discussant: David Efron, MD

Introduction: Timing of extremity fracture fixation in patients with an associated major vascular injury remains controversial. Some favor temporary fracture fixation prior to definitive vascular repair to limit potential graft complications. Others advocate immediate revascularization to minimize ischemic time. The purpose of this study was to evaluate the timing of fracture fixation on outcomes in patients with concomitant long bone fracture and major arterial injury.
Methods: Patients with a combined long bone fracture and major arterial injury in the same extremity requiring operative repair over 11-years were identified and stratified by timing of fracture fixation. Vascular-related morbidity (rhabdomyolysis, AKI, graft failure, extremity amputation) and mortality were compared between patients who underwent fracture fixation prior to (PRE) or post-revascularization (POST).
Results: 104 patients were identified: 19 PRE and 85 POST. Both groups were similar with respect to age (28 vs 27, p>0.99), % male (89 vs 84, p=0.52), ISS (7 vs 10, p=0.073), admission base excess (-3.4 vs -4, p=0.57), 24-hour PRBCs (4 vs 8 units, p=0.35), and concomitant venous injury (37 vs 36%, p=0.98). The PRE group had fewer penetrating injuries (32 vs 60%, p=0.024) and a longer ischemic time (9 vs 5.8 hours, p=0.0002). Although there was no difference in mortality (0 vs 2%, p>0.99), there were more vascular-related complications in the PRE group (58 vs 32%, p=0.03): specifically, rhabdomyolysis (42 vs 19%, p=0.029), graft failure (26 vs 8%, p=0.026), and extremity amputation (37% vs 13%, p=0.013). Multivariable logistic regression identified fracture fixation pre-revascularization as the only independent predictor of graft failure (OR 4; 95%CI 1.1-14.3, p=0.03) and extremity amputation (OR 3.9; 95%CI 1.3-12.1, p=0.02).
Conclusions: Fracture fixation prior to revascularization contributes to increased vascular-related morbidity and was consistently identified as the only *modifiable* risk factor for both graft failure and extremity amputation in patients with a combined long bone fracture and major arterial injury. For these patients, delaying temporary or definitive fracture fixation until post-revascularization should be the preferred approach.

Session XIVB: Papers 57-67
Paper 66: 4:00 PM – 4:20 PM

TIME TO OR FOR PATIENTS WITH ABDOMINAL GUNSHOT WOUNDS: A POTENTIAL PROCESS MEASURE TO ASSESS THE QUALITY OF TRAUMA CARE?

Arielle Thomas, MD, MPH; Brendan Campbell, MD, MPH; Haris Subacius, MA; Karl Y. Bilimoria, MD, MS; Anne M. Stey, MD, MPH; Brian Nasca. MD; Doulia M. Hamad, MD; Avery Nathens, MD, MPH, PhD; American College of Surgeons
Invited Discussant: Maria Jimenez, MD

Introduction: Abdominal gunshot wounds (GSW) require rapid assessment and operative intervention to reduce the risk of death and complications. We sought to determine if time to the OR might be an appropriate process measure for the assessment of the quality of trauma care. We assessed whether there were trauma centers that performed consistently well and whether this was associated with lower rates of adverse outcomes.

Methods: We evaluated time to OR for adult patients with an abdominal GSW and shock presenting to ACS TQIP centers from 2016-19. We calculated the 75th percentile time to the OR for each center and then characterized each center as an average, a slow outlier, or a fast outlier. We compared patient and facility characteristics across outlier status as well as risk adjusted outcomes using hierarchical multivariable logistic models.

Table 1: Hospital characteristics of fast, average, and slow outliers

	Fast outlier (n=844)	Average (n=1912)	Slow outlier (n=460)
75th percentile time to OR (minutes) *	33 (31)	45 (30)	63 (47)
GSW-shock case volume/yr*	5.9	5.3	5.4
Surgeon case volume/yr*	4.7	2.9	3.4
Transfusion ≥6units, n (%)*	378 (47)	912 (52)	237 (56)
Risk adjusted complications	1.07 (0.82-1.40)	Ref	0.92 (0.66-1.27)
Risk adjusted mortality	1.17 (0.86-1.59)	Ref	0.92 (0.62-1.35)

*p<0.01

Results: 2965 patients cared for in 363 centers met inclusion criteria. Mortality was 28%. There were 43 (12%) slow and 51 (14%) fast centers. ISS and ED vital signs were similar across centers. Fast hospitals had higher case volumes, more cases per surgeon, and were more likely to be level 1 centers. Patients cared for in these centers required less blood transfusion, with similar risk-adjusted rates of complications and mortality (Table 1).

Discussion: Time to OR for patients with GSWs and shock might be a useful process measure to evaluate rapid decision making and OR access. Trauma center and surgeon experience and a rapid surgical response associated with level 1 trauma center requirements might be contributory. Prompt interventions are associated with lower blood requirements yet similar rates of complications and mortality.

Session XIVB: Papers 57-67
Paper 67: 4:20 PM – 4:40 PM

LONG-TERM FUNCTIONAL AND PATIENT REPORTED OUTCOMES AFTER ISOLATED RIB FRACTURES

Patrick Heindel, MD; Mohamad El Moheb, MD; Alexander Ordoobadi, MD; Shannon Garvey, BS; Jessica Serventi-Gleeson, BS; Annie Heyman, BS; Nikita Patel; Sabrina Sanchez, MD, MPH; Haytham M.A. Kaafarani, MD, MPH; Juan Herrera Escobar, MD, MPH; Ali Salim, MD; Deepika Nehra, MD; Brigam & Women's Hospital
Invited Discussant: Raminder Nirula, MD, MPH

Introduction: Despite the ubiquity of rib fractures in patients with blunt chest trauma and their association with increased short-term morbidity and mortality, long-term outcomes for patients with this injury pattern are not well described.
Methods: The Functional Outcomes and Recovery after Trauma Emergencies (FORTE) project has established a multi-center prospective registry with 6 to 12-month follow up for trauma patients treated at participating centers. We combined the FORTE registry with a detailed retrospective chart review investigating detailed admission variables and injury characteristics. We included all trauma survivors with complete FORTE data and isolated chest trauma (AIS≤1 in all other regions) with rib fractures. Outcomes included HRQoL (SF-12), Trauma Quality of Life, PTSD (Breslau), return to work, chronic pain, and both inpatient and discharge pain control modalities.
Results: Our cohort comprised 301 patients with a mean age of 65 years, 61.5% were male, and 84% were white. 57/301 (20.2%) patients underwent tube thoracostomy and 27/301 (9.6%) required mechanical ventilation. Patients were prescribed a mean oral morphine equivalent of 238.4 (SD = 232.5) at discharge. Older age, higher number of rib fractures, and ICU admission were independently associated with higher odds of receiving regional anesthesia. Long-term functional limitations were observed in the majority of patients (Table).
Conclusions: Isolated rib fractures are a non-trivial trauma burden that often result in functional impairments and reduced quality of life even 6-12 months after injury.

Long-term outcomes	All patients (n=301)
New limitation in activity of daily living	75 (24.9%)
New physical limitation	148 (56.7%)
New exercise limitation	127 (51.2%)
Did not return to work*	35 (31.3%)
New chronic pain	123 (46.9%)
Daily use of analgesics	30 (23.3%)
Post-traumatic stress disorder	27 (9.7%)
Quality of life	
SF-12 physical health score, mean (SD)	43.3 (11.2)
SF-12 mental health score, mean (SD)	51.4 (10.7)

*N=112; cohort who were working prior to their injury.

Annual Business Meeting

AAST Members Only

Friday, October 1, 2021

4:45 PM – 6:15 PM

Location: Salon

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

2020 Alexander Colonna, MD, MSCI
2019 Vanessa Ho, M.D., M.P.H
2018 Jamie Coleman, M.D.
2017 Scott Brakenridge, M.D.
2016 Jon Simmons, M.D.
2015 Matthew Bloom, M.D.
2014 Sarah Majercik, M.D.
2013 Jason Smith, M.D.
2012 Stephanie Savage, M.D.
2011 Jay Manaker, M.D., FACEP
2010 Oscar Guillamondegui, M.D.
2009 Andrew Bernard, M.D.
2008 Randall Friese, M.D.
2007 Kari Hansen, M.D.
2006 Saman Arbabi, M.D.
2005 Carnell Cooper, M.D.
2004 Eileen Bulger, M.D
2003 James Jeng, M.D.
2002 Karen Brasel, M.D., M.P.H.
2001 Hans-Christoph Pape, M.D.
2000 John Owings, M.D.
1999 David Spain, M.D.
1998 Charles Mock, M.D., M.P.H., Ph.D.
1997 Ronald Simon, M.D.
1996 Rodney Durham, M.D.
1995 Patrick Offner, M.D.
1994 Frederick Luchette, M.D.
1993 Philip Barie, M.D., M.B.A.

Associate Member Best Oral and Paper Award

2020 Sydney Radding, MD

Session XV:
Quickshot Session I 1-13

Saturday, October 2, 2021

8:00 AM – 9:18 AM

Location: Salon

Moderator: Deborah Stein, M.D., M.P.H.

Session XV: Quickshot Session I 1-13
Quickshot 1: 8:00 AM – 8:06 AM

PREHOSPITAL WHOLE BLOOD IS ASSOCIATED WITH IMPROVED HEMOSTASIS AND CLINICAL OUTCOMES: RESULTS OF A PROSPECTIVE RANDOMIZED PILOT TRIAL

Francis Guyette, MD, MPH; Joshua Brown, MD, MSc; Darrell Triulzi, MD; Matthew Neal, MD; Mark Yazer, MD; Adnan Hassoune, MD; Brian Zuckerbraun, MD; Christine M. Leeper, MD; Raquel Forsythe, MD; Jason Sperry, MD; University of Pittsburgh
Invited Discussant: Donald Jenkins, MD

Introduction: Whole Blood (WB) resuscitation is increasingly common in both military and civilian settings. Data regarding the safety and efficacy of prehospital WB remains limited.
Methods: We performed a prospective cluster randomized prehospital thru in-hospital whole blood pilot trial for injured air medical patients. We compared standard prehospital air medical care including red cell transfusion and in-hospital component transfusion to WB resuscitation. Prehospital vital signs were used as inclusion criteria (SBP≤90; HR≥108) or (SBP≤70) for patients at risk of hemorrhage. Primary outcomes were feasibility and 28-day mortality. Secondary outcomes included 24hr mortality, multiple organ failure, nosocomial infection, 24hr transfusion requirements and arrival coagulation parameters.
Results: Between November 2018 thru October 2020, 86 injured patients were cluster randomized by helicopter base. Overall, 28-day mortality for the cohort was 26%. Injured patients randomized to prehospital whole blood (n=40) relative to standard care (n=46) were similar in demographics, injury characteristics, shock severity and incidence of brain injury. Intent to treat Kaplan-Meier survival analysis demonstrated no statistical mortality benefit at 28 days (25% vs. 26%, log rank 0.03, p= 0.80) Patients randomized to prehospital WB relative to standard care had lower blood component transfusion requirements at 24 hours (p=0.04) and improved arrival thromboelastography parameters (K-time, maximal amplitude and G-value, all $p<0.05$) compared to standard care patients. WB randomized patients demonstrated a trend toward a lower incidence of nosocomial infection (p=0.07) and improved INR upon arrival (p=0.08). Multivariable regression analysis demonstrated a significant 24-hour mortality benefit (OR 0.10 95%CI 0.01-0.97, p=0.048, FIGURE) after controlling for differences in prehospital resuscitation and injury characteristics. No transfusion reactions during the prehospital or in-hospital phase of care were documented.
Conclusion: Prehospital thru in-hospital WB resuscitation is safe and associated with hemostatic and clinical outcome benefits. A large-scale clinical trial is feasible and would allow the effects of WB on survival and other pertinent clinical outcomes to be appropriately characterized.

Session XV: Quickshot Session I 1-13
Quickshot 2: 8:06 AM – 8:12 AM

LIFE OVER LIMB: VASCULAR LIMB COMPLICATIONS FOLLOWING REBOA

Robert B. Laverty, MD; Shane McEntire, MD; David S. Kauvar, MD, MPH; and the AAST AORTA Study Group; Brooke Army Medical Center
Invited Discussant: Jeffrey Nicholas, MD

Introduction: Vascular limb complications (VLC) may complicate the arterial access required for resuscitative endovascular balloon occlusion of the aorta (REBOA) access and may be a source of morbidity. We sought to identify and characterize the occurrence of VLC in REBOA survivors.
Methods: This is a retrospective cohort study of adult patients (2013-2020) from the AAST Aortic Occlusion for Resuscitation in Trauma and Acute care surgery registry who underwent REBOA and survived at least 48 hours. The primary outcome was VLC, (clinically apparent extremity ischemia or distal embolization). Demographics, injury severity, and presenting and procedural characteristics were compared between patients with and without VLC.
Results: Of 418 identified patients, 36 (8.6%) had at least one recorded VLC: 22 ischemia, 25 embolism, 11 both. Demographics and injury severity and characteristics were similar between those with and without VLC. SBP at placement was modestly lower in those with VLC (62±29 vs 70±35 mmHg, P=.09); median time arrival to REBOA was 20 min in both groups. VLC was associated with larger devices (7.3% VLC with ER-REBOA vs 22% other, P=.009), arterial access technique (25% cutdown, 8.4% percutaneous, P=.02), procedural setting (11% ER vs 4.9% other, P=.05), pelvic binder/ex-fix (14% vs 6.4%, P=.01), and strongly associated with TXA use (14% vs 5.3%, P=.002). 61% of VLC had TXA administered. Mortality was 22% and not associated with VLC, however VLC had longer hospital length of stay (LOS, 31 vs 24 days, P=.02). 5 VLC had recorded surgical intervention, 4 underwent amputation. On multivariate analysis, cutdown technique (OR 3.4, 95%CI 2.9-3.9, P=.02) and TXA (2.7, 2.3-3.1, P=.006) independently predicted VLC.
Conclusion: Vascular limb complications occur in at least 9% of REBOA survivors and result in prolonged LOS and still undefined morbidity. TXA should be used with caution in patients undergoing REBOA and the percutaneous technique for placement is preferred.

Session XV: Quickshot Session I 1-13
Quickshot 3: 8:12 AM – 8:18 AM

BALLOONS FOR KIDS: ANATOMIC CANDIDACY AND OPTIMAL CATHETER SIZE FOR PEDIATRIC REBOA

Alicia Sykes, MD; William Sisson, MD; Lucas Wang; Hariharan Thangarajah, MD, MPH; Matthew Martin, MD; Nathanial Fernandez, MD; Meghan Nelles, MD; Romeo Ignacio, Jr., MD, MSc, FACS; Rady Children's Hospital San Diego
Invited Discussant: Barbara Gaines, MD

Introduction: REBOA (Resuscitative Endovascular Balloon Occlusion of the Aorta) is a potential adjunct in pediatric trauma patients with truncal hemorrhage, however there is little data evaluating the anatomic considerations of REBOA in children. We evaluated the vascular dimensions and anatomic limitations of utilizing REBOA in children.
Methods: Computed tomography (CT) scans of pediatric patients performed between February 2016 and October 2019 were retrospectively reviewed by two providers. Inter-rater reliability (IRR) for measurements were determined using intraclass correlation coefficient (ICC). Vascular dimensions were correlated with the patient's height, weight and body mass index (BMI) using linear regression analysis. Categorization within Broselow categories were also evaluated.
Results: 569 CT scans were reviewed. Measurements of vessel diameter and distance from the common femoral artery (CFA) to aorta zones I and III were determined and grouped by Broselow category (Table 1). Patient age ranged 0-18 years, with a male to female ratio of 1:1. IRR of vessel measurements was excellent with an ICC $\geq$ 0.880. Vessel diameters had greatest correlation with height and weight, and poorly correlated with BMI.
Conclusion: This study represents the largest compilation of REBOA-related pediatric vessel diameter measurements and the first to provide data on distance between access site and balloon deployment zones. Based upon our measurements, the 7 Fr REBOA catheter would be appropriate for the Black, Green, and Orange Broselow categories, and a 4 Fr REBOA catheter would be warranted for all other Broselow categories included in this study.

Table 1. Vascular Measurements by Broselow Category

	Yellow 12-14 kg 85-98 cm	**White** 15-18 kg 98-110 cm	**Blue** 19-23 kg 110-121 cm	**Orange** 24-29 kg 121-133 cm	**Green** 30-36 kg 133-147 cm	**Black** > 36 kg ≥ 147 cm
CFA diameter, mean mm	3.3	3.8	4.1	4.5	4.9	6.0
Aorta Zone I diameter, mean mm	9.2	10.2	10.9	12.0	13.1	15.3
Aorta Zone III diameter, mean mm	6.3	6.9	7.6	8.8	9.7	11.5
CFA to Zone I, mean cm	32.7	36.1	38.7	42.4	46.4	54.1
CFA to Zone III, mean cm	19.0	20.8	22.5	24.3	26.9	31.0
Recommended REBOA Catheter Size, Fr.*	4	4	4	4 / 7†	4 / 7†	7

* Based upon ability to maintain <50% OD/AD ratio
† OD/AD ratio 60-66% with standard 7 Fr introducer sheath
CFA: common femoral artery, OD: standard introducer sheath outer diameter, AD: access vessel luminal diameter

Session XV: Quickshot Session I 1-13
Quickshot 4: 8:18 AM – 8:24 AM

FOLLOW YOUR COMPASS®: REBOA MANAGEMENT GUIDED BY A NOVEL HANDHELD PRESSURE TRANSDUCER

Torbjorg Holtestaul, MD; Daniel Lammers, MD; Ian Jones, MD; Jeffrey Conner, MD; Jessica Weiss, MD; Jason Bingham, MD, FACS; Matthew J. Martin, MD, FACS; Matthew Eckert, MD, FACS
Invited Discussant: Doug Schuerer, MD

Introduction: Management of truncal hemorrhage utilizing REBOA requires arterial pressure monitoring that can be logistically challenging in austere or emergency settings. Novel pressure transducer devices such as the Centurion COMPASS® device (CD) offer a possible alternative to traditional systems. We sought to assess the feasibility of guiding full and intermittent REBOA in a porcine shock model guided only by CD monitoring.
Methods: Ten Yorkshire swine underwent 20% hemorrhage with an uncontrolled vascular injury. Time-based intermittent zone 1 REBOA was performed with volume-based resuscitation to maintain permissive hypotension. Proximal MAPs from a carotid arterial line (AL) were obtained and compared to CD readings from the proximal REBOA port. The REBOA operator was blinded to AL pressures, and guided therapy exclusively with the CD.
Results: 60% of animals survived to study endpoint. Mean survival time was 85 (range 32-120) minutes from injury. AL and CD measurements were highly correlated ($r = .94$, $p < .001$). Bland-Altman analysis for comparison of clinical measurements demonstrated a mean difference of 6 mmHg (95% CI -22 to 34 mmHg) for all MAPs, with a mean difference of 3 mmHg (95% CI -6 to 12 mmHg) in a clinically relevant MAP <65 subset.
Conclusion: The CD represents a miniaturized and portable arterial pressure monitor that provides a highly accurate and reliable alternative to logistically burdensome AL monitoring to guide REBOA use. The CD was able to guide permissive hypotension and intermittent REBOA without standard AL monitoring equipment.

Session XV: Quickshot Session I 1-13
Quickshot 5: 8:24 AM – 8:30 AM

ADVANCED PARTIAL OCCLUSION CONTROLLER FOR REBOA IN A PORCINE MODEL OF HEMORRHAGIC SHOCK

Alexis L. Lauria, MD; Alexander J. Kersey, MD; John A. Mares, MPH; David M. Burmeister, PH.D.; Paul W. White, MD; Todd E. Rasmussen, MD; Joseph M. White, MD; Walter Reed National Military Medical Center, Uniformed Services University of the Health Sciences, Bethesda
Invited Discussant: Matthew Martin, MD

Introduction: Targeted regional optimization (TRO), a partial resuscitative endovascular balloon occlusion of the aorta (REBOA) strategy, may mitigate distal ischemia and extend the window of effectiveness for this adjunct. An automated device may allow greater control and precise regulation of flow past the balloon, while being less resource-intensive. The objective of this study was to assess the technical feasibility of the novel advanced partial occlusion controller (APOC) in achieving TRO at multiple distal pressures.
Methods: Female swine (n=33, 67.6±0.876 kg) were randomized to a target distal mean arterial pressure (MAP) of 25, 35 or 45 mmHg by either manual (MAN) or APOC regulation (n=4-7 per group). Uncontrolled hemorrhage was generated by liver laceration. TRO was performed for 85 minutes, followed by surgical control and a 6-hour critical care phase. Proximal and distal MAP and flow rates were measured continuously.
Results: At a target distal MAP of 25mmHg, there was no difference in the mean pressure attained (APOC: 25.0±1.00 vs. MAN: 27.2±2.21 mmHg) but the APOC had significantly less deviance (8.30%) than manual titration (15.8%, $p<0.0001$). Similarly, at a target distal MAP of 45 mmHg, there was no difference in mean pressure (44.5±1.41 vs. 46.2±1.65 mmHg) but APOC had less deviance (11.3% vs. 13.8%, $p=0.0408$). There was no difference between APOC and MAN in mean (35.2 vs. 32.7 mmHg) or deviance (12.6% vs. 13.5%) at a target distal MAP of 35 mmHg, respectively. The APOC made on average 85 balloon volume adjustments per experiment compared to 30 by manual titration.
Conclusion: The novel APOC consistently achieved and sustained precisely regulated TRO across all groups and demonstrated reduced deviance at the 25mmHg and 45mmHg groups compared to manual titration.

Session XV: Quickshot Session I 1-13
Quickshot 6: 8:30 AM – 8:36 AM

PROSPECTIVE VALIDATION OF THE RIB INJURY GUIDELINES (RIG) FOR TRAUMATIC RIB FRACTURES

Adam Nelson, MD; Ahmad Hammad, MD; Ashley Northcutt, MD; Omar Obaid, MD; Lourdes Castanon, MD, FACS; Michael Ditillo DO, FACS; Letitia Bible, MD; Molly Douglas, MD; Andrew Tang, MD, FACS; Bellal Joseph, MD, FACS; The University of Arizona
Invited Discussant: Andrew Doben, MD

Introduction: The Rib Injury Guidelines (RIG) were developed to guide triage of traumatic rib fracture patients to home, regular floor, or ICU and standardize care. The RIG score is based on patient history, physical examination, and imaging findings. The aim of this study is to evaluate triage effectiveness and healthcare resources utilization following RIG implementation.

Methods: This is a prospective analysis at a Level I trauma center from October 2017 to January 2020. Adult (age ≥18 years) blunt trauma patients with a diagnosis of at least one rib fracture on CT imaging were included. Patients before (PRE) and after (POST) implementation of RIG were compared. In the POST group, patients were divided into RIG 1, RIG 2, and RIG 3 based on their RIG score. **(Figure)** Outcomes were readmission for RIG 1 patients, unplanned ICU admission for RIG 2 patients, and overall ICU admission. Secondary outcomes were hospital length of stay (LOS) and mortality.

Results: A total of 1107 patients were identified (PRE: 757; POST: 350). Mean age was 56±19 years, 792 (71.5%) were male, and median ISS was 14 [10-22]. The most common mechanism of injury was motor vehicle collision (557; 50.3%), 254 (22.9%) patients had ≥5 rib fractures, and 53 (4.8%) patients had a flail chest. In the POST group, 74 patients (21.1%) were RIG 1, 123 (35.2%) RIG 2, and 153 (43.7%) RIG 3. No patient in RIG 1 was readmitted following initial discharge, and 2 (1.6%) patients in RIG 2 had an unplanned ICU admission (both for alcohol withdrawal syndrome). POST patients had shorter hospital LOS (3 [1-6] vs. 4 [1-7] days; p=0.019) and no difference in mortality (6.9% vs. 8.1%; p=0.485). On multivariate analysis, RIG implementation was associated with decreased ICU admission (aOR 0.536 [0.368-0.781]; p=0.001).

Conclusion: RIG is safe and effectively defines triage of rib fracture patients with an overall reduction in ICU admissions, shorter hospital LOS, and no readmissions.

RIG Score Calculator	
Variable	Points
Age ≥60 years	4
Incentive Spirometry <750 mL	4
Severe pulmonary contusions on CT scan	2
Rib fractures ≥5	2
COPD, Asthma, or smoker	2
Hemothorax, Pneumothorax, or chest tube placed	2
Pain score ≥6/10	1
Weak or absent cough	1

RIG Category	RIG Score	Disposition
RIG 1	≤2	Discharge if possible
RIG 2	3-9	Floor
RIG 3	≥10 or severe extra-thoracic injuries	ICU

Session XV: Quickshot Session I 1-13
Quickshot 7: 8:36 AM – 8:42 AM

NOT SO FAST- CHEST ULTRASOUND UNDERDIAGNOSES TRAUMATIC PNEUMOTHORAX

Jarrett E. Santorelli, MD; Harrison Chau, MD; Laura Godat, MD; Giovanna Casola, MD; Jay J Doucet, MD; Todd W. Costantini, MD; UC San Diego Health System
Invited Discussant: Marc de Moya, MD

Background: Ultrasonography for trauma is a widely used tool in the initial evaluation of trauma patients with complete ultrasonography of trauma (CUST) demonstrating equivalence to CT for detecting clinically significant abdominal injury. Initial reports demonstrated high sensitivity of CUST for the bedside diagnosis of pneumothorax. We hypothesized that the sensitivity of CUST would be non-inferior to initial supine chest radiograph (CXR) for detecting pneumothorax.

Methods: A retrospective analysis of patients diagnosed with pneumothorax from 2018 through 2020 at a Level 1 trauma center was performed. Patients included had routine supine CXR and CUST performed prior to intervention as well as confirmatory CT imaging. All CUST were performed during the initial evaluation in the trauma bay by a registered sonographer. All imaging was evaluated by an attending radiologist. Subgroup analysis was performed after excluding occult pneumothorax. Immediate tube thoracostomy was defined as tube placement with confirmatory CXR within 8 hours of admission.

Results: There were 568 patients screened with a diagnosis of pneumothorax, identifying 362 patients with a confirmed pneumothorax in addition to CXR, CUST and confirmatory CT imaging. The population was 83% male, had a mean age of 45, with 85% presenting due to blunt trauma. Sensitivity of CXR for detecting pneumothorax was 43% while the sensitivity of CUST was 35%. After removal of occult pneumothorax (n=167), CXR was 78% sensitive while CUST was 65% sensitive ($p<0.01$). In this subgroup, CUST had a false negative rate of 35% (n=58). Of those patients with a false negative CUST, 46% (n=27) underwent tube thoracostomy, with 85% (n=24) requiring immediate placement.

Conclusion: CUST performed on initial trauma evaluation had lower sensitivity than CXR for identification of pneumothorax including clinically significant pneumothorax requiring tube thoracostomy. Utilizing CUST as the primary imaging modality in the initial evaluation of chest trauma should be considered with caution.

Session XV: Quickshot Session I 1-13
Quickshot 8: WITHDRAWN

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

RISK FACTORS FOR STROKE IN PENETRATING CAROTID TRAUMA IN THE AAST PROOVIT REGISTRY

LA O'Banion, MD; R Dirks, PhD; JJ Dubose, MD; K Inaba, MD, FRCSC, FACS; B Williams, MD; L Lucero, MD; GA Magee, MD, MSc, FACS, FSVS;
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Invited Discussant: Alison Wilson, MD

Background: Penetrating carotid injuries are associated with substantial risk of stroke up to 20% in modern studies. However, because penetrating trauma has significantly declined in the past two decades, these injuries are increasingly difficult to study because of small sample size at even the largest centers. This study evaluated all penetrating carotid injuries in the American Association for Surgery of Trauma (AAST) PROspective Observational Vascular Injury Trial (PROOVIT), with the aim of determining factors associated with stroke in these patients.
Methods: All patients with a penetrating extracranial carotid injury in the AAST PROOVIT registry from 2012-2020 were evaluated. Isolated external carotid injuries were excluded. Patients with documented post-injury in-hospital stroke were compared to those without in univariate analysis. Significant predictors ($p<0.1$) for stroke on univariate analysis were included in a multivariate regression.
Results: 102 patients from 18 institutions met criteria for analysis. Mean age was 35 ± 18 years and 80% were male. Average GCS on presentation was 9 ± 5, with an ISS of 22 ± 13. Operative management of the injury occurred in 51% of patients, who were significantly more hypotensive ($p = .015$) with a lower initial pH ($p = .001$) and more likely to present with hard signs of a vascular injury ($p < .001$). Primary repair was performed in 31% of patients, bypass in 27%, covered stent in 8%, and ligation/coil embolization in 35%. Shunting was rarely performed, 5.9%. The overall stroke rate was 17% (23% in those requiring operative repair vs 10% in those undergoing nonoperative management, $p = .076$). Lack of postoperative antiplatelet therapy (23% vs. 11%, $p = .03$) and need for completion angiography (62% vs 38%, $p = .02$) were associated with a significantly higher rate of stroke on univariate analysis. Time to repair, type of injury, carotid ligation, concomitant jugular vein injury, and jugular vein ligation were not associated with stroke. On multivariate logistic regression, lower GCS and need for completion angiography remained the only independent variables associated with stroke ($p = .05$ and $.04$).
Conclusion: Penetrating carotid trauma undergoing operative management had a stroke rate of 23%. Low GCS on arrival and need for completion angiography are independently associated with post-injury in-hospital stroke. Unfortunately, the ideal treatment strategy (open repair, ligation, use of shunting and endovascular techniques) remains elusive due to small sample size. A dedicated multicenter study may help to achieve higher fidelity data on this rare but devastating injury.

Session XV: Quickshot Session I 1-13
Quickshot 10: 8:48 AM – 8:54 AM

DELETERIOUS EFFECTS OF PLASMA-DERIVED CELLULAR DEBRIS IN A PORCINE MODEL OF HEMORRHAGIC SHOCK

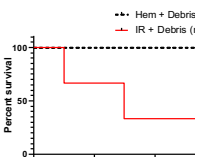
Colin T. Buckley, M.D.; Yann L. Lee, M.D.; A. Michele Schuler, DVM Ph.D.; Raymond J. Langley, Ph.D.; Matthew E. Kutcher, M.D.; Robert Barrington, Ph.D.; Jonathon P. Audia, Ph.D.; Jon D. Simmons, M.D.;
University of South Alabama
Invited Discussant: Martin Schreiber, MD

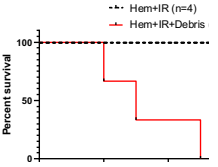
Introduction: Recent studies identify large quantities of inflammatory cellular debris within Fresh Frozen Plasma (FFP). As FFP is a mainstay of hemorrhagic shock resuscitation, we used a porcine model of hemorrhagic shock to investigate the inflammatory potential of plasma-derived cellular debris during resuscitation.

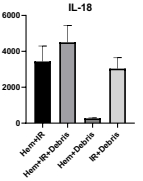
Methods: The porcine model of hemorrhagic shock included: laparotomy with 35% hemorrhage (Hem), followed by 40 minutes of ischemia from supraceliac aortic occlusion (IR) and protocolized resuscitation for 6 hours. Cellular debris (Debris) was added to the resuscitation phase in three groups. The four groups consisted of Hem+IR (n=4), Hem+IR+Debris (n=3), Hem+Debris (n=3), and IR+Debris (n=3). A battery of laboratory, physiologic, cytokine, and outcome data were compared between groups.

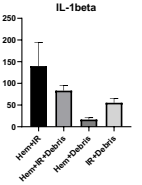
Results: As expected, the Hem+IR group showed severe time dependent decrements in organ function and physiologic parameters. However, all animals that included the combination of IR and Debris died prior to six hours (see Figure). All animals in the Hem+IR and Hem+Debris survived. Cytokine levels at 30-60 minutes after resuscitation revealed significant differences in IL-18 and IL-1β between all groups (Kruskal-Wallis $p<0.05$), and IL-18, IL-1β, IL-2, IL-10, and IL-12 between Hem+Debris and IR+Debris.

Conclusions: Ischemia and reperfusion appear to prime the immune system to the deleterious effects of plasma-derived cellular debris. In the presence of IR, this model showed 100% lethality when resuscitation included quantities of cellular debris routinely administered to trauma patients during transfusion of FFP. A deeper understanding of the immunobiology of plasma product cellular debris is critical to optimize resuscitation from hemorrhagic shock.









Session XV: Quickshot Session I 1-13
Quickshot 11: 8:54 AM – 9:00 AM

IMAGE BASED DETECTION AND ANALYSIS OF STROKE DUE TO BLUNT CEREBROVASCULAR INJURY

Jonathan Black, MD; Russell Griffin, Ph.D; Peter Abraham, MD; Mackenzie Abraham, MD; Elizabeth Liptrap, MD; Bart Thaci, MD; Jeffrey Kerby; MD, Ph.D; Mark Harrigan, MD; Jan Jansen, MBBS, Ph.D;
University of Alabama at Birmingham
Invited Discussant: Jamie Coleman, MD

Introduction: Patients with blunt cerebrovascular injury (BCVI) are at risk of stroke. The timing of these events is not well understood, yet critical to prevention efforts. In our institution, all patients evaluated for blunt traumatic injuries undergo a screening CTA of the neck, and all patients with suspected strokes undergo MRI of the brain. We conducted a retrospective review to determine the stroke rate and potentially preventable stroke rate, and when these events occur.
Methods: Retrospective review of all neck CTAs and head MRIs obtained in blunt trauma patients over a two year period August 2017 to August 2019. All positive studies were individually reviewed to confirm the diagnosis of BCVI and stroke. Stroke was defined as brain MRI-evidence of new ischemic lesions, and each MRI was further reviewed to identify the territory affected. We further extracted the time to aspirin administration and the timing of stroke onset from patients' electronic health records.
Results: Records for 6800 patients who sustained blunt trauma were reviewed. Of these, 479 patients (7.0%) were found to have BCVIs, and 24 patients (5.0%) were found to have had a stroke on admission. Of the 455 BCVI patients who did not have a stroke on admission, 12 (2.6%) subsequently had a stroke during their hospitalization. The overall stroke rate of patients with BCVI is 7.5%, and the potentially preventable stroke rate is 2.6% (of all patients with BCVI who do not have a stroke on admission). The median time to stroke in these 12 patients with BCVI was 21:40 hours (IQR 12:54 to 30:58). Only 4 of the 12 patients received aspirin prior to the onset of stroke symptoms. All 36 patients with BCVI and stroke had thromboembolic lesions in the territory supplied by an injured vessel.
Conclusion: Stroke in blunt trauma patients occurs in 7.6% of patients admitted with BCVI. Two-thirds of these strokes are evident on admission, and may not be preventable. One-third of BCVI-related strokes occur after admission, but often relatively early, necessitating rapid commencement of preventative treatment. Further studies are required to demonstrate the effectiveness of antithrombotics in preventing stroke in BCVI patients.

Session XV: Quickshot Session I 1-13
Quickshot 12: 9:00 AM – 9:06 AM

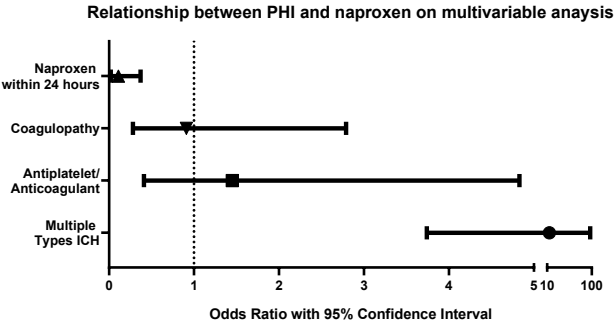
HEMORRHAGE PROGRESSION IN TRAUMATIC BRAIN INJURY OCCURS EARLY AND IS NOT INCREASED BY NAPROXEN

Kayla D. Isbell, MD; Gabrielle E. Hatton, MD, MS; Charles E. Wade, PhD; Lillian S. Kao, MD, MS; John A. Harvin, MD, MS; University of Texas Health Sciences Center at Houston
Invited Discussants: Anupamaa Seshadri, MD

Background: Non-selective non-steroidal anti-inflammatory drugs, such as naproxen, are often included in multimodal analgesic regimens for trauma patients. However, these drugs are often withheld following traumatic brain injury (TBI) due to concern for progression of hemorrhagic injury (PHI). Additionally, little is known about time from injury to PHI or the effects of naproxen on PHI risk. We hypothesized that, among patients with TBI, administration of naproxen does not increase risk of PHI.

Methods: A post-hoc analysis of adult patients with TBI enrolled in the randomized Multi-modal Analgesic Strategies in Trauma (MAST) trial was conducted. The two arms of the trial, MAST 1 and MAST 2, initiated either celecoxib or naproxen within 24 hours, respectively. Serial non-contrast head CTs for each patient were assessed for PHI, using the ABC/2 method of volume calculation. PHI was defined as >33% increase in volume. Coagulopathy was determined according to rTEG.. Rates of PHI in MAST 1 vs. MAST 2 were compared via unadjusted analysis. In order to assess the effect of early (<24h) naproxen exposure, multivariable analysis of PHI in only MAST 2 patients was performed.

Results: In the trial, 18% (276/1561) of patients had a TBI **(**MAST 1= 144, MAST 2=132) and 38 (14%) had PHI (MAST 1=17 (12%) vs MAST 2=21 (16%), p=0.32). In the MAST 2 group, 3 patients received naproxen prior to PHI. Median time to PHI was 6.1 hours (interquartile range [IQR] 3.8-10.1), while median time to naproxen was 15.5 hours (IQR 9.7-28.1). Patients with PHI were older (62 vs 46 years, p<0.001), more severely injured (ISS 29 vs 22, p<0.001), and more likely to have multiple types of intracranial hemorrhage (90% vs 42%, p<0.001) than those without PHI; they were less likely to receive naproxen prior to progression (14% vs 86%, p<0.001). On multivariable analysis, administration of naproxen was not associated with increased PHI (**Figure**). **Conclusions:** The majority of PHI occurred early, prior to naproxen exposure. Although selection bias cannot be excluded, naproxen exposure was not associated with increased PHI.



Session XV: Quickshot Session I 1-13
Quickshot 13: 9:06 AM – 9:12 AM

DEVELOPMENT OF AN AI-DRIVEN POINT-OF-CARE TRAUMA BIOMARKER PANEL TO IDENTIFY INJURY PRESENCE AND SEVERITY

Deniz Vurmaz, PH.D.; Michael Klein, MD, FACS; Will Haberkorn, BS; Spiros Frangos, MD, MPH, FACS; Charles DiMaggio, PhD, MPH; Marko Bukur, MD; John McDevitt, PhD; New York University School of Medicine/Bellevue Hospital Center
Invited Discussant: Andrew Young, MD

Objectives: For trauma patients, rapid diagnosis and management of injuries decrease morbidity and mortality. Typically, assessing injuries and their associated severity relies upon CT scanning, which is costly, exposes patients to radiation, and may not be available in resource-poor settings. The objective of this study was to evaluate a point-of-care (POC) biomarker panel for its ability to assess injury presence and severity rapidly.
Methods: By developing a systematic approach with AI, ~600 candidate biomarkers were screened in 12 million trauma-related research articles from bibliographic databases. The top 9 biomarkers were identified after conducting a meta-analysis of their diagnostic accuracy. Properdin, Cystatin-C (Cys-C), NGAL, D-Dimer (DD), Complement-5 (C5), Procalcitonin (PCT), Myoglobin (MYO), Protein-C (PC) and, C-reactive protein (CRP) were incorporated into a trauma diagnostic panel for POC use. We conducted a prospective, observational study of 46 trauma patients who presented to our urban, Level-1 trauma center for initial proof of concept clinical validation. A blood sample was drawn immediately upon patient arrival, and injuries were identified via traditional evaluation and imaging. Injury severity was compared to candidate biomarkers and against healthy controls. The area under the curve (AUC) for receiver operator characteristics was used to assess the diagnostic performance of the novel biomarkers compared with traditional methods. Spearman correlation coefficients (rho) correlated between novel biomarkers and injury severity scores (ISS).
Results: AUC values of Cys-C and Properdin were 0.99; DD and C5 were 0.88 and 0.84; PC and MYO* were 0.79 and 0.72 associated with the presence of injury ($p<0.001$: $*p<0.05$), respectively. Among these novel biomarkers, ISS was strongly correlated with Cys-C and DD (rho; $r=0.71$, $r=0.70$ $p<0.001$).
Conclusion: There is strong potential for a POC biomarker panel to aid clinical decision-making in trauma by identifying both the presence and perhaps severity of visceral injuries. The predictive value of these tests and their correlation with both injuries and injury severity requires further study.

Session XVI:
Quickshot Session II 14-26

Saturday, October 2, 2021

9:40 AM – 10:58 AM

Location: Salon

Moderator: Walter Biffl, M.D.

Session XVI: Quickshot Session II 14-26
Quickshot 14: 9:40 – 9:46 AM

SMALL BOWEL OBSTRUCTION IN THE VIRGIN ABDOMEN

Liasidis PK, MD; Huang VP, BS; Lewis M, MD, FACS; Benjamin ER, MD, PhD, FACS; Ghafil C, MD; Demetriades D, MD, PhD, FACS; LAC and USC Medical Center
Invited Discussant: Jose Diaz, MD

Introduction: Surgical dogma has historically mandated operative management of small bowel obstruction (SBO) in patients with no previous abdominal surgery. The purpose of this study was to examine the contemporary etiology, management, and outcomes of patients with SBO in a virgin abdomen.
Methods: Retrospective analysis of adult patients with confirmed SBO and no previous abdominal surgery who presented to our center between June 2015 and February 2020. Patients were excluded for clinical or radiologic evidence of acute abdomen. Radiology and pathology reports, operative findings, outcomes, and follow up data were analyzed.
Results: A total of 66 patients were included, with mean age of 53 years and 71.2% male. 32 patients (48.5%) were managed operatively and 34 (51.5%) non-operatively. The etiology in patients who underwent exploration was adhesions (25.0%), malignancy (15.6%), infectious/inflammatory mass or stricture (12.5%), volvulus (9.4%), bezoar (6.3%), intussusception (3.1%), internal hernia (3.1%), initial Crohn's flare (3.1%), encapsulating peritonitis (3.1%), and ovarian torsion (3.1%). The etiology in patients managed nonoperatively was constipation/fecal impaction (11.8%), malignancy (8.8%), substance intoxication/withdrawal (5.9%), infectious or inflammatory (5.9%), bezoar (2.9%), foreign body (2.9%), and not definitively determined in 21 patients (61.8%). Overall, 8 patients (12.1%) were diagnosed with malignancy, of which 5 underwent operation during the index admission, and 3 following further work-up. The preoperative CT scan was suggestive of malignancy in 7 of the 8 cases. The negative laparotomy rate was 9.4%, in addition to one negative diagnostic laparoscopy (3.1%). 16 patients (50.0%) who underwent exploration required admission to the ICU, compared to 3 (8.8%) who were managed nonoperatively ($p<0.001$). Hospital length of stay was significantly longer in the operative group (10 vs 2 days, $p<0.001$).
Conclusion: SBO in patients with a virgin abdomen is most often due to a benign underlying cause. Those resulting from a newly diagnosed malignancy are detected by preoperative imaging in most cases. The rate of negative laparotomy in this population is significant. In the absence of clinical or radiological evidence of acute abdomen, a non-operative approach with close follow up may be appropriate in these patients.

Session XVI: Quickshot Session II 14-26
QS 15: 9:46 AM – 9:42 AM

BURNOUT REDUCTION IN ACUTE CARE SURGEONS: IMPACT OF A FACULTY SCHEDULE CHANGE AT A LEVEL 1 TRAUMA AND TERTIARY CARE CENTER

Caitlin Jones, MD; Terence O'Keeffe, MD; Cassandra White, MD; Steve Holsten, MD; Rashid Sayyid, MD; Elizabeth Fox, MD; Andrew Lawson, DO; Medical College of Georgia at Augusta University
Invited Discussant: Jennifer Hartwell, MD

Background: Acute care surgeons are prone to burnout due to heavy workload, concurrent clinical responsibilities, and busy in-house call. Modifiable burnout factors have been identified, but few studies have looked for longitudinal effects after change is implemented. We hypothesized that optimizing faculty workflow could decrease burnout without compromising productivity.
Methods: We streamlined the faculty schedule at our institution to eliminate 24-hour call by creating weekly blocks of 12-hour day and night call, free from other clinical obligations. Protected academic time was added. The Maslach Burnout Inventory (MBI) and Areas of Worklife Survey (AWS) for health care providers were given to faculty at baseline, 6, and 12 months. Close friends or family members completed the survey based on their perception of the surgeon's burnout. MBI and AWS proprietary formulas were used to assess change in factors contributing to burnout. Our primary outcome measure was the presence of burnout. Chart delinquency and RVUs were secondary outcome measures assessing for change in clinical productivity.
Results: Survey completion rates were 92% for faculty and 75% for family. All burnout risk factors improved at 6 and 12 months compared to baseline. In both the surgeon and family groups, the following percentage improvements were noted in the mean scores of risk factors at one year: workload (74%, 68%), control (38%, 16%), reward (14%, 24%), fairness (69%, 22%), emotional exhaustion (27.5%, 24%), depersonalization (37.5%, 14%), personal accomplishment (12.5%, 2%), community (3%, 5%), values (10%, 15%), and over-all burnout (12.5%, 23.3%). There was a reduction in charts reaching delinquent status. RVU production did not change.
Conclusion: This study demonstrates that implementing a weekly, 12-hour call schedule can improve factors which lead to burnout. Improvements were noted in surgeon and family groups alike, signifying not only subjective perceptual improvements, but also an observed change in the surgeons' behavior. This was accomplished without compromising clinical productivity.

Session XVI: Quickshot Session II 14-26
Quickshot 16: 9:52 AM – 9:58 AM

CODE CRITICAL AIRWAY: A COLLABORATIVE SOLUTION TO A CATASTROPHIC PROBLEM

Amber Himmler, MD; Chelsea Mcdermott, MS; Jordan Martucci, MS; Emily Rhoades, CRNP; Christine T Trankiem, MD, FACS; Laura S Johnson, MD, FACS; MedStar Washington Hospital Center
Invited Discussant: Niels Martin, MD

Introduction: Airway emergencies (AEs) are infrequent events that can occur suddenly and carry a high risk of morbidity and mortality. In 2006, a multi-disciplinary "Code Critical Airway" Team was created at our institution, with the goal of promoting the least invasive approach to airway management in the emergency situation while maintaining airway stability. This intervention involved hospital-wide airway management education that emphasized a proactive rather than reactive approach. The objective of this study is to examine the demographics of the patients for whom a "Code Critical Airway" is activated, and to examine patient outcomes following this event.
Methods: A retrospective chart review was conducted of all patients over 18 years of age on whom a "Code Critical Airway" (CCA) was called from 2008-2020. Patient demographics including age, gender, BMI, admitting diagnosis, location in the hospital, and medical history of conditions pertinent to airway management were collected. The outcomes measured included: number of attempts to secure the airway, intervention performed to establish the airway and airway-associated mortality. The early period of the experience with CCAs (2008-2014) was compared to the later period (2015-2020). Data was analyzed in SPSS 24 using Fishers exact test and Cochran Armitage trend test where appropriate.
Results: From 2008-2020 there were 953 CCA events called. Over time, there was a statistically significantly increase in the number of CCAs activated. Two hundred seventy-four (29.0%) CCAs occurred in the emergency department, 255 (27.0%) in the intensive care unit, 60 (6.4%) in the step-down unit, 294 (31.1%) on the wards, and 61 (6.5%) elsewhere in the hospital. No single patient-related factor was associated with increased risk of needing a surgical airway in this cohort; interestingly BMI >30 decreased over time. Critical airways were managed with intubation using the Glidescope in 231 patients (25.7%), fiberoptic bronchoscopy in 305 patients (33.8%), aide of a bougie in 48 patients (5.3%), replacement of a prior tracheostomy in 243 patients (26.3%) and creation of a new surgical airway in 85 patients (9.2%). Mortality directly related to an airway event was 6.1%. There was a statistically significant increase in the number of successful first attempts at obtaining an airway comparing our experience in early period from 2008-2014 to the late period from 2015-2020 ($p<0.001$). There was a statistically significant decrease in number of CCAs requiring creation of a surgical airway comparing 2008-2014 and 2015-2020 ($p=0.022$).
Conclusion: Inculcation of aggressive early escalation of airway emergencies through implementation of a Code Critical Airway Team has resulted in significant improvement in first attempt definitive airway stabilization and a decrease in the need for surgical airways.

Session XVI: Quickshot Session II 14-26
Quickshot 17: 9:58 AM – 10:04 AM

DOES PRACTICE MATCH TRAINING? CONSULTATION PRACTICES IN SURGICAL CRITICAL CARE

Christopher P. Michetti, MD; Susan Evans, MD; Niels Martin, MD; Salman Ahmad, MD; Panna A. Codner, MD; Wendy Greene, MD; INOVA Fairfax
Invited Discussant: Krista Kaups, MD, MSc, MS

Background: Despite a defined curriculum, the Surgical Critical Care (SCC) scope of practice may vary depending on local policies, resources, & expertise. Understanding practice patterns may inform educational needs and personnel distribution.
Methods: We studied ICU consultation practices by email survey of AAST members. Under 8 medical specialties a list of related diagnoses was provided *(e.g.* Neurology*: stroke, seizures, meningitis, etc.)*; respondents were asked for which conditions they would consult that specialist. We also queried confidence in management of clinical categories and opinions about consultation. Descriptive statistics were used.
Results: Of 1,682 AAST members, 314 physicians (18.6%) responded (68% male; 79% White; 96.2% SCC certified). Percentage of clinical time spent in SCC was 26-50% in 57%, >50% in 14.5%. Respondents' ICUs were closed (39%), open (25%), or hybrid (36%). Highest average confidence ratings for managing select conditions (1=least, 5=most) were 4.64, ventilator; 4.51, palliative care; 4.44 infections; 4.31 (tie) organ donation, hemodynamics; lowest rating was 3.85, myocardial ischemia. Opinions on consultants' effect on costs were 71% "increase", 20% "no effect", and 9% "decrease". Over half of respondents (53%) agreed or strongly agreed that consultant use increases family confusion about who is in charge of patient care. Out of an average of 20 listed conditions per specialty, respondents tended to consult more frequently for cardiology, hematology, and neurology and less frequently for nephrology, palliative care/geriatrics, GI, infectious disease, & pulmonary. For procedures, few respondents (<10%) consulted for chest tubes (0.7%), central lines (1%), thoracentesis (8.1%), or fasciotomies (9.8%), but most (>90%) consulted for intracranial pressure monitors (95%), percutaneous abdominal drains (91%), cholecystostomy tubes (95.4%), nerve blocks (84.8%), & vena cava filters (82%). For routine intubation 22.1% consulted vs. 61.6% for difficult airway intubation.
Conclusions: Use of consultants in the ICU varies based on specialty and diagnosis. Among predominantly surgical intensivists, consultation is primarily requested for conditions where specific interventions are required. These practices have economic and educational implications for SCC.

Session XVI: Quickshot Session II 14-26
Quickshot 18: 10:04 AM – 10:10 AM

ESTRADIOL REDUCES MORTALITY IN A SWINE MODEL OF POLY TRAUMA AND HEMORRHAGIC SHOCK

Hossam Abdou, MD; Jonathan J Morrison, MD; Joseph C Edwards, MD; Neerav Patel, MD; Eric Lang; Michael J Richmond; Noha Elansary, BS; Mathangi Gopalakrishnan, PhD; Jonathan Berman, MD, PhD; William J Hubbard; Thomas M Scalea, MD; Irshad H Chaudry, PhD; University of Maryland, Shock Trauma Center
Invited Discussant: Michael Goodman, MD

Introduction: Although 17α-ethynylestradiol-3-sulfate (estradiol) reduces mortality in small and large animal models of controlled hemorrhage, its role in a clinically relevant model of injury is unknown. We assessed the impact of estradiol in a swine model of poly-trauma and hemorrhage.
Methods: The study was performed under Good Laboratory Practice regulations, with 30 male uncastrated swine (25-50 kg) subjected to a pulmonary contusion (via a bolt gun), comminuted tibial fracture and 30% controlled hemorrhage over an hour. Animals were randomized to one of five estradiol doses: 0 (control), 0.3, 1, 3 and 5 mg/kg, which was administered at 10-mins post-injury. Subjects received no resuscitation and were observed for 6 hours or until death. Survival data (mins) was collected and analyzed using Cox-proportional hazard regression. Left ventricular pressure-volume loops were collected and used to derive preload recruitable stroke work (PRSW) as a measure of cardiac inotropy. Immediate post-injury values were compared to end-of-study (EOS) values within groups.
Results: 6-hr survival for the 0, 0.3, 1, 3 and 5 mg/kg groups was 0%, 50%, 33.3%, 16.7% and 0%, respectively. Following Cox regression, the hazard [95% confidence interval] of death was significantly reduced in the 0.3 (0.22 [0.05-0.93]) and 1 (0.24 [0.06-0.89]) mg/kg groups but not in the 3 and 5 mg/kg groups: 0.49 [0.15-1.64] and 0.46 [0.14-1.47]. Mean time of survival for the entire study period was significantly extended in the 1 mg/kg group (246 min) vs the 0 mg/kg group (96 min) [$p=0.04$, t-test]. EOS inotropy was significantly higher than post-injury values in the 0.3 and 1 mg/kg groups ($p<0.001$). Inotropy was unchanged in the 3 mg/kg group, but the EOS values were significantly depressed compared to post-injury data in the control and 5 mg/kg groups ($p<0.001$).
Conclusion: Low dose estradiol, even in the absence of fluid resuscitation, reduces mortality and improves cardiac inotropy in a clinically relevant swine model of poly-trauma and hemorrhage. These findings support the need for a clinical trial in human trauma patients.

Session XVI: Quickshot Session II 14-26
Quickshot 19: 10:10 AM – 10:16 AM

THE INTERACTION BETWEEN β-ADRENERGIC BLOCKADE AND THE REVISED CARDIAC RISK INDEX IN RELATION TO MORTALITY AFTER TRAUMATIC HIP FRACTURE SURGERY IN GERIATRIC PATIENTS

Ahmad Mohammad Ismail, MD; Rebecka Ahl, MB, BChir, PH.D.; Maximilian P. Forssten, MD; Yang Cao, PH.D.; Per Wretenberg, MD, PH.D.; Tomas Borg, MD, PH.D.; Shahin Mohseni, MD, PH.D.; Orthopedic Surgery
Invited Discussant: Mitch Cohen, M.D.

Introduction: An association between beta-blocker (BB) therapy and a reduced risk of major cardiac events and mortality in patients undergoing surgery for hip fractures has previously been demonstrated. Furthermore, a relationship between an increased Revised Cardiac Risk Index (RCRI) score and a higher risk of postoperative mortality has also been detected. The purpose of the current study was to investigate the interaction between BB therapy and RCRI in relation to 30-day postoperative mortality in geriatric patients after hip fracture surgery. The hypothesis was that patients with higher RCRI scores will have a greater benefit of BB therapy, in terms of reduced postoperative mortality.

Methods: All patients over 65 years of age who underwent primary emergency hip fracture surgery in Sweden between January 1, 2008 and December 31, 2017, except for pathological fractures, were included in the study. Patients were divided into cohorts based on their RCRI score (RCRI 1, 2, 3, and ≥4) and whether they had ongoing BB therapy at the time of admission. A Poisson regression model with robust standard errors of variance was used, while adjusting for confounders, to evaluate the association between BB therapy, RCRI, and 30-day mortality. This analysis was performed on the whole study population as well as within each RCRI cohort.

Results: A total of 126,934 cases met the study inclusion criteria. Beta-blocker therapy was associated with a 65% decrease in the risk of 30-day postoperative mortality in the whole study population [adj. IRR (95% CI): 0.35 (0.32-0.38), $p < 0.001$]. The use of BB also resulted in a significant reduction in 30-day postoperative mortality within all RCRI cohorts. However, the most pronounced effect of beta-blocker therapy was seen in patients with an RCRI score greater than 0.

Conclusions: Beta-blocker therapy is associated with a reduction in 30-day postoperative mortality, irrespective of RCRI score. Furthermore, patients with an elevated cardiac risk appear to have a greater benefit of beta-blocker therapy.

Session XVI: Quickshot Session II 14-26
Quickshot 20: 10:16 AM – 10:22 AM

HEMORRHAGE INCREASES CAPILLARY CONGESTION IN A PORCINE MULTIPLE TRAUMA MODEL

El Haddi SJ, MD, MS; Brito A, MD; Dixon AL, MD; Smith S, MD; Appleman ML, PH.D.; Rick E, Makar RR, PH.D; Underwood SJ, MS; Mahuvakar A, McCully B, PH.D. Shibani P, MD. PhD; Schreiber MA, MD, FACS, FCCM; Oregon Health & Science University
Invited Discussant: Lawrence Diebel, MD

Introduction: The combination of pulmonary contusion (PC) and hemorrhagic shock are risk factors for the development of Acute Respiratory Distress Syndrome (ARDS) after trauma. Appropriate animal models are critical for testing novel therapies to prevent ARDS.
Methods: Anesthetized swine (n=87) were randomized to sham (n=6, immediate euthanasia), control (n=9, instrumentation with 48 hours of ventilation), PC, (n=36), or PC and grade V liver injury (PC + LI, n=36). Injured animals randomly receive prothrombin complex concentrate (n=18), swine plasma, (n=18), or a swine mesenchymal stem-cell suspension (n=18), or crystalloid, (n=18). After 48 hours the animals were euthanized, and lung biopsies were obtained from all six lung lobes. Tissues were scored by a blinded pathologist for severity of capillary congestion, alveolar edema, acute inflammation, and intra-alveolar hemorrhage. Scores were compared by a generalized linear model with injury, treatment, early death, and interaction terms.
Results: Of the 87 animals studied, 12 randomized to PC + LI expired prior to the end of the 48 hours. Treatments did not significantly affect survival. ARDS pathologic scores were: sham 7.5, controls 10.3, PC 10.2, and PC + LI 12.3. Treatment did not affect pathology score. PC + LI scored higher than PC alone after adjusting for treatment effects ($p = 0.03$). PC + LI was also associated with a higher capillary congestion sub-score compared to PC alone ($p = 0.023$).
Conclusion: This is the first study to report the added pathologic effects of hemorrhagic shock in addition to PC in a multiple trauma porcine injury model and suggests that hemorrhagic shock magnifies the effects of PC in the development of ARDS by increasing pulmonary capillary congestion. This study will provide mechanistic targets for future interventional trials.

Session XVI: Quickshot Session II 14-26
Quickshot 21: 10:22 AM – 10:28 AM

DEFINING SEPSIS PHENOTYPES - TWO MURINE MODELS OF SEPSIS AND MACHINE LEARNING

Allan E. Stolarski, MD, MD; Jiyoun Kim, Ph.D.; Jacob Nudel, MD; Sophia Gunn, BA; Daniel Remick, MD; Boston Medical Center
Invited Discussant: Robert Maxwell, MD

Introduction: Sepsis phenotypes have been described in the clinical literature. However, the immunobiology defining the clinically apparent differences in response to sepsis remains unclear. We hypothesize that in murine models of sepsis we can identify phenotypes of sepsis using non-invasive physiologic parameters (NIPP) early after infection to distinguish between different inflammatory states.
Methods: Two murine models of sepsis were used: gram-negative pneumonia (PNA) and cecal ligation and puncture (CLP). All mice were treated with broad spectrum antibiotics and fluid resuscitation. High-risk sepsis responders (pDie) were defined as those predicted to die within 72-hours following infection. Low-risk responders (pLive) were expected to survive the initial 72 hours of sepsis. R-Studio was used for statistical analysis and machine learning.
Results: NIPP obtained at 6- and 24-hours after infection of 291 mice (85 PNA and 206 CLP) were used to define the sepsis phenotypes. Using lasso regression for variable selection with 10-fold cross validation to prevent overfitting, variables selected to discriminate between phenotypes include 6-hour temperature and 24-hour pulse distention, heart rate, and temperature. Applying the model to fit test data (n=55), area under the curve (AUC) for the receiver operating characteristics (ROC) curve was 0.93. Subgroup analysis of 120 CLP mice revealed a heart rate of less than 620 bpm at 24-hours as a univariate predictor of pDie. (AUC of ROC curve=0.98). Subgroup analysis of PNA exposed subjects (n=121) did not reveal a single predictive variable highlighting the complex physiological alterations in response to sepsis. However, applying the lasso regression and cross validation technique to the PNA subgroup, the following variables were selected: 6-hour percent change in weight from baseline, 6-hour temperature, as well as 24-hour measurements of pulse distention, heart rate, and percent oxygen saturation. (AUC of ROC curve=0.85).
Conclusion: In murine models with various etiologies of sepsis, NIPP assessed just 6- and 24- hours after infection can identify different sepsis phenotypes. Stratification by sepsis phenotypes can transform future studies investigating novel therapies for sepsis.

Session XVI: Quickshot Session II 14-26
Quickshot 22: 10:28 AM – 10:34 AM

THE IMPACT OF COVID STATUS ON COMPLICATIONS IN PATIENTS PRESENTING IN HEMORRHAGIC SHOCK

Jason B. Brill, MD; Krislynn M. Mueck, MD; Madeline E. Cotton, BS; Brian Tang, BS; Mariela Sandoval, BSN; Lillian S. Kao, MD, MS; Bryan A. Cotton, MD; McGovern Medical School
Invited Discussant: Patricia O'Neill, MD

Background: Hemorrhagic shock and SARS-CoV-2 infections have each been shown to cause endothelial injury and dysfunctional coagulation. We hypothesized that in patients presenting with hemorrhage, COVID-positive status would result in increased complications, organ failure, and mortality.
Methods: All trauma patients admitted 04/20-07/20 were evaluated. Patients were included in analysis if they (1) were 16 years or older, (2) presented in hemorrhagic shock and (3) received emergency release blood products in the trauma bay. Patients who died in the emergency department or prior to collecting nasal swab for COVID were excluded. Patients were divided into COVID(+) and COVID(-). Data analyzed by STATA 12.1.
Results: 255 patients met inclusion criteria; 22 (9%) were COVID(+), 233 were COVID(-). There were no differences in demographics, injury severity, initial lab values, or transfusions between groups. COVID(+) had significantly higher complications (TABLE). 30-day survival was lower (62 vs 78%) in the COVID(+) group, but did not reach statistical significance (p=0.08). Controlling for age, sex, and ISS, COVID(+) patients had a 70% decreased odds of survival (OR 0.28, 95% C.I. 0.09-0.81; p=0.019).
Conclusion: COVID(+) status was associated with a 2-fold increased risk of major complications and 70% decreased odds of survival in hemorrhagic shock patients. Given the endothelial injury sustained during hemorrhage, it is not surprising that COVID-related damage to the endothelium is additive and results in worse outcomes in an already critically ill population.

Session XVI: Quickshot Session II 14-26
Quickshot 23: 10:34 AM – 10:40 AM

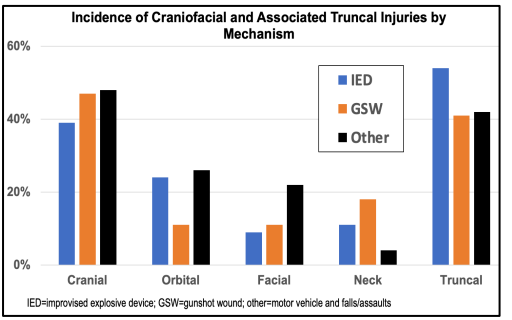
THE NEW FACE OF WAR: CRANIOFACIAL INJURIES FROM OPERATION INHERENT RESOLVE

Neubauer DC, MD; Camacho M, MD; O'Reilly EB, MD; Brice M, DO; Gurney JM, MD; Martin MJ; MD; Naval Medical Center San Diego
Invited Discussant: Joseph Galante, MD

Introduction: During the last 20 years of conflict in the Middle East, improvements in body armor and the use of improvised explosive devices has resulted in an increased incidence of complex craniofacial trauma (CFT). Currently, CFT comprises up to 40% of all casualties. We present new data from the recent conflict in Iraq and Syria during Operation Inherent Resolve.

Methods: Data was collected for patients treated at Role 1, Role 2, and Role 3 facilities in Iraq and Syria over a one-year period. During this time, a specialized Head & Neck surgical augmentation team was deployed and co-located with the central Role 3 facility. Data included: injury type and mechanism, triage category, initial managing facility and subsequent levels of care, and procedures performed.

Results: Ninety-six patients sustained CFT over the study period. The most common injuries were soft tissue (57%), followed by cranial (44%) and orbital/facial (31%). Associated truncal and/or extremity injuries were seen in forty-six patients (48%). There were marked differences in incidence and pattern of injuries between mechanisms (Figure, all $p<0.05$). While IEDs had the highest rate of cranial and truncal injuries, GSW and blunt mechanisms had higher incidences of orbital/facial and neck injuries. Overall, 45% required operative interventions including complex facial reconstruction, craniotomy, and open globe repair. Mortality was 6% with 83% due to associated severe brain injury. Most patients were local nationals (70%) who required discharge or transfer to the local healthcare system.



Conclusion: Complex craniofacial trauma is increasingly seen by deployed surgeons, regardless of subspecialty training or location. Deployment of a centrally located Head & Neck team greatly enhances the capabilities for forward deployed management of CFT, with excellent outcomes for both U.S. and local national patients.

Session XVI: Quickshot Session II 14-26
Quickshot 24: 10:40 AM – 10:46 AM

LIFE THREAT DURING ASSAULTIVE TRAUMA: CRITICAL PERI-TRAUMATIC RISK FACTORS FOR INJURED PATIENTS

Sydney Timmer-Murillo, MS; Andrew T. Schramm, PhD; Terri A. deRoon-Cassini, Ph.D.; Medical College of Wisconsin
Invited Discussant: Tracey Dechert, MD

Introduction: Rates of PTSD among injury survivors are higher relative to the general population. Screening while hospitalized has improved identification of those most at-risk for PTSD following injury. Yet, more is needed to identify which specific factors lead to the quickest and most parsimonious risk identification. The current study evaluated whether trauma type (assaultive vs. non-assaultive) and perceived life threat during the trauma combined led to greater PTSD symptom cluster endorsement 1 month and 6 months post-injury.
Methods: Data were combined from two prospective longitudinal studies of adult injured trauma survivors admitted to two level 1 trauma centers. While hospitalized, participants completed a screening measure assessing perceived life threat during trauma. Mechanism of injury (MOI) was collected via record review and was collapsed into two categories: assaultive and non-assaultive. The Clinician Administered PTSD Scale (DSM-5) was administered at 1 month and 6 months after injury.
Results: Four 2 (time) X 2 (life threat) X 2 (trauma type) analyses of variance (ANOVA) examined whether life threat and assaultive trauma led to greater symptoms across the four PTSD symptom clusters (intrusions, avoidance, hyperarousal, and negative mood) at 1 and 6 months post-injury. Results showed significant interaction effects of life threat, trauma type and time for intrusive symptoms, $F(1, 82) = 7.63$, $p = .008$, $\eta\ 2 = .08$, and avoidance symptoms, $F(1, 82) = 7.75$, $p = .007$, $\eta\ 2 = .09$. Individuals with life threat during assaultive traumas maintained heightened intrusive symptoms across time and increased avoidance at 6 months. On the other hand, participants with either life threat or assaultive traumas had decreased symptoms at 6 months. Additional findings across symptom clusters also found.
Discussion: Individuals with assaultive traumas who experienced life threat may represent a specific at-risk group following injury. This study highlights a need to assess for these peri-trauma factors and supports early intervention targeting avoidance and intrusive symptoms in this group.

Session XVI: Quickshot Session II 14-26
Quickshot 25: 10:46 AM – 10:52 AM

ACUTE STRESS DISORDER IN TRAUMA PATIENTS DISCHARGED IN 72 HOURS OR LESS

Aaron Veenis, B.S.; Bachar Halimeh, M.B.B.S.; Robert D Winfield, M.D., F.A.C.S.; University of Kansas Medical Center
Invited Discussant: Cherisse Berry, MD

Introduction: Acute Stress Disorder (ASD) is a psychiatric condition affecting individuals exposed to real or perceived trauma. ASD affects up to 33% of patients admitted following injury and is associated with subsequent post-traumatic stress disorder (PTSD), but diagnosis requires the presence of symptoms at 72 hours following the traumatic event. Many patients evaluated for traumatic mechanisms are discharged prior to 72 hours, but the risk of ASD remains. The aim of this study was to quantify the prevalence of acute stress disorder in trauma patients admitted for fewer than 72 hours.
Methods: We performed a prospective, observational study of trauma patients discharged prior to 72 hours following injury at our ACS Level I Trauma Center between June 2020 and December 2020. Participants were administered an institutional screening tool via telephone following hospital discharge. Those screening positive were then administered the diagnostic Acute Stress Disorder Scale (ASDS) tool. The rate of acute stress disorder was calculated and bivariate comparisons between participants who met diagnostic criteria and those who did not were performed to identify risk factors for the development of acute stress disorder.
Results: During the study period, 693 patients were evaluated for trauma, with 335 discharged prior to 72 hours. 133 patients were enrolled in the study, with 116 patients ultimately participating. Overall, subjects had a median age of 54, were largely male (66%), and had a median injury severity score (ISS) of 9. Forty patients (34%) screened positive via the institutional screening tool, with 14 (12%) ultimately demonstrating ASD by ASDS. Participants who developed ASD were more likely to be female (71 vs. 30%, p=0.05), African American (43 vs. 12% White, p=0.016), spend less time in the hospital overall (1-2 vs. 2-3 days. p=0.045), and have a lower ISS (6 vs. 9, p=0.041).
Conclusions: A significant number of trauma patients discharged prior to 72 hours develop ASD. While the physical injuries may not require extended hospitalization, these data emphasize the need for reassessment of injured patients following discharge and the importance of developing pathways for trauma patients to access mental health resources.

Session XVI: Quickshot Session II 14-26
Quickshot 26: 10:52 AM – 10:58 AM

EARLY PREDICTORS OF POST DISCHARGE DEATH IN THE ELDERLY TRAUMA POPULATION TO GUIDE PALLIATIVE CARE DISCUSSIONS

Andrew H. Chang, BS; Katie Love Bower, MD; Sarah A. Dewitt, MD; Karen N. Kuehl, MD; Tonja Locklear, PhD; Bryan R. Collier, DO; Carilion Clinic
Invited Discussant: Ashley Meagher, MD, MPH

Introduction: Geriatric trauma patients are at higher risk for both inpatient and post-discharge mortality(PDM). Patients at high risk would benefit from early goals of care discussion, however this population remains poorly characterized. This study aims to identify admission variables that predict PDM within 30 days to help determine prognosis early in a patient's hospital stay. We hypothesize that pre-injury functional status and injuries of the head will predict post-discharge mortality in geriatric trauma patients.
Methods: Patients $\geq$ 65 y admitted between 7/2008 and 12/2017 were identified in a level I trauma registry. Patient identifiers were used to extract and merge National Death Index data with registry data. Four mortality outcomes were investigated: inpatient death, death $\leq$ 30 days post discharge, 31-180 days, and 181-365 days. Cox regression was used in each outcome group combined with patients who survived >365 days to determine hazard ratios of our predictor variables, including, but not limited to: Age, gender, hospital length of stay, Glascow Coma Score(GCS), baseline functional independence measure(FIM), and abbreviated injury scale(AIS).
Results: Of 3617 patients were identified, 881 (24%) died within 1 year. Among those deaths, 233 (26%) died during their hospital admission, 194 (22%) died within 30 days post discharge, 285 (32%) died 31-180 days, and 169 (19%) died between 181-365 days. Older age, male gender, lower GCS, and lower FIM had significant hazard ratios in all outcomes. Specific to 30-day PDM, patients were 22% more likely to die for each point increased in AIS head/neck (HR 1.22, 95% CI 1.03-1.44) and 19% more likely to die for each point increase in AIS extremities (HR 1.19, 95% CI 1.02-1.38).
Conclusion: Most deaths among geriatric trauma patients occur post discharge. Over half of those deaths occur within 6 months, making them Hospice-eligible at the time of discharge from the hospital. Patients with baseline functional disability who suffer severe injuries to the head or extremities are at highest risk and should be targets for early goals of care conversations and recommendations that involve palliation.

AAST Posters

Poster #1

IMPACT OF TRANSFUSING PACKED RED BLOOD CELLS THROUGH A RAPID INFUSER ON POTASSIUM LEVELS

John D. Cull MD; John Whitcomb PhD; Alex Ewing PhD; Ashley Metcalf BS; Debra Kitchens BS; John Reddic PhD; Wesley Liao MD; Benjamin Manning MD
University of South Carolina

Introduction: Hyperkalemia may be associated with transfusion of packed red blood in trauma patients. Currently available rapid infusers have the capability of infusing blood up to 500 ml/minute. To our knowledge, no study has evaluated mechanical hemolysis as a possible source of hyperkalemia due to the rate of infusion in trauma patients. The purpose of this study is to determine if high rates of blood transfusion impacts potassium levels in the blood.

Methods: Two baseline samples were obtained to measure potassium and hemolysis scores in 12 units of expired blood prior to infusion. This expired blood was then infused via the Belmont® Rapid Infuser into collection bags at varying rates of infusion (50 ml/min, 100 ml/min, 250 ml/min, 500 ml/min) utilizing different catheter sizes (18 gauge catheter, 16 gauge catheter, and cordis catheter). Two post infusion blood samples were collected and tested for potassium and hemolysis scores and compared to pre-infusion values. This process was then repeated with blood less than 14 days old (fresh blood). Samples were analyzed on an Abbott Architect c8000 autoanalyzer.

Results: The potassium levels of the two samples taken from each unit prior to infusion (average difference 0.245) and after infusion (average difference 0.08) correlated well. There was no difference in potassium levels pre and post infusion at any rate of infusion even after accounting for catheter size and age of blood (See table 1). The median potassium of the fresh blood was 5.025 prior to infusion and 4.875 after infusion. The median potassium level of the expired blood was 16.05 prior to infusion and 16.4 post infusion. There was no significant difference in the hemolysis scores between the pre-infusion and post-infusion samples. The expired blood had higher hemolysis scores compared to the fresh blood.

Conclusion: The hyperkalemia in trauma patients undergoing massive transfusions is not a result of mechanical hemolysis from the high rates of blood infusion. Rate of blood administration should be determined by patient's volume status and not concern for causing hyperkalemia.

Poster #2

OVER-TRIAGE WITH BLOOD FOR SUSPECTED HEMORRHAGE IS NOT ASSOCIATED WITH WORSE CLINICAL OUTCOMES

Rondi Gelbard MD; Russell Griffin MD; Jeffrey Kerby MD, PhD; Parker Hu MD; Rindi Uhlich MD; Jeffrey Warner BS; Peter Abraham MD; Marisa Marque, MD; Jan Jansen MBBS, PhD; John Holcomb MD
University of Alabama at Birmingham

Introduction: For trauma patients in hemorrhagic shock, delayed blood transfusion can lead to higher mortality, while unnecessary transfusion has been associated with worse clinical outcomes. We evaluated patient outcomes after early, small volume blood transfusion in the setting of presumed hemorrhagic shock. We hypothesized that over-triage with even small amounts of blood would be associated with a higher risk of complications.

Methods: Retrospective review of trauma patients admitted to a Level 1 trauma center between 2016 and February 2021. Data on red blood cell (RBC) units (U) transfused and massive transfusion protocol (MTP) activation were collected. Patients predicted to require MTP who survived ≥72 hours were categorized according to units of RBCs transfused in the first 24h: 0, 1-3, 4-9, ≥10U. Patients that received whole blood were excluded. A Cox regression model stratified by dichotomized ISS and adjusted for blunt injury mechanism and initial pulse >120bpm was used to estimate hazard ratios (HRs) for the outcomes of interest.

Results: Of the 22,998 trauma patients admitted during the study period, 8,347 were included. Of these, MTP was activated in 834/8347 (9.9%): 18% (154/834) received 0U, 28% (234/834) 1-3U, 34% (285/834) 4-9U and 19% (161/834) ≥10U of RBCs. Mean ISS increased with each category of RBC transfusion. There was no significant difference in the risk of acute kidney injury (AKI), acute respiratory distress syndrome (ARDS), infectious complications, cardiac arrest, venous thromboembolic events or stroke for patients receiving 1-3U of RBCs compared to the 0U or 4-9U groups ($p>.05$). Compared to those receiving ≥10U, the 1-3U group had a significantly lower risk of AKI (HR 0.22, 95% CI 0.09-0.53), ARDS (HR 0.12, 95% CI 0.02-0.97); and cardiac arrest (HR 0.17, 95% CI 0.05-0.61).

Conclusion: Early empiric blood transfusion for presumed hemorrhagic shock may subject patients to over-triage with blood. Among patients meeting current clinical triggers for massive transfusion, receiving 1-3 units of allogeneic blood is not associated with worse outcomes.

Poster #3

A COMPARISON OF WHOLE BLOOD VERSUS COMPONENT THERAPY IN CIVILIAN TRAUMA PATIENTS

Emilio Ramos, BS; Marc D Trust, MD; Pedro Teixeira, MD; Jayson Aydelotte, MD; Tatiana Cardenas, MD, MS; Sadia Ali, MPH; Chole Ng, MPH; Lawrence Brown, PH.D.; Marielle Ngoue, BS; Carlos VR Brown, MD

Dell Seton Medical Center at the University of Texas

Introduction: Despite promising data in the military setting, civilian studies comparing whole blood (WB) and component therapy (CT) are limited. Furthermore, data regarding the use of WB in massively transfused patients are also limited. The purpose of this study was to compare outcomes in trauma patients before and after implementation of a WB program at a civilian trauma center. We hypothesized that patients receiving WB would have lower mortality and receive less blood products.

Methods: We performed a single center cohort study of adult male trauma patients who received blood products upon admission to our ACS-verified, urban, level 1 trauma center. Patients who received initial resuscitation with two units of WB followed by CT were prospectively collected and compared to two years of historic control patients who received only CT blood products. Primary outcomes included mortality as well as total blood product cost and volume transfused (including WB, packed red cells, plasma, platelets). Secondary outcomes were ICU and hospital length of stay (LOS).

Results: We identified 295 patients that met inclusion criteria (90 WB and 205 CT). Patients who received CT were older (45 vs 39 years old, p=0.005), more Caucasian (79% vs 67% p=0.03) and had more severe extremity injuries (AIS 2±1.6 vs 1.5±1.4, p=0.02). There were no other significant differences in patient demographics or injury patterns. Outcomes in the table.

	CT (n=205)	WB (n=90)	P-Value
Mortality	38 (19%)	16 (18%)	0.88
Hospital LOS (days)	15 ± 17	15 ± 20	0.94
ICU LOS (days)	9 ± 13	8 ± 9	0.39
Transfusion volume (liters)	5.5 ± 9.4	4.6 ± 5.7	0.43
Cost	$3,407±$5,522	$2,798±$3,313	0.33

Analysis of a subset of patients who received massive transfusion (n=140) also showed no differences in mortality (21% CT vs 27% WB, p=0.47), cost ($5,643±7163 CT vs $4,703±4,030 WB, p=0.43), or transfusion volume (9.4±12.4 L CT vs 8.0±7.0 L WB, p=0.51).

Conclusion: Initial resuscitation of trauma patients with two units of WB is not associated with reduced mortality or blood product cost and utilization. Future studies should evaluate the use of higher volumes of WB in civilian trauma patients.

Poster #4

A MULTICENTER STUDY ON MASSIVE BLOOD TRANSFUSION THRESHOLDS AMONG SEVERELY INJURED PATIENTS

Darwin Ang MD, PhD, MPH; Samir Fakhry MD; Dorraine Watts PhD, RN; Huazhi Liu MS; Jennifer Morse, BS; John Armstrong MD; Michele Ziglar MSN; Joseph Restivo DO; David Plurad MD; Stanley Kurek DO; Ernest Gonzales MD
Ocala Regional Medical Center

The COVID-19 pandemic has created a donation shortage of blood products. Massive transfusion protocols (MTP) for severe hemorrhage can rapidly reduce institutional and regional blood availability. The purpose of this study is to provide data-driven guidance for the use and triage of the MTP when the blood supply is severely limited.

This is a retrospective cohort study of 47 Level I and II trauma centers (TC) within a single health system whose patients received MTP from 2017-2019. All TC used a unifying MTP protocol for balanced blood product transfusions. The primary outcome was mortality as a function of volume of blood transfused and age. Hemoglobin thresholds and measures of futility were also estimated. Risk adjusted analyses were performed using multivariable and hierarchical regression to account for confounders and hospital variations.

MTP volume thresholds for three age cohorts were identified: 60 units for ages 16-30, 48 units for ages 31-55, and 24 units for > 55 years. For all age groups, the range of mortality less than the transfusion threshold was 30-36%, but doubled to 67-77% when the threshold was exceeded. Hemoglobin concentration differences relative to survival were clinically insignificant. Prehospital measures of futility were pre-hospital cardiac arrest and non-reactive pupils. In-hospital risk factors of futility were midline shift on brain CT and cardio-pulmonary arrest.

MTP practices under blood shortage conditions, such as the current COVID 19 pandemic, could sustain blood availability by following thresholds for MTP use according to age group.

Poster #5

DEFINING THE SUPERMASSIVE TRANSFUSION IN US AND COALITION FORCES DURING COMBAT OPERATIONS IN AFGHANISTAN AND IRAQ

Andrew D. Fisher, MD; Jason Lavender; Michael D. April, MD, DPhil, MSc; Matthew A. Borgman, MD; Ronnie Hill; James Bynum, PhD; Steven G. Schauer, DO, MS
University of New Mexico School of Medicine

Introduction: Hemorrhage is the leading cause of potentially preventable death on the battlefield. After hemorrhage control, resuscitation with blood products is essential to restore circulating volume, repay the oxygen debt, and prevent coagulopathy. While massive transfusion (MT) occurs frequently after major trauma, the characteristics of the subset of casualties requiring super massive transfusion (SMT) and thus mobilization of additional resources remains unclear. We seek to describe this population.

Methods: This is a secondary analysis of a previously described dataset from the Department of Defense Trauma Registry. In this analysis, we isolated US and Coalition casualties that received at least 1 unit of packed red cells (PRBC) or whole blood (WB). To describe the SMT recipients, we included those patients receiving the top quartile of total products administered within the first 24 hours following arrival to a military treatment facility.

Results: There were 28,950 casualties from 01 January 2007 through 17 March 2020, of which 10,172 were US military or Coalition forces. Of these, 2,608 received at least one unit of packed red blood cells or whole blood and met inclusion for this analysis. The median number of units transfused was 8 (IQR 4-18). Using a threshold of 18, our SMT group had 666 casualties. The median age was 24 in both groups with similar for US military (Baseline 81.6% versus SMT 79.7%, $p=0.269$). Most were battle injuries (92.5% versus 95.9%, $p=0.002$) and injured by explosives (68.6% versus 84.9%, $p<0.001$). The median ISS was 18 versus 27 in the SMT cohort ($p<0.001$). Survival to discharge was 93.3% in the baseline cohort versus 85.8% in the SMT cohort ($p<0.001$). Vital signs and laboratory values were worse in the SMT group. The SMT cohort received larger quantities of all blood products including WB, PRBCs, platelets, cryoprecipitate, and fresh frozen plasma. On an analysis of associated injury patterns, the SMT cohort was more likely to have injuries to the thorax (Odd Ratio 1.55), abdomen (2.39), extremities (4.93), and skin (2.70).

Conclusions: Compared to all other PRBC and WB recipients, SMT patients experienced more severe injury patterns, ED vital sign derangements, and mortality. More data is needed to define this population early in their clinical course for early identification to facilitate rapid resource mobilization.

Poster #6

RELATIONSHIP OF POST-RESUSCITATION HEMOGLOBIN TO FUTURE BLOOD TRANSFUSION NEEDS

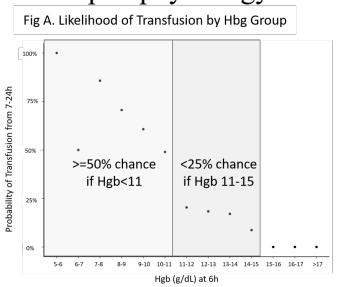
AnaMaria J Robles, MD; Zhuowei Cheng, MS; Zachary A Matthay, MD; Brenda Nunez-Garcia, MA; Lucy Z Kornblith, MD; Linda Petzold, PH.D.; Rachael A Callcut MD, MSPH, FACS
University of California, Davis Medical Center

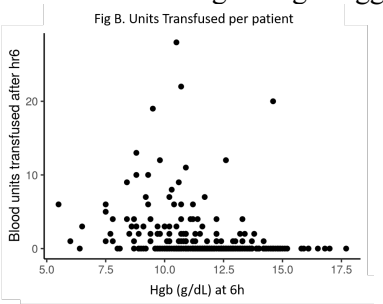
Introduction: Goal post-resuscitation (PR) hemoglobin (Hgb) remains unclear in the 24 hours (h) following injury. Although guidance exists for stable all-comer critically ill patients (Hgb>=7), no clear criteria exists in the first 24h for injured patients. With empiric balanced resuscitation protocols, concerns about 'over-transfusion' exist given initial PR Hgbs of 9-11g/dL. This study investigates the relationship between PR Hgb & subsequent likelihood of packed red blood cell (PRBC) transfusion out to 24h.

Methods: Adult highest-level trauma activations enrolled in a prospective cohort study who were alive at 6h & had a PR Hgb were included. PR Hgb was defined as the Hgb 6h from initial presentation. Demographics, injury characteristics, vital signs, lab data, and complications were collected. Those receiving & not receiving PRBC transfusion at 6-24h were compared.

Results: 282 patients were alive at 6h (median ISS 26, age 38y, 70% blunt). Between 6-24h, 32% were transfused PRBCs. 28-day survival was 87%. Likelihood of PR PRBC transfusion was inversely correlated to 6h Hgb reaching at least a 50% chance if Hgb<11g/dL (Fig A). There was no trend difference by mechanism. Median PR PRBC units(u) transfused was 2 if Hgb<11g/dL vs. 0 for Hgb>11g/dL (p<0.001), with 24% receiving >4u if Hgb<11g/dL (Fig B).

Conclusion: Applying transfusion criteria of Hgb<7g/dL is likely not appropriate in the 24h post-injury. Initial PR transfusion practices should be based upon physiology in combination with a higher Hgb trigger threshold.





Poster #7

RESUSCITATIVE ENDOVASCULAR BALLOON OCCLUSION OF THE AORTA IMPROVES SURVIVAL IN HEMORRHAGIC SHOCK

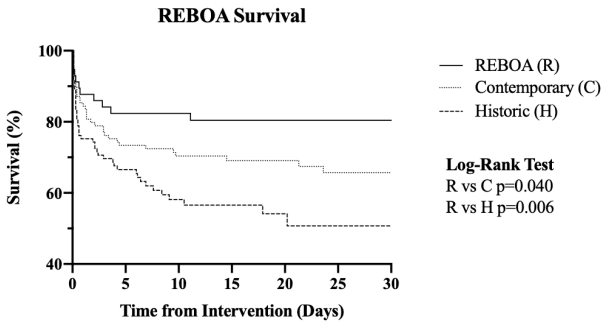
Melike N Harfouche MD; Marta J Madurska MD; Noha Elansary BS; Hossam Abdou MD; Eric Lang BS; Joseph J DuBose MD; Rishi Kundi MD; Thomas M Scalea MD; Jonathan J Morrison MD
University of Maryland, Shock Trauma Center

Objective: Resuscitative Endovascular Balloon Occlusion of the Aorta (REBOA) is controversial as a hemorrhage control adjunct due to lack of data with a suitable control group. We aimed to determine outcomes of trauma patients in shock undergoing REBOA versus no-REBOA.

Methods: This single-center, retrospective, matched cohort study analyzed patients >16 years in hemorrhagic shock without cardiac arrest (2000-2019). REBOA (R; 2015-2019) patients were propensity matched 2:1 to historic (H; 2000-2012) and contemporary (C; 2013-2019) groups. In-hospital mortality and 30-day survival were analyzed using chi-squared and log rank testing, respectively.

Results: A total of 39,390 patients were included (R=57, C=25,410, H=13,923). Propensity scores were assigned using age, race, mechanism, lowest systolic blood pressure, lowest Glasgow Coma Score (GCS), and body region Abbreviated Injury Scale scores to generate matched groups (R=57, C=114, H=114). Mortality was significantly lower in the REBOA group (19.3%) compared to the contemporary (35.1%; p=0.024) and historic (44.7%; p=0.001) groups. 30-day survival was significantly higher in the REBOA versus no-REBOA groups.

Conclusion: In a high-volume center where its use is part of a coordinated hemorrhage control strategy, REBOA improves survival in patients with noncompressible torso hemorrhage.



Poster #8

TYPE O BLOOD IS A RISK FACTOR FOR SYSTEMIC HYPERFIBRINOLYSIS AND MASSIVE TRANSFUSION

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Introduction: Von Willebrand factor (VWF) levels are 25–35% lower in blood type O. VWF's functions include attachment to platelets and binding FVIII. We hypothesize that patients with type O are more likely to present with trauma-induced coagulopathy.

Methods: Adult trauma activations with known blood type in a Level I trauma center with field SBP<90mmHg were studied. The relationships of blood group O vs. non-O to PT/INR, PTT, fibrinogen, D-dimer, r-TEG, and massive transfusion (MT, >4U RBC or ≥1U RBC + death/1hr postinjury), ventilator-free days, and mortality were adjusted for confounders (univariately associated with Type-O with $p<0.25$). Fibrinolysis in the setting of hypotension was defined as (Hyperfibrinolysis (HF) LY30>3%; Shutdown (SD) LY30<0.9%). A subset of patients (n=212, 79.1%) with available plasma had VWF activity quantified on a STAGO apparatus.

Results: 268 patients (42.9% Type-O, 57.1% blunt injury, median age 33.9 years, 78.7% M, and median NISS=25) met criteria. Type-O patients had lower mean VWF activity (222.4±8.072% vs. 249.2±9.748%, $p=0.01$). There were no differences in risk factors between groups, except NISS (O: 27; Non-O: 22, $p=0.14$) and blunt mechanism (O: 64.3%; Non-O: 51.6%, $p=0.04$). After adjustment for NISS and blunt mechanism, Type-O had higher odds of HF (OR: 1.94, 95%CI:1.09-3.47; Pearson GOF test, $p=0.56$) and increased odds of MT (OR: 3.02, 95%CI:1.22-7.49; AUROC: 0.82; 95%CI:0.72-0.92).

Conclusions: Type-O patients with injury-related hypotension are at higher risk for HF and MT after adjustment for NISS and mechanism. This suggests that patients with Type-O and/or receiving Type-O should be monitored closely for HF to attenuate their increased risk of MT.

Poster #9

WHOLE BLOOD IMPACT ON A TRAUMA CENTER: DECREASED TRANSFUSIONS DESPITE INCREASED PATIENT VOLUME

Parker Hu MD; Rondie Gelbard MD; Rindi Uhlich MD; Daniel Cox MD; Jan Jansen MBBS, PhD; Marisa Marques MD; Jeffrey Kerby MD, PhD; John Holcomb MD
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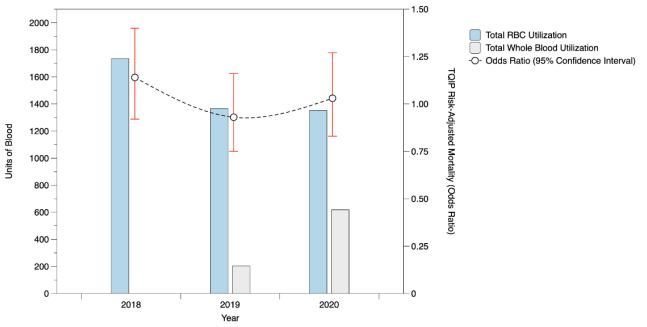
Introduction: The number of civilian trauma centers using whole blood (WB) for resuscitation is increasing. While improvement in patient outcomes has been described, the impact of WB on overall blood product utilization is relatively unknown. We sought to evaluate the global changes to our trauma program after the introduction of WB to our initial trauma resuscitations.

Methods: WB was introduced at our center in 2019. Blood bank records were used to measure service level trends in annual blood product utilization while TQIP was utilized to identify mortality and complication rates before and after WB implementation.

Results: From 2018-2020, there were 15,162 trauma activations with 11,527 admissions, both increasing annually. Risk adjusted mortality decreased over the study period (OR 1.14 vs. 1.03 for pre- and post-WB, respectively). The median number of RBCs (4 [2,10] vs 3 [2,6]) and FFP (4 [2-9] vs 3 [2,6]) transfused within 4 hours to patients with hemorrhagic shock declined from 2018 to 2020, while the median units of WB increased from 0 [0,0] to 4 [2,4]. The total number of RBCs transfused to trauma patients declined every year from 2018 (1735 units) to 2020 (1351 units). Over the same period, the number of units of WB increased (0 to 618). The average combined number of units of RBCs and WB per admission fell from 0.48 to 0.47 from 2018 to 2020.

Conclusion: Implementation of a WB resuscitation program for trauma corresponded with an increase in patient volume but decrease in overall blood utilization at our trauma center.



Poster #10

WHOLE BLOOD IN MASSIVE TRANSFUSION PROTOCOL LOWERS BLOOD USE WITH MARGINAL INCREASE IN COST

Parker Hu, MD; Rindi Uhlich, MD; Russell Griffin, PH.D.; Marisa Marques, MD; Daniel Cox, MD; Jeffrey Kerby MD, PhD; John Holcomb, MD, FACS; Jan Jansen, MBBS, PhD
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Introduction: A limitation to use of whole blood (WB) in civilian trauma is increased unit cost. However, WB may decrease overall blood product requirements. We compared the cost of blood products and outcome before and after adding WB to our massive transfusion protocol (MTP).

Methods: Retrospective review of patients receiving MTP from 10/2018-05/2020. Equal cohorts evaluated comparing patients receiving components only (COMP-MTP) and whole blood plus components (WB-MTP). Costs obtained from the blood bank. Repeated measures ANOVA used to compare patients on MTP type and length of stay to account for survival bias. Piecewise Cox regression used to estimate mortality.

Results: 229 patients were included (141 COMP-MTP, 88 WB-MTP). WB-MTP received significantly fewer units of RBCs (5.6±0.8 vs. 9.1±1.0; p=0.04), FFP (5.2±0.6 vs. 8.1±0.8; p=0.03), and platelets (0.5±0.1 vs. 1.3±0.1; p=0.03) compared to COMP-MTP within 3 hours. No differences in product utilization from 3-24 hours or mortality rates. Total costs were higher for WB-MTP compared to COMP-MTP at 24 hours (Table 1)

Conclusion: Adding WB to the MTP decreased early blood product utilization with minimal increase in average cost of all transfused products.

Table 1: Comparison of Mean Blood Product Acquisition Costs Between Patients with and without Whole Blood in Massive Transfusion.

		COMP-MTP (n = 141)	WB-MTP (n = 88)
Whole Blood	24 Hour	$0	$2,125.00
	7 Day	$0	$2,125.00
Packed Red Blood	24 Hour	$2,292.20	$1,343.18
Cells	7 Day	$2,740.43	$1,647.73
Fresh Frozen	24 Hour	$395.18	$245.91
Plasma	7 Day	$427.80	$270.00
Platelets	24 Hour	$964.54	$431.82
	7 Day	$1,138.30	$528.41
Total Product	24 Hour	$3,651.91	$4,145.91
Acquisition Costs	7 Day	$4,306.52	$4,571.14

*Adjusted for race, sex, severe traumatic brain injury, and Injury Severity Score

Poster #11

HYPERGLYCEMIA IN NON-DIABETIC ADULT TRAUMA PATIENTS IS ASSOCIATED WITH WORSE OUTCOMES THAN DIABETIC PATIENTS: AN ANALYSIS OF 95,770 PATIENTS

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Introduction: The adverse impact of acute hyperglycemia is well documented but its specific effects on non-diabetic trauma patients are unclear. The purpose of this study was to analyze the differential impact of hyperglycemia on outcomes between diabetic and non-diabetic trauma inpatients.

Methods*:* Adults admitted 2018-19 to 45 Level I/II trauma centers with ≥2 blood glucose tests (BGT) were analyzed. Diabetes status was determined from ICD-10, trauma registry and/or HbA1c >6.5. Patients with and without ≥1 hyperglycemic result >180 mg/dL were compared. Logistic regression examined the effects of hyperglycemia and diabetes on outcomes, adjusting for age, gender, ISS & BMI.

Results*:* There were 95,770 patients: male 54%, mean age 61, mean ISS 10, diabetic 21%. Patients with hyperglycemia had higher mortality and worse outcomes compared to those without hyperglycemia (Table). Non-diabetic hyperglycemic patients had the highest odds of mortality (Diabetic: aOR: 2.1, 95% CI: 1.7-2.7, Non-diabetics aOR: 7.5, 95% CI: 6.8-8.4).

Conclusions*:* Hyperglycemia is associated with increased odds of mortality in both diabetic and non-diabetic patients. Hyperglycemia during hospitalization in non-diabetics was associated with the worst outcomes and represents a potential opportunity for intervention in this high-risk group.

	Diabetic		Non-Diabetic	
	Hyperglycemic	**Not Hyperglycemic**	**Hyperglycemic**	**Not Hyperglycemic**
	n=14,724 (15%)	n=5,761 (6 %)	n=9,380 (10 %)	n=65,905 (69%)
ISS (mean score)	9.7*	8.6	16.2*	9.3
Age (mean years)	70.5*	71.2	58.2	58.5
Male (%)	50.9*	46.7	60.9*	54.7
LOS (mean days)	6.9*	4.4	11.4*	5.0
ICU stay (% yes)	40.2*	35.0	68.6*	35.1
Mortality (%)	3.9*	1.6	14.6*	1.1
Sepsis (%)	0.5*	0.1	1.0*	0.1

*Group differs statistically from not hyperglycemic patients with same diabetes status (ref.) at p<.05

Poster #12

ANTECEDENT TRAUMATIC INJURIES INDEPENDENTLY PREDICT HIGHER 90-DAY MORTALITY FOR PATIENTS ADMITTED TO THE ICU WITH SURGICAL SEPSIS

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Ohio State University

Introduction: Patients admitted with traumatic injuries are at high risk for sepsis due to their acutely dysregulated immune responses, which can alter the severity of the septic insult. It is unclear how this additive insult changes the course of severe sepsis. The primary objective of this study was to compare in-house mortality between patients with and without antecedent trauma for those admitted to the surgical ICU (SICU) with sepsis.

Methods: All patients admitted to the SICU with a diagnosis of sepsis (Sepsis III) were reviewed at a single academic institution between 2014-2019 (n=1489). Demographics, comorbidities, and sepsis presentation were compared between patients with an acute, preceding traumatic injury (n=111) and those without (n=1378). The primary outcome was 90-day mortality; secondary outcomes included respiratory failure (RF), hospital length of stay (LOS) and discharge disposition. A Cox proportional hazards model was performed to calculate hazards ratios for predictors of 90-day mortality. A p value <0.05 was considered significant.

Results: The trauma cohort was younger (60.1 +/- 14.8 years vs. 56.8 +/- 20.0 years, p=0.03), more likely to be male (68.5% vs. 54.5%, p=0.004), and have less median comorbidities (Charlson Comorbidity Index 2 (0-4) vs 4 (2-6), $p<0.005$) compared to the non-trauma cohort. In-house mortality was significantly higher for the trauma cohort (30.6% vs 22.5%, p = 0.05). Compared to critically-ill patients without an antecedent trauma, the trauma cohort also exhibited higher median overall LOS (25 (12-40) days vs 19 (10-31) days, $p<0.005$), rates of RF (92.8% vs 70.5%, $p <0.005$), and were less likely to be discharged home (13.0% vs 28.8%, p = 0.03). Compared to the non-trauma cohort, trauma status was associated with an over two-fold increase in the Hazards ratio for 90-day mortality (HR: 2.23, 95th CI: 1.5-3.22, $p <0.005$), after adjusting for age, sex, medical comorbidities, obesity and SOFA score.

Conclusion: Our data suggests that traumatic injuries predispose patients to worse outcomes following sepsis, despite having favorable characteristics such as younger age, less medical comorbidities, and reduced SOFA scores. This suggests that the sepsis profile associated with trauma may be unique from other patients with surgical sepsis. Further data is needed to delineate specific risk factors that can assist with earlier identification and treatment for this cohort.

Poster #13

DELRIUM RISK IN GERIATRIC ARTHROPLASTY (DRIGHA). DEVELOPMENT AND VALIDATION OF A NOVEL SCORE USING NATIONAL DATA

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Background: The incidence of delirium in geriatric patients after a hip arthroplasty has been reported up to 55%. In-hospital delirium results in prolonged hospital course and increase morbidity and mortality. The purpose of the study was to identify the risk factors and create a scoring system for the point of care physician to minimize the risk.

Methods: The National Surgical Improvement Program (NSQIP) database was accessed for the study. Included in the study were all geriatric patients age 65 years and older who underwent hip arthroplasty. First, the data were compared between the group who developed delirium and the group who did not develop delirium. Multivariable analysis was performed to identify the risk of delirium using all the available information including demography, timing of surgery, comorbidities and infective complications. Eighty percent of the data were used to develop the model and 20% data were used to validate the risk model. A Receiving Operating Characteristics (ROC) curve was created and Area Under the Curve (AUC) was calculated with 95% confidence interval (CI). A delirium risk in geriatric hip arthroplasty (DRIGHA) score was created from the β coefficient of the variables, multiplied by the factor 10, and rounded to the nearest whole number. All p values were two sided and a p value <0.01 was considered statistically significant.

Results: Out of 36,090 patients who qualified for the study, 9,980 (27.7%) patients developed in-hospital delirium. There were significant differences found on many variables in univariate analysis. Our risk model showed advanced age, male gender, prior history of delirium and dementia, certain comorbidities and lack of mobility after the surgery were associated with higher incidence of in-hospital delirium. The area AUC was 0.79 (95% CI, 0.79-0.80) means the model is good for predicting the delirium. Our DRIGHA score goes from 0-80 and the predictability of delirium goes from 6.5% to 99.9%.

Conclusion: The incidence of in-hospital delirium after hip arthroplasty was ~ 28%. Certain demography characteristics, comorbidities and infective complications were associated with higher risk of developing in-hospital delirium. DRIGHA score can be calculated at the bedside to identify the high-risk patients.

Poster #14

IMPACT OF EARLY MICROBIAL CULTURES IN TRAUMA PATIENTS ADMITTED TO THE ICU

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University of Wisconsin School of Medicine and Public Health

Introduction: Sepsis is a common, life-threatening condition following trauma that is associated with high mortality. Early diagnosis and treatment of the underlying source of sepsis improves survival. However, the diagnosis of sepsis in trauma patients can be complicated by concomitant systemic inflammatory response secondary to tissue injury. The purpose of the study was to examine the rate at which microbial cultures are positive in trauma patients at presentation.

Methods: Adult (Age ≥ 16 years) patients with an Injury Severity Score (ISS) of ≥ 9 admitted to the Intensive Care Unit at a level I trauma center over a five-year period were included in a retrospective cohort. Demographic, clinical, injury-related characteristics, and results of all microbial cultures (urine, blood, bronchoalveolar lavage/tracheal aspirate) were abstracted. The primary outcome was fraction of patients where cultures were obtained (patients with cultures sent/all patients) on each day in the hospital. The secondary outcome was fraction of those cultures that yielded positive results (patients with positive culture/all patients with cultures sent). Comparisons between fractions over days were performed using the chi-square test.

Results: Of a total of 12,321 patients, 1,604 met the study criteria. The median age was 55 years and 71% of patients were male. The median ISS was 22. On day one, 66/1,604 patients (4%) were cultured and this rate increased to 113/1562 (7%) on day two ($p<0.001$). However, fraction of cultures positive was 49% (32/66) on day one and it decreased to 37% (42/113) on day two ($p=0.138$). Of the 38 positive cultures on day one, most patients (45%) had positive urine cultures (n=17), followed by bronchoalveolar lavage/tracheal aspirate (34%, n=13) and blood (18%, n=7).

Conclusion: Approximately half the cultures sent on the first day were positive in trauma patients admitted to the ICU. Early detection of sepsis in the setting of systemic inflammatory response is important because early treatment and source control may prevent mortality.

Poster #15

IMPROVING ENTERAL NUTRITION DELIVERY IN THE CRITICALLY ILL TRAUMA & SURGICAL POPULATION

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Introduction: Critically ill trauma and surgical patients often fail to achieve adequate enteral nutrition (EN) support. The Society of Critical Care Medicine (SCCM) and the American Society for Parenteral and Enteral Nutrition (ASPEN) jointly recommend that at least 80% of prescribed enteral nutrition therapy should be delivered. A review of our institution's historic performance demonstrated 65% delivery of prescribed EN. Nutrition delivery was improved to 72% of prescribed EN with implementation of a volume-based protocol, however, remained below recommended ASPEN guidelines. Implementation of an evidence-based multidisciplinary protocol has been shown to improve EN delivery in mostly non-surgical patients. An evidence-based multidisciplinary protocol was developed to enhance EN delivery in critically ill trauma and surgical patients. We identified delivery of EN percentage as a quality improvement metric and coupled the outcome to attending physician performance incentive. The protocol aimed to minimize perioperative fasting times, enhance delivery using a volume-based feeding protocol, increase post-pyloric access, minimize cessation of enteral feeding for intolerance, and education implementation. We hypothesized that implementation of this multidisciplinary nutrition enhancement protocol (EP) would result in improved delivery of prescribed EN.

Methods: Data were prospectively captured from the daily rounds and the electronic health record (EHR) and entered into our REDCap (Research Electronic Data Capture) database. Captured data included daily volume of tube feeds, type of tube feeds, reasons for inadequate delivery of EN, calculated daily delivery of EN, and nutritional requirement based on individual energy and protein needs using simplistic weight-based equations as recommended by ASPEN guidelines. The study compared patients prior to protocol (PP) with patients following implementation of the enhanced protocol (EP). The primary outcome was delivery of greater than 80% of prescribed EN kilocalories (kcal) in critically ill trauma and surgical patients. Institutional Review Board approval was obtained as a quality improvement initiative and the study was completed at an ACS-verified Level 1 trauma center. Inclusion criteria for the study consisted of patients aged > 18 years, admission to trauma or surgical ICU for > 72 hours, and hemodynamic stability to receive EN. Patients were excluded if they had undergone recent gastrointestinal procedure which would preclude enteral feedings. Data were analyzed using standard statistical methods. For continuous variables, comparisons were made between groups using Student's t-tests. For categorical variables, comparisons were made using χ^2. P-value < 0.05 was considered significant.

Results: We identified 2663 EN days prior to intervention and 2059 EN days following intervention between September 2016 and September 2020. The average percentage of nutrition delivered (based on 24-hr kcal requirements) improved following the enhanced protocol (75.3 PP vs 85.5% EP, $p < 0.01$). The primary outcome of patients receiving greater than 80% of nutrition goal also improved (52.7% PP vs 65.2% EP, $p < 0.01$). The average percentage of nutrition delivered was improved in both surgical (69.9% PP vs 78.7% EP, $p < 0.01$) and trauma (78.2% PP vs 87.3 % EP, $p < 0.01$) populations. For the trauma patients that failed to meet adequate daily caloric intake, perioperative cessation of feeds, gastrointestinal intolerance, and failure to adhere to protocol were the most significant contributors.

Conclusion: Implementation of a multidisciplinary, focused nutrition-enhancement protocol improved nutrition delivery to critically ill trauma and surgical patients.

	Prior to Protocol	Enhanced Protocol	Difference	p-Value
All patients' average percentage of prescribed EN delivered (%)	75.3	85.5	10.2	<0.01
Percentage of patients receiving > 80% of prescribed EN (%)	52.7	65.2	12.5	<0.01
Trauma patients' average percentage of prescribed EN delivered (%)	78.2	87.3	9.1	<0.01
Surgical patients' average percentage of prescribed EN delivered (%)	69.9	78.7	8.8	<0.01

Poster #16

LATE TRACHEOSTOMY WHEN NEW YORK CITY WAS THE COVID-19 EPICENTER: WAS IT WORTH THE WAIT?

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Jacobi Medical Center

Introduction: During New York City's (NYC) time as the world's COVID-19 epicenter, there was unclear guidance on when to perform tracheostomy for COVID+ patients. We hypothesized that early tracheostomy (≤14 days) would demonstrate improvement in clinical outcomes over late tracheostomy.

Methods: We conducted a retrospective chart review of all COVID+ tracheostomies performed between March 6-June 9 2020 in patients ≥18 years at the 11 acute care hospitals comprising the NYC municipal hospital system. 30-day mortality, ICU LOS, and 30-day decannulation were compared between early and late tracheostomy using proportional hazards regression.

Results: There were 49 early (mean 9.6±3.6 days) and 154 late (26.3±8.5 days) tracheostomies with total mean age 59±12 years and no difference in mean Charlson Comorbidity Index (CCI), admission Sequential Organ Failure Assessment (SOFA) and median PaO2/FiO2 (P/F) ratio. There was no difference in mortality or complications between groups. After adjusting for age, CCI, SOFA score, P/F ratio, and ICU complications, patients with late tracheostomies were 63.5% less likely to be discharged at 5 weeks and 65.1% less likely to be decannulated in a 30-day postoperative observation period.

Conclusions: This study, the largest COVID+ tracheostomy series to date, suggests late tracheostomy may contribute to longer hospitalizations and delayed decannulation in critically-ill COVID-19 patients without improvement in mortality.

Poster #17

OBESITY IS ASSOCIATED WITH INCREASED MORTALITY FOLLOWING ADMISSION TO THE ICU WITH SURGICAL SEPSIS

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Ohio State University

Introduction: Many large studies have demonstrated a protective association between obesity and survival following sepsis. Given its association with surgical morbidity, the primary objective of this study was evaluating the association between obesity and mortality following admission to the surgical ICU (SICU) for patients with surgical sepsis.

Methods: All patients admitted to the SICU were reviewed from 2014-2019 at a single center and grouped into obese (OB; BMI $\geq$ 30 kg/m^2, n=810) and non-obese (NOB; BMI <30 kg/m^2, n=621). Exclusion criteria included BMI <18.5 kg/m^2 and SOFA <2. Baseline demographic, comorbidity and clinical data were compared between groups, including admission SOFA, vasopressor use and lactate. Respiratory failure (RF), renal replacement therapy (RRT), SICU length of stay (LOS), and 90-day mortality were compared. Multivariable regression analyses were used to model predictors of 90-day mortality, RF, RRT, and SICU LOS. P value <0.05 was considered significant.

Results: Age and racial composition were comparable between groups. The OB cohort were more likely to have type II diabetes (T2DM) (35.6% vs 21.4%, p <0.0005) and congestive heart failure (CHF) (10.1% vs 6.6%, p = 0.02) but less likely to present with moderate-severe liver disease (MS-LD) (5.6% vs 8.4%, p = 0.04). The median SOFA was not different between cohorts. OB patients had higher rates of RF (75.6% vs 67.5%, p=0.001), RRT (21.5% vs 11.6%, p<0.0005), and longer median SICU LOS (8 (3.5-17.5) days vs 6 (2.7-14.5) days, p=0.0003). 90-day mortality was higher in the OB cohort (33.8% vs 23.8%, p<0.0005). After controlling for age, sex, SOFA, CHF, T2DM, and MS-LD, obesity was associated with a 31% increase in 90-day mortality compared to NOB (HR: 1.3, 95th CI: 1.1-1.6) and was an independent predictor for RRT (OR: 2.3, 95th CI: 1.7-3.1), RF (OR 1.5, 95th CI: 1.1 – 1.9) and SICU LOS (β:1.8, 95th CI: 0.3-3.3).

Conclusion: Following admission to the SICU, obesity was associated with increased 90-day mortality, RRT, RF, and ICU LOS, after controlling for comorbidities and sepsis severity. This suggests that the obesity paradox may not be applicable within the context of surgical sepsis. Further studies are needed to elucidate the impact of obesity on sepsis-induced immune dysregulation and what implications it has on the management of critically-ill surgical patients.

Poster #18

ONE SIZE DOES NOT FIT ALL - SEX BIAS IN PHARMACOLOGIC VENOUS THROMBOEMBOLISM PROPHYLAXIS

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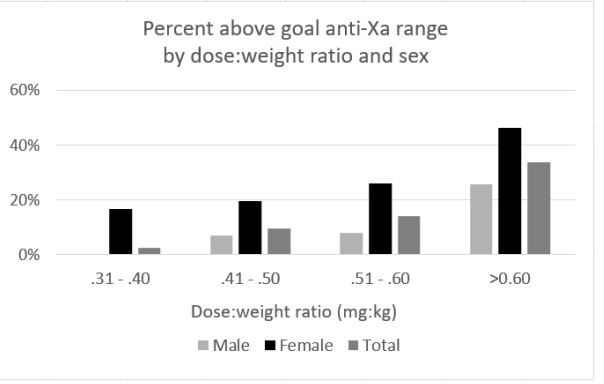
Introduction: Optimal dosing strategies for VTE prophylaxis in trauma patients remain unclear. Current dosing guidelines often include weight, age, and renal function, but do not consider sex. We hypothesized that additional patient factors influence optimal prophylactic dosing in trauma patients.

Methods: This is a retrospective review of patients admitted to a level 1 trauma center for ≥4 days from 7/2015-4/2019 who received enoxaparin VTE prophylaxis per protocol (<60kg: 30mg BID, 60-99kg: 40mg BID, >100kg: 50mg BID) and had an appropriately timed anti-Xa level. Multivariate regression was performed to identify predictors of in-range prophylactic anti-Xa (PAX) levels on the first assessment.

Results: The cohort (n=779) was 72.8% male, mean age 49.8 ± 20.0 years, weight 82.5 ± 21.0 kg (males mean 85.5kg, females 74.4kg), and ISS 15.3 ± 10.3. Overall, 67.0% had an in-range PAX on first assessment. Males were more likely to have a sub-PAX level (24.1% vs. 9.0%, p<0.001), while females were more likely to have supra-PAX levels (25.9% vs. 8.1%, p<0.001); rates of in-range PAX levels were equivalent. When controlled for creatinine clearance, PAX level was independently associated with dose:weight ratio (OR 0.43, p<0.001, CI 0.33-0.52) and sex (OR -0.06, p<0.001, CI 0.08-0.05).



Conclusion: Female patients were more likely to have supra-PAX levels compared to male patients at all dose:weight ratios. To improve the accuracy of VTE chemoprophylaxis, inclusion of sex in dosing models should be considered.

Poster #19

THE GREAT EQUALIZER: COVID-19 AND THE INJURED PATIENT. A MULTI-INSTITUTIONAL REVIEW

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Introduction: COVID-19 has been shown to affect outcomes in surgical patients. We hypothesized that COVID-19 would worsen the outcome of trauma patients, regardless of the Injury Severity Score (ISS).

Methods: We undertook a retrospective analysis of trauma registries from two level I trauma centers (suburban and urban) from 3/1/2020 to 6/30/2020 and 3/1/2019 to 6/30/2019, comparing baseline characteristics and cumulative adverse events. Patients were categorized as either COVID (+) or COVID (-) based on PCR, ICD-10, or COVID-19 diagnosis. Data collected included ISS, demographics, and comorbidities. The primary outcome was time from hospitalization to mortality. Outcomes during the height of the pandemic were also compared to the same timeframe in the prior year. Kaplan-Meier method with Log-rank test and Cox proportional hazard models were used to compare outcomes.

Results: 1180 patients were admitted during the study period from March 2020 to June 2020. Of these, 596 were not tested for COVID-19 and were excluded. There were 148 COVID+ patients and 436 COVID- patients. Compared to the 2019 cohort, the overall 2020 cohort was older with more associated comorbidities and adverse events but lower ISS. Statistically significant higher rates of hypertension (81.8% vs. 66.1%, $p<0.001$), diabetes (38.5% vs. 26.2%, $p=0.004$), neurologic (37.4% vs. 24.1%, $p=0.002$), and coagulopathic (29.9%% vs. 14.7%, $p<0.001$) events were displayed in COVID+ patients, compared to COVID- patients. D-dimer and ferritin were unreliable indicators of COVID-19 positivity; however, CRP levels were higher in COVID+, relative to COVID- patients (median 66 vs. 25, $p=0.03$). Despite a lower median ISS among COVID+ compared to COVID- patients (4.0 vs. 5.0, $p<0.001$), COVID+ patients had longer LOS and higher rates of mortality [HR (95% CI)=2.7 (1.5, 5.2), $p=0.002$].

Conclusions: Trauma patients with COVID-19 admitted to the trauma centers had increased morbidity and mortality compared to COVID-19 positive patients regardless of ISS. A better understanding of the physiologic impact of COVID-19 on injured patients warrants further investigation.

Poster #20

VALIDATION OF A NOVEL BLOOD VOLUME-BASED DOSING PROTOCOL FOR VENOUS THROMBOEMBOLISM PROPHYLAXIS IN TRAUMA PATIENTS

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Introduction: Fixed-dose and body mass index (BMI) based enoxaparin regimens provide inadequate venous thromboembolism (VTE) prophylaxis for many trauma patients. Our previous investigation found that mg of enoxaparin per L of estimated blood volume (BV) correlated most strongly with anti-Xa level compared to body mass and BMI. BV has replaced BMI as the basis for VTE prophylaxis dosing at our institution.

Methods: This was a pre/post study evaluating the effectiveness of the historical BMI-based protocol (pre group) versus the novel BV-based protocol (post group) at a large academic Level 1 Trauma Center. All adult trauma patients admitted from Oct-Dec 2019 (pre) and Aug-Oct 2020 (post) who received enoxaparin per protocol, and had an anti-Xa level drawn, were included. The BV protocol was as follows: patients with a BV 3-4.9 L = enoxaparin 30 mg q12h, a BV 5-6.9 L = 40 mg q12h, and a BV ≥7 L = 60 mg q12h. The primary outcome was the percentage of patients who attained a target anti-Xa peak level (0.2-0.5 units/mL). Secondary outcomes included bleeding and VTE rates.

Results: A total of 241 patients (99 BMI, 142 BV) were included. Groups were similar, except the BV group was more often white with a higher creatinine clearance. The study population had a median age of 38 vs 41.5 years, a mean BMI of 27.4 vs 27.7, and a mean BV of 5.1 vs 5.1, respectively. A total of 63 patients (63.6%) in the BMI group attained target anti-Xa levels compared to 115 patients (81%) in the BV group (p=0.008). Upon multivariate regression, the BV-based protocol was the only variable associated with attainment of target anti-Xa levels (adjusted OR 1.93, p=0.018). Clinically relevant bleeding and VTE rates were similar between groups, 4 vs 2.1% and 1 vs 3.5%, respectively.

Conclusion: Dosing prophylactic enoxaparin using a novel BV-based dosing protocol significantly increased attainment of target anti-Xa levels and may provide more adequate VTE prophylaxis in trauma patients.

Poster #21

"JUST GET A PAN-SCAN" - PHYSICAL EXAM IS NOT AN ACCURATE PREDICTOR OF SIGNIFICANT INJURIES IN GERIATRIC PATIENTS WITH LOW-ENERGY BLUNT TRAUMA

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Background: It is commonly accepted that geriatric patients with even low-energy traumatic mechanisms require a "pan-scan" as part of their trauma assessment, however it would be advantageous from a resource use perspective to scan selectively. Evidence from observational studies is conflicting. We hypothesized that for geriatric patients (≥65y) presenting to the emergency department with ground level falls the physical exam is sensitive enough to identify patients that require pan-scan.

Methods: We queried the trauma registry at a large, urban Level 1 trauma center for the calendar year 2019 for patients ages ≥65 with mechanism of fall from sitting or standing and performance of "pan-scan" at time of assessment. Exclusion criteria included falls from height, GCS <14, and absence of complete pan scan. Physical exam was extracted from the EMR. "Significant injuries" were defined as injuries that were diagnosed on CT and that changed management

Results: 751 patients were included in analysis. Of these, 296 (39%) had a positive CT for significant injury and 455 (61%) were negative. Median age was 84 years old. 269 (36%) were male and 482 (64%) were female. The majority of injuries identified were fractures, followed by visceral injuries. Sensitivity of the physical exam for serious injuries found on the full or any part of the pan scan did not exceed 70%.

Table 1: Physical Exam and CT "Pan-Scan" Results

	PE (+)	PE (-)	PE Sensitivity
Pan-Scan (+)	**204**	**92**	**0.69**
Head CT (+)	**33**	**20**	**0.62**
C-spine CT (+)	**7**	**28**	**0.20**
C/A/P CT (+)	**174**	**122**	**0.20**

Conclusion: The physical exam was not sufficiently sensitive to safely exclude geriatric trauma patients with low-energy mechanism from undergoing any part of a pan-scan.

Poster #22

GROUND-LEVEL FALLS IN GERIATRICS ARE LOW-IMPACT INJURIES WITH HIGH-IMPACT CONSEQUENCES: HOW DOES FRAILTY FACTOR IN?

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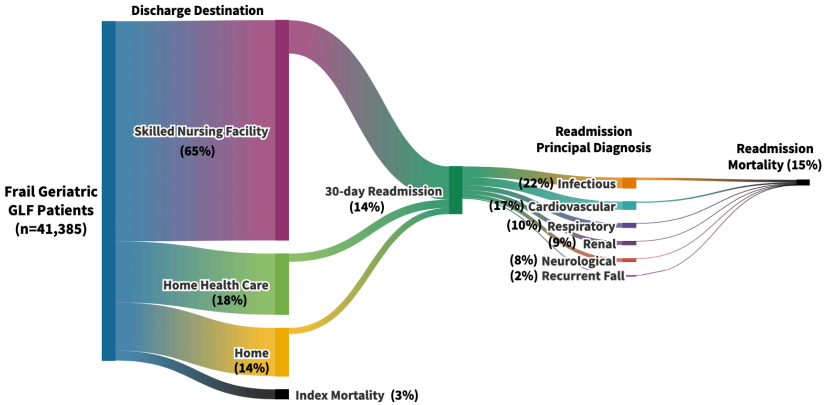
Introduction: Ground-level falls (GLFs) in geriatrics are increasing with the increase in life expectancy, and more patients are being discharged to skilled nursing facility (SNF) for continuity of care. GLF patients are not a homogenous cohort, and the role of frailty remains to be assessed. The aim of this study is to examine the impact of frailty on long-term outcomes of GLF patients.

Methods: This is a cohort analysis from the Nationwide Readmissions Database 2017. Geriatric (age ≥65 years) trauma patients presenting following GLFs were identified and grouped based on their frailty status. The associations between frailty and 30-day mortality and emergency readmission were examined by multivariate regression analyses adjusting for patient demographics and injury characteristics.

Results: A total of 100,850 geriatric GLF patients were identified (frail: 41% vs. non-frail: 59%). Frail GLF patients were younger (81[74-87] vs. 83[76-89] years; p<0.001) and less severely injured ISS (4[1-9] vs. 5[2-9]; p<0.001). Frail patients had higher index mortality (2.9% vs. 1.9%; p<0.001) and 30-day readmissions (14.0% vs. 9.8%; p<0.001). Readmission mortality was higher in the frail group (15.2% vs. 10.9%; p<0.001), with 75.2% of those patients readmitted from SNF. **(Figure)** On multivariate analysis, frailty was associated with 30-day mortality (OR 1.75; p<0.001) and 30-day readmission (OR 1.49; p<0.001).

Conclusion: Frail patients are at 75% higher odds of mortality and 50% higher odds of readmission following GLFs. Of those emergently readmitted, more than one in seven patients died, 75% of whom were readmitted from SNF. This underscores the need for optimization plans that extend to the post-discharge period to reduce readmissions and subsequent high-impact consequences in geriatric GLF patients.



Poster #23

MORE HARM OR GOOD? OPERATIVE FEEDING TUBE MORTALITY IN ELDERLY TRAUMA PATIENTS

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Introduction: Placement of feeding tubes in elderly patients has been associated with poor outcomes in general medical patient populations; however, this issue has not been studied in elderly trauma patients. The objectives of this study were to determine in-hospital mortality in elderly trauma patients receiving operative feeding tubes and to identify factors associated with in-hospital mortality.

Methods: A retrospective study utilizing 2017 National Trauma Data Bank data was conducted. Trauma patients aged 65 and older with operative feeding tube placement were included in analysis. Demographic, injury related, medical comorbidity, and general hospital course data was analyzed. Patients were divided into two cohorts: those who survived and those who did not survive to hospital discharge. Bivariate analysis was used to compare the groups with performance of subsequent logistic regression to determine factors independently associated with in-hospital mortality.

Results: A total of 3,398 patients were included in analysis with 331 (9.7%) dying during hospitalization. Overall, patients had a median age of 75 years, were mostly male (66%), injured by blunt mechanism (95%), and sustained severe injuries (median ISS 17). Patients who died were noted to be slightly older (76 vs. 75 years, $p=0.03$), be more severely injured (ISS 22 vs. 17, $p<0.001$), have a higher geriatric trauma outcome score (134 vs. 121), and lower rates of dementia (8 vs. 13%, $p=0.01$). Multivariate regression found that male sex, lower admission GCS, higher Charleston Comorbidity Index, and an Advance Directive Limiting Care (ADLC) were independently associated with in-hospital mortality in elderly trauma patients who received an operative feeding tube. Dementia diagnosis was negatively associated with in-hospital mortality.

Conclusions: The in-hospital mortality rate for elderly trauma patients with operative feeding tubes placed was found to be notably high at 9.7%. The results that male sex, higher admission GCS, higher comorbid disease burden, and the presence of an ADLC are associated with increased in-hospital mortality will serve to assist providers in counseling patients and caregivers about the risks associated with operative feeding tube placement in this patient population.

Poster #24

PARAVERTEBRAL NERVE BLOCK VS. EPIDURAL ANALGESIA IN GERIATRIC RIB FRACTURES: ARE WE TOO INVASIVE?

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Introduction: Multiple pain control modalities exist for rib fracture patients. The use of epidural analgesia (EA) in older adults has been associated with a high-risk profile. The aim of our study is to compare outcomes among geriatric rib fracture patients who received PVNB vs. EA.

Methods: We queried the (2011-2015) Nationwide Readmission Database to include geriatric (≥65y) trauma patients with rib fractures. We excluded patients who were dead on arrival, those with head-AIS ≥3, spine-AIS >0, penetrating injuries, and cognitive impairment. Propensity score matching was performed (1:2 ratio). Primary outcomes were delirium, length of stay (LOS), and mortality. Secondary outcomes were respiratory complications, readmission, and mechanical ventilation (MV).

Results: We included 2,855 patients, from which a matched cohort of 1,041 patients was obtained (347 received PVNB vs. 694 received EA). Mean age was 78±8y, chest-AIS was 3[2-3], and ISS was 9[4-16]. Majority of patients (70%) had >3 rib fractures. No difference was found in rates of delirium (12.4% vs. 12.9%; p=0.81), LOS (5[3-9] vs. 6[4-11]; p=0.63), index-hospital mortality (5.2% vs. 6.8%; p=0.30), 90-day mortality (7.6% vs. 8.4%; p=0.65), respiratory complications (10.1% vs. 10.4%; p=0.85), readmission (20.1% vs. 16%; p=0.27), and MV (7.5% vs. 7.4%; p=0.94) between the two groups.

Conclusion: The use of PVNB in geriatric trauma patients with multiple rib fractures is associated with comparable in-hospital and post-discharge outcomes relative to EA. PVNB is relatively easy to perform and has a better side effect profile. The use of PVNB as part of rib fracture management protocols warrants further consideration.

Poster #25

PRE-INJURY HEALTHCARE USE TRAJECTORIES AND POST-INJURY PATIENT-REPORTED OUTCOMES IN OLDER TRAUMA PATIENTS

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Background: Previous work revealed considerable variability in the long-term Health Related Quality of Life (HRQoL) recovery trajectories of patients after non-neurologic injury. However, little is known about how pre-injury health trajectories might influence HRQoL at the time of injury. Healthcare information exchanges (HIE) could be used to determine pre-injury health trajectory and to predict baseline HRQoL as well as those who might need post-discharge support. The purpose of this study was to identify and describe pre-injury healthcare utilization trajectories using data from a statewide HIE for the two-year period prior to injury in non-neurologically injured older patients. We compared patient-reported HRQoL outcomes across trajectory groups at index hospitalization for trauma.

Methods: Healthcare use data was obtained from a local HIE for 156 patients enrolled in a longitudinal cohort recruited into a randomized controlled trial. Healthcare use scores were calculated for each quarter of the two-years prior to injury and group-based trajectory modeling was performed to identify unique pre-injury healthcare use trajectory groups. Descriptive statistics were conducted to compare group characteristics. ANCOVA was used to compare patient-reported HRQoL after injury.

Results: Three utilization trajectories, dubbed “low”, “medium”, and “high” utilization, were identified. The majority of patients (n=103) belonged to the low utilization group while n=44 and n=9 patients belonged to the medium and high utilization groups, respectively. The groups significantly differed with respect to Charlson score, racial composition, insurance status, education, and mechanism of injury at index hospitalization. The prevalence of anxiety and depression were similar among groups. The trajectory groups differed significantly in the physical role functioning, energy & fatigue, social functioning, and general health subscales of the SF-36 after adjusting for age, sex, Charlson score, ISS, and mechanism of injury.

Conclusions: Three distinct healthcare utilization trajectories were identified. Preinjury healthcare utilization is significantly associated with physical and social functioning, energy and fatigue, and general health perceptions after non-neurologic injury in older patients. This is the first description of using a HIE to determine pre-injury health trajectories in an injured population. This proof-of-concept study suggests that magnitude of healthcare utilization, which can be calculated using widely available HIE data, can help identify patients at risk of low HRQoL at the time of injury.

Poster #26

UNDERSTANDING PREVENTABLE DEATHS IN THE GERIATRIC TRAUMA POPULATION: ANALYSIS OF 1,567,650 PATIENTS FROM THE CMS AND AHRQ DATABASES

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Background: Patient safety indicators (PSIs) are avoidable complications that can impact outcomes. Geriatric patients have a higher mortality than younger patients with similar injuries, and understanding the etiology may help reduce patient mortality. We aim to estimate preventable geriatric trauma mortality in the US and identify risk factors associated with increased mortality.

Methods: A retrospective cohort study of patients aged ≥65, in the CMS and AHRQ databases from 2011-2013. Risk-adjusted multivariable regression was performed to calculate observed-to-expected (O/E) mortality ratios for failure-to-prevent and failure-to-rescue PSIs with significance defined as $p< 0.05$.

Results: 1,567,650 geriatric patients were analyzed. Patients aged 75-84, had 63% higher odds of preventable mortality (adjusted odds ratio [aOR]=1.63, 95% confidence interval [CI]=1.58,1.68) whereas patients aged ≥85 had 149% higher odds of preventable mortality (aOR=2.49, 95% CI=2.42,2.56) compared to patients aged 65-74. Failure-to-prevent O/Es were >1 for all PSIs evaluated with physiologic and metabolic derangements having a high O/E (56.28). Failure-to-rescue O/Es were >1 for 9/11 (81.8%) PSIs with physiologic and metabolic derangements having the highest O/E (2.72). US states with higher quantities of geriatric trauma patients experienced reduced preventable mortality.

Conclusion: Odds of preventable mortality increases with age. In-hospital postoperative hip fracture and physiologic/metabolic derangements produce significant preventable mortalities. US states differ in their failure-to-prevent and failure-to-rescue PSIs, indicating geographic variations in geriatric trauma care may exist. Utilization of national guidelines, early correction of metabolic derangements, more through history taking, and greater incorporation of inpatient geriatricians may serve to reduce preventable mortality in elderly trauma patients.

Poster #27

COMPARISON OF NEBULIZED KETAMINE AT THREE DIFFERENT DOSING REGIMENS FOR TREATING ACUTE AND CHRONIC PAINFUL CONDITIONS

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Introduction: Ketamine is a noncompetitive NMDA/glutamate-receptor complex antagonist that decreases pain by diminishing central sensitization and hyperalgesia. Our goal was to assess and compare the analgesic efficacy and rates of adverse effects of ketamine administered via breath-actuated nebulizer at three different dosing regimens for patients presenting with acute and chronic painful conditions.

Methods: This was a prospective, randomized, double-blinded trial comparing three doses of nebulized ketamine (0.75mg/kg, 1 mg/kg and 1.5 mg/kg) administered via breath-actuated nebulizer, in adult Emergency Department patients aged 18 years and older with moderate to severe acute and chronic pain. Primary outcome included the difference in pain scores between all three groups at 30 minutes.

Results: We enrolled 120 subjects (40 per group). Difference in mean pain scores at 30 minutes between the 0.75 mg/kg and 1 mg/kg groups was 0.25 (95% confidence interval [CI]: -1.28 to 1.78), between the 1 mg/kg and 1.5 mg/kg groups was -0.225 (95% CI: -1.76 to 1.31), and between the 0.75 mg/kg and 1.5 mg/kg groups was 0.025 (95% CI: -1.51 to 1.56). No clinically concerning changes in vital signs were observed. No serious adverse events occurred in any of the groups.

Conclusion: Nebulized ketamine administered at the 1.5 mg/kg dose via breath-actuated nebulizer did not provide superior analgesia to nebulized ketamine at the 0.75 mg/kg and the 1 mg/kg for short-term treatment of moderate to severe pain in the Emergency Department and resulted in slightly higher rates of dizziness and fatigue.

Poster #28

EFFICACY OF FASCIA ILIACA COMPARTMENT BLOCK FOR HIP FRACTURES: DOES TYPE OF BLOCK MATTER?

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Introduction: The AAOS surgical guidelines for hip fracture in the elderly strongly recommend regional analgesia to improve preoperative pain control. Regional blockade of the fascia iliaca (FICB) can be administered as a continuous infusion or a single injection. We sought to determine differences in pain, analgesia, and delirium by FICB administration type compared to systemic analgesics alone.

Methods: This study was designed as an a priori subset analysis of a prospective, multicenter, observational cohort of geriatric adults with unilateral traumatic hip fracture requiring surgery. We excluded patients admitted to facilities that did not perform both types of FICB (n=99) and FICB placed postoperatively (n=24). Outcomes were development of delirium within 48h postoperatively (primary outcome, %), mean self-reported pain (0-10 scale), median oral morphine equivalent (OME) consumption, and analgesic-related complications (%).

Results: There were 394 patients, 215 (55%) received a continuous FICB, 69 (18%) received a single injection FICB, and 110 (28%) did not receive FICB. There were no differences in delirium between continuous, single, and no FICB groups (5.1%, 4.4% and 3.6%, p=0.82). There were no differences in OME consumption in the preoperative period (24mg, 27mg, 23mg, respectively; p=0.95) or in the postoperative period (34mg, 41mg, 31mg, respectively; p=0.60). There were also no differences in analgesic complications (4.2%, 2.9%, 1.8%, respectively; p=0.52). Arrival pain was similar between groups (p=0.43), while pain scores were significantly lower with continuous FICB and single FICB compared to no FICB, at admission (5.5, 4.7, 6.4, respectively; p<0.001) and preoperatively (3.8, 3.4, 4.9, p<0.001). Moreover, admission pain was significantly lower with single FICB than continuous FICB (p=0.03).

Conclusion: Compared to patients receiving systemic analgesia only, both FICB types were equally effective at reducing pain in the preoperative period. There was no treatment effect for either type of block on delirium, opioid consumption, and analgesic-related complications. These data suggest the pain sparing benefit of FICB does not result in an accompanying reduction in narcotics or delirium.

Poster #29

POSTOPERATIVE MORTALITY IN HIP FRACTURE PATIENTS STRATIFIED BY THE REVISED CARDIAC RISK INDEX: A SWEDISH NATIONWIDE RETROSPECT COHORT STUDY

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Introduction: The Revised Cardiac Risk Index (RCRI) is a tool that can be used to evaluate the 30-day risk of postoperative myocardial infarction, cardiac arrest, and mortality. This study aims to confirm its association with postoperative mortality in patients who underwent hip fracture surgery.

Methods: All adults who underwent primary emergency hip fracture surgery in Sweden between 1/1/2008 and 31/12/2017 were included in this study. The database was retrieved by cross-referencing the Swedish National Quality Register for hip fractures with the Swedish National Board of Health and Welfare registers. The outcomes of interest were the association between the RCRI score and mortality at 30 days, 90 days and one year postoperatively.

Results: 134,915 cases were included in the current study. There was a statistically significant linear trend in postoperative mortality with increasing RCRI scores at 30 days, 90 days and one year. An RCRI score ≥4 was associated with a 3.1 times greater risk of 30-day postoperative mortality (adj. IRR 3.13, $p<0.001$), a 2.5 times greater risk of 90-day postoperative mortality (adj. IRR 2.54, $p<0.001$), and a 2.8 times greater risk of 1-year postoperative mortality (adj. HR 2.81, $p<0.001$) compared to that observed with an RCRI score of 0.

Conclusion: An increasing RCRI score is strongly associated with an elevated risk 30-day, 90-day, and 1-year postoperative mortality after primary hip fracture surgery. The objective and easily retrievable nature of the variables included in the RCRI calculation makes it an appealing choice for risk stratification in the clinical setting.

Poster #30

THE PUBLIC HEALTH BURDEN OF GERIATRIC TRAUMA CARE: ANALYSIS OF 2,684,983 HOSPITALIZATIONS FROM CMS INPATIENT CLAIMS

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Introduction: Geriatric trauma care (GTC) represents an increasing proportion of injury care, but associated public health research on outcomes and expenditures is limited. The purpose of this study was to describe GTC characteristics, location, diagnoses, and expenditures.

Methods: Patients at short-term, non-federal hospitals aged ≥65 with ≥1 injury ICD-10 code were selected from 2016-19 CMS Inpatient Standard Analytical Files (IPSAF). Trauma center levels were linked to the IPSAF file via AHA Hospital Provider ID and fuzzy string matching. Patient demographics, care location, diagnoses, and expenditures were compared across groups.

Results: 2,684,983 hospitalizations (62% female; 90% white; 71% falls) from 3,286 hospitals were included. Level I centers treated 21.2% and non-trauma centers treated 37.7%. The most frequent primary diagnoses were hip/femur fracture in 28.3% followed by TBI in 10.1% (Table). Expenditures totaled $32.8B (1.1% of annual Medicare budget). Overall mortality rate was 3.5%.

Trauma Centers		*ISS Mean*	*Total hospitalizations n (%)*	*Most frequent 1º diagnosis*	*2nd most freq. 1º diagnosis*	*Expenditures $B (%)*
Level	**Number (%)**					
I	236 (7.2)	7.4	568,898 (21.2)	Hip/femur (19.8)	TBI (17.6)	9.20 (28.1)
II	333 (10.1)	6.8	617,136 (23.0)	Hip/femur (25.7)	TBI (13.4)	7.27 (22.2)
III	455 (13.8)	6.4	382,482 (14.2)	Hip/femur (33.6)	Medical (9.9)	4.15 (12.6)
IV	339 (10.3)	6.1	104,259 (3.9)	Hip/femur (35.2)	Medical (10.8)	1.08 (3.3)
None	1923 (58.5)	6.0	1,012,208 (37.7)	Hip/femur (31.9)	Medical (10.6)	11.08 (33.8)
Total	**3,286 (100)**	**6.5**	**2,684,983 (100)**	**Hip/femur (28.3)**	**TBI (10.1)**	**32.79 (100)**

Conclusion: The largest proportion of GTC occurs at non-trauma centers, emphasizing their vital role in trauma care. Hip/femur fractures account for the largest portion of GTC. Public health prevention programs and GTC guidelines should be implemented by all hospitals, not exclusively trauma centers.

Poster #31

A DECADE OF PEDIATRIC FIREARM VIOLENCE: A CALL TO ARMS

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Introduction: Firearm injuries cause significant morbidity and mortality in children and adolescents. We characterized the epidemiology and predictors of mortality in pediatric victims of firearm violence in Northern California.

Methods: Trauma patients <18 years old at a level 1 pediatric trauma center presenting with gunshot wounds (GSW) 2009-2019 were included. The primary outcome was mortality. The secondary outcomes included interventions, massive transfusion (>40 ml/kg of blood products within 24 hours of arrival), costs, and recidivism, defined as presenting again with another GSW. Significance was set at $p<0.05$.

Results: There were 295 GSWs (2.1%), with 7.5% mortality (n=22/295) out of 13,840 pediatric trauma patients. Thirty-six percent were taken straight to the operating room, 42% were admitted to the ward, and 22% were admitted to the intensive care unit. Half required surgery (54%). Seventeen patients received massive transfusion, with a higher mortality than those not receiving massive transfusion (53% vs. 5%, $p<0.0001$, Fisher's exact test). On multivariable analysis, after adjusting for age, sex, injury severity, massive transfusion, and year, massive transfusion was significantly associated with mortality (OR 4.4, 95% CI 1.1-17.2, $p=0.03$). The cost of these injuries was over $5.5 million. There were four cases of recidivism (2%) after a median interval of 108 days (range 48-1089).

Conclusions: Firearm violence in pediatric patients is highly lethal and is associated with a high level of resource utilization, with half requiring operative intervention. Patients receiving massive transfusion were significantly more likely to die. The index presentation may represent a key time for interventions to prevent future re-injury.

Poster #32

EFFICACY OF ANIMAL ASSISTED THERAPY IN THE TREATMENT OF PATIENTS WITH TRAUMATIC BRAIN INJURIES

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Introduction: Traumatic brain injury (TBI) is a serious public health concern accounting for nearly 3 million emergency department visits each year; the significant impact of severe TBI on the patient, family, and society has been extensively documented in the literature. Hospitals utilize a range of interventions to address the biopsychosocial and emotional needs of the patient. We aimed to understand how Animal Assisted Therapy (AAT), the use of the human/animal bond in goal-directed interventions, with dogs affects outcomes of patients hospitalized with severe TBI.

Methods: Adult patients admitted with severe TBI (GCS $\leq$ 10), were randomized to receive AAT during their hospitalization in a single Level I Trauma Center. Pre- and post- AAT session Glasgow Coma Scale (GCS), Rancho Los Amigos Scale (RLAS) and levels of command (LOCmd) scores were recorded; we used nonparametric Wilcoxon rank sum tests to identify differences between the groups.

Results: Study patients (N=70) received 151 sessions with a hander and dog (intervention, n=38) and 156 without (control, n=32) from a total of 25 dogs and 9 handlers. The mean change in intervention vs. control was 0.09 vs. -0.13 GCS (p= 0.03); 0.1 vs. 0.01 RLAS (p=0.002); 0.16 vs. 0.00 LOCmd (p=0.00). P-values were adjusted for multiple comparisons.

Conclusions: Patients with severe TBI receiving AAT with dogs demonstrated significant improvement following treatments, compared to a control group. AAT may be a valuable adjunct therapy for this population.

Patient Characteristics(N=70)	AAT (n=38)	Control (n=32)	Adjusted p-value
Average age (in years)	47	45	0.67
Sex, Male	22	28	0.01
Injury Severity score (ISS) 9-15	3	4	0.97
ISS $\geq$ 16	35	28	0.01
Interactions	151	156	0.34
Change following interaction	(mean scores)		
GCS	0.09	-0.13	0.03
RLAS	0.10	0.01	0.00
LOCmd	0.16	0.00	0.00

Poster #33

FIREARM VIOLENCE AGAINST CHILDREN IN THE UNITED STATES: TRENDS IN THE WAKE OF THE COVID-19 PANDEMIC

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Introduction: This study aimed to evaluate the patterns of firearm violence against children before and after the COVID-19 pandemic, as well as the patterns of specific types of firearm violence against children over time (2016-2020).

Methods: Retrospective firearm violence data were obtained from the Gun Violence Archive. Rate of firearm violence was weighted per 100,000 children. A scatterplot was created to depict the rate of total yearly child involved shooting incidents over time; with a linear trendline fit to 2016-2019 data to show projected versus actual 2020 firearm violence. All 50 states were sorted into either "strong gun law" (n=25) or "weak gun law" (n=25) cohorts. Bivariate and multivariate linear regressions were run for number of child-involved shootings over time.

Results: There were a total of 1,076 child-involved shootings in 2020, 811 in 2019 and 803 in 2018. Median total child involved shooting incidents per month increased from 2018 to 2020 (0.095 vs. 0.126, p=0.002) and from 2019 to 2020 (0.097 vs. 0.126, p=0.007). Child injured by self and child killed by adult incidents also increased in 2020 compared to 2018 (p=0.012, p=0.017) and 2019 (p=0.017, p=0.033). The scatterplot demonstrates that total child involved shootings in addition to both fatal and non-fatal firearm violence incidents exceeded the projected number of incidents extrapolated from 2016-2019 data. Multivariate linear regression demonstrated that, compared to weak gun law states, strong gun law states were associated with decreased monthly total child-involved shooting incidents between 2018 and 2020 ($p<0.001$) as well as between 2019 and 2020 ($p<0.001$).

Conclusions: Child-involved shooting incidents increased significantly in 2020 surrounding the COVID-19 pandemic. Given that gun law strength was associated with a decreased rate of monthly child-involved firearm violence, public health and legislative efforts should be made to protect this vulnerable population from exposure to firearms.

Poster #34

IMPROVED IDENTIFICATION OF SEVERELY INJURED PEDIATRIC TRAUMA PATIENTS USING REVERSE SHOCK INDEX MULTIPLIED BY GLASGOW COMA SCALE (RSIG)

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Background: The pediatric shock index (SI) predicts the need for increased resources and mortality among *bluntly* injured pediatric patients but underperforms in predicting resource needs for all pediatric trauma patients. A new scoring system, rSIG, which is the reverse shock index (rSI) multiplied by the Glasgow Coma Scale (GCS), has been shown to be superior at predicting outcomes in adult trauma patients and battlefield mortality in pediatric patients when compared to traditional scoring systems. We sought to compare the accuracy of rSIG to SI in predicting the need for early interventions among civilian pediatric trauma patients.

Methods: All pediatric patients (≤18 years old) in the 2014-2018 TQIP database with complete heart rate, systolic blood pressure, and total GCS were included. Optimal cut-points using rSIG and SI were calculated for predicting blood transfusion within four hours, intubation, hemorrhage control operation or angiography, intracranial pressure (ICP) monitoring, intensive care unit (ICU) admission, and mortality. From the optimal thresholds, sensitivity, specificity, and area under the curve (AUC) were calculated from receiver operating characteristics (ROC) analyses to predict each outcome.

Results: A total of 604,931 patients with a mean age of 11.1 years old were included. Over half (53.8%) of patients sustained a blunt injury mechanism and the mean Injury Severity Score was 7.6. rSIG performed better than age-unadjusted SI at predicting all outcomes for the overall population (Table 1).

Conclusions: rSIG outperformed SI in the early identification of traumatically injured children at risk for early interventions, such as blood transfusion within four hours, intubation, and mortality. rSIG may be utilized as a bedside triage tool to rapidly identify those patients who will likely require early interventions and higher levels of care.

Table 1. Optimal cutoff points for rSIG and SI, by outcome

	Predictor	Optimal Cutpoint	Sensitivity (%)	Specificity (%)	AUC
Blood transfusion within 4 hours	rSIG	16.9	82.8	60.4	**0.83**
	SI	1.6	14.7	98.9	0.70
Intubation	rSIG	17.4	8.5	59.1	**0.85**
	SI	1.5	9.3	98.4	0.57
ICP Monitor	rSIG	15.0	89.7	73.9	**0.90**
	SI	0.8	51.0	53.7	0.53
OR/Angiography	rSIG	20.7	32.1	84.7	**0.73**
	SI	1.7	98.3	8.3	0.61
ICU Admission	rSIG	19.4	70.5	43.8	**0.65**
	SI	1.4	6.9	97.7	0.54
Mortality	rSIG	14.4	55.6	77.4	**0.72**
	SI	0.8	67.2	40.1	0.58

Poster #35

ISOLATED PARESTHESIA IS NOT A RELIABLE PREDICTOR OF SPINE INJURY IN BLUNT TRAUMA

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Introduction: Isolated extremity paresthesia is a criterion for trauma team activation at some centers given a perceived concern for spine injury. The predictive nature of this finding is unknown, and unnecessary activation is associated with increased costs and resource utilization. We hypothesized that isolated paresthesia as identified in the trauma team activation page does not predict spine injury.

Methods: All adult blunt trauma activations with a GCS ≥ 12 at our urban level I trauma center between 1/1/2018 and 6/30/2020 were identified. Detailed trauma activation pages were reviewed for evidence of paresthesia and neurologic motor deficit to group patients into three categories: paresthesia only, paresthesia with deficit/deficit only and no paresthesia or deficit mentioned. Baseline and injury specific characteristics were compared between groups. Sensitivity, specificity, negative, and positive predictive values were calculated for isolated paresthesia on the primary outcome of spine injury (defined as a spine AIS ≥ 2). Receiver operator curves (ROC) were constructed.

Results: 995 patients met inclusion criteria; 132 (13%) had isolated paresthesia, 44 (4%) had paresthesia with deficit/deficit only, and 819 (82%) had no paresthesia or deficit. 264 (27%) had spine AIS ≥ 2, with overall median spine AIS of 0 [0-2]. Those with isolated paresthesia had a similar rate of spine injury compared to those without paresthesia or deficit (26% vs. 25%, p=0.91). Those with paresthesia with deficit/deficit only were more likely to have spine injury compared to those with isolated paresthesia (52% vs. 26%, p=0.001) and to those without paresthesia or deficit (52% vs. 25%, p<0.001). There was no difference in isolated paresthesia between those with and without spine injury (17% vs 14 %, p=0.21). The sensitivity, specificity, positive predictive value, and negative predictive value for isolated paresthesia on spine injury were 14%, 86%, 26% and 75%, respectively. Area under the ROC for the diagnostic accuracy of paresthesia on spine injury was 0.49 (95% CI 0.45-0.53).

Conclusion: In this sample of blunt trauma patients, isolated extremity paresthesia identified prior to trauma team activation was not predictive of spine injury. Future prospective studies are needed to substantiate these findings, which have implications for both resource utilization and costs of care.

Poster #36

LONG-TERM FUNCTIONAL OUTCOMES AFTER TRAUMATIC SPINE FRACTURES

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Introduction: Traumatic spine fractures (TSF) can result in chronic pain, disability, and prolonged rehabilitation. Data for long-term functional outcomes after TSF is lacking, with few reports on functional recovery after nonoperative compared to operative management strategies. We evaluated patients with TSF to determine the long-term impact of TSF on functional outcome after nonoperative and operative management.

Methods: Patients with TSF over a five-year period were identified and stratified by management strategy (nonoperative [NO] vs operative [OP]) and compared. Functional outcomes were measured using the Boston Activity Measure for Post-Acute Care (AM-PAC) to assess basic mobility (BM) and daily activity (DA). Multiple linear regression (MLR) was used to identify predictors of functional outcome after TSF.

Results: 488 patients were identified: 271 NO and 217 OP. Follow-up was obtained in 168 (34%) patients: 95 (35%) NO and 73 (34%) OP. Mean follow-up was 5.7 years (range 3-8 years). Patients with thoracic, multilevel spine, or concomitant pelvic fractures were more commonly managed non-operatively. The majority were discharged home regardless of management. Mean AM-PAC scores in patients managed NO for BM (68 vs 64, $p=0.09$) and DA (69 vs 66, $p=0.26$) were clinically similar to those managed OP. MLR identified increasing age as a predictor of decreased BM ($\beta=-0.50$, $p<0.0001$, $\beta=-0.17$, $p=0.022$) and DA ($\beta=-0.58$, $p<0.0001$, $\beta=-0.35$, $p=0.003$) in NO and OP groups, respectively. In NO patients, a thoracic spine fracture was predictive of both decreased BM ($\beta=-5.88$, $p=0.041$) and DA ($\beta=-8.62$, $p=0.043$). In OP patients, lower extremity fractures ($\beta=-8.86$, $p=0.012$), discharge location ($\beta=-6.91$, $p=0.003$), and time to operative fixation ($\beta=-0.77$, $p=0.040$) were predictors of decreased BM.

Conclusion: All patients with TSF displayed mild to moderate functional impairment regardless of management strategy. Increasing age and thoracic spine fractures worsened long-term functional outcomes in NO patients while increasing age, lower extremity fractures, and discharge location worsened functional outcomes in OP patients. Time to operative fixation emerged as the only potentially *modifiable* risk factor for improving outcomes following TSF.

Poster #37

THE SCOPE OF FIREARM INJURIES IN AMERICA: INTENT MATTERS

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Purpose: Firearm injuries are a public health crisis in the United States. Knowledge of the intent of injury and their outcomes can help direct interventions and prevention.

Methods: The Nationwide Readmissions Database from 2010-2014 was used to identify patients < 18 years admitted after firearm injury, categorized by intent (violent, self-inflicted, or unintentional). Demographics and outcomes were analyzed and compared to each intent type. Chi-squared analysis and Mann-Whitney U test were used for comparison between cohorts and significance was set at $p<0.05$.

Results: Over the five-year period, 12,832 children were admitted secondary to firearm injury. The cohort was 86% male, and 89% were over the age of 13. Mortality was 6%. The most common locations of injury were the extremities (47%), abdomen (21%), and chest (19%). Operative procedures were performed in 63%, with the most common being orthopedic interventions (34%), exploratory laparotomy (21%), or soft tissue repair (20%). Overall readmission rate within 30 days was 5% and 11% within a year. Unplanned readmissions were most common (72%) due to operative intervention (35%), infection (22%), complications of spinal cord injury/paralysis (11%) or venous thromboembolism (4%). Violence was the most common intent of injury (65%), follow by unintentional (31%), and self-inflicted (5%). Self-inflicted injuries had the highest injury severity, were more likely to cause brain injury, carried the highest hospital charges, readmission rate, and had significantly higher mortality, **Table 1**. Violent injuries were more common in low-income patients, more often required exploratory laparotomy and had the highest rate of trauma recidivism.

Conclusion: Firearm injuries are a frequent cause of morbidity and mortality in children. Violent, accidental, and self-inflicted injuries carry their own unique patterns and outcomes. These findings can help target future efforts to decrease the burden of this preventable public health crisis.

Table 1: Comparison of demographics and outcomes by firearm intent

	Self-Inflicted (n=617)	**Violent** (n=8280)	**Unintentional** (n=3935)	P=
Age <13	10%	6%	24%	<0.001
ISS[a]	16 [9-25]	11 [5-22]	9 [4-17]	<0.001
Low Income[b]	34%	59%	53%	<0.001
Brain Injury	56%	8%	8%	<0.001
Exploratory Laparotomy	12%	24%	17%	<0.001
Hospital Charges[a]	$61,449 [66,223-145,621]	$44,328 [22,175-93,899]	$37,308 [18,908-73,699]	<0.001
Readmission Rate	15%	10%	12%	<0.001
Trauma Recidivism[c]	0%	8%	3%	<0.001
Mortality	37%	4%	5%	<0.001

a. data presented as median [interquartile range]; b. lowest income quartile; c. readmission for repeat unrelated (new) trauma within the year

Poster #38

DOES THROMBOELASTOGRAPHY PREDICT PREINJURY ANTICOAGULATION IN TRAUMATIC BRAIN INJURY?

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Introduction: Thromboelastography (TEG) is a widely used tool to assess post-traumatic coagulopathy. The aim of this study was to evaluate the effect of pre-injury anticoagulants on TEG parameters in severely injured Traumatic Brain Injury (TBI) patients.

Methods: We performed a 2-year retrospective analysis of our prospectively maintained TBI database. We included all adult (age >18) TBI (Head AIS ≥3) patients who received a TEG within the first 24 hours of presentation. We excluded patients with bleeding disorders/liver disease and those who were transferred. Patients were stratified as having received pre-injury AC or no-AC. We performed 1:2 propensity score matching. Outcome measures were TEG and conventional coagulation test parameters, intracranial hemorrhage (ICH) progression on CT scan, and mortality.

Results: A total of 198 patients were analyzed (AC, n = 66 vs. no-AC, n = 132). Post-match characteristics were similar between the two groups, including age (p=0.78), gender (p=0.76), ISS (p=0.09), GCS (15 vs. 14; p=0.23) and head-AIS (3[3-4] vs. 3[3-4]; p=0.64). Reaction time was significantly prolonged in AC group as compared to no AC (p=0.04). There were no differences in the other TEG parameters including K-value, alpha angle and maximum amplitude. Conventional tests, including the international normalized ratio (INR) and activated partial thromboplastin time (aPTT), were significantly deranged in AC group. ICH progression on repeat head CT was significantly higher in AC group compared to no AC (30% vs. 17%; p=0.02). There were no differences in the two groups in terms of neurosurgical intervention (12% vs. 8%; p=0.45), in-hospital LOS (days) (10 vs. 9; p=0.88) and mortality (18% vs.15%; p=0.69).

Conclusion: TEG has a limited clinical utility to evaluate pre-injury anticoagulants. Although, TEG can be used to assess trauma induced coagulopathy, its role in patients with preinjury anticoagulant therapy merits further evaluation.

Parameters	Anticoagulants (n=66)	No-Anticoagulant (n=132)	*p-value*
Thromboelastography			
Reaction Time (minutes), mean ± SD	4.7 ± 1.2	4.1 ± 1.6	**0.04**
K value (minutes), mean ± SD	1.1 ± 0.7	1.2 ± 0.5	0.18
Alpha Angle (degrees), mean ± SD	65 ± 8.6	65 ± 7.2	0.84
Maximum Amplitude (mm), mean ± SD	64 ± 6.0	66 ± 5.7	0.77
Conventional			
aPTT (seconds), mean ± SD	31 ± 6.5	26 ±4.5	**<0.01**
INR, mean ± SD	1.8 ± 1.4	1.1 ± 0.2	**<0.01**

Poster #39

INCREASED NEED FOR SWALLOW THERAPY AMONG TRAUMA PATIENTS WEARING CERVICAL COLLARS

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Background: Up to 93% of patients with traumatic brain injuries (TBI) develop dysphagia which can lead to aspiration, pneumonia, and death. Cervical collars (c-collars) restrict pharyngoesophageal segment opening, increase hyoid anterosuperior elevation and epiglottic inversion times which could increase the risk for dysphagia.

Methods: This retrospective study included geriatric patients (aged ≥ 65 years old) with a TBI or cervical spine injury admitted to a level I trauma center from January 2016 to December 2018. Patients who had a c-collar placed were compared to patients who did not. The primary outcome was swallow therapy for dysphagia. Secondary outcomes included: aspiration, pneumonia, respiratory failure, and death.

Results: 704 patients were included, 21.2% had a c-collar and 78.8% (555) did not. Overall, the mean (SD) age was 77.0 (7.5), 49.9% were female, and the mean injury severity score was 13.4 (8.0). Patients were comparable in demographics, ISS and GCS. There was a significantly higher proportion of patients with a c-collar who had swallow therapy for dysphagia than patients without a c-collar [54.4% (81) vs. 38.0% (211), $p<0.001$]. Respiratory failure occurred significantly more frequently in patients with a c-collar than patients without [16.8% (25) vs. 6.7% (37), $p<0.001$]. Although not statistically significant, aspiration occurred more frequently in patients with a c-collar than without, [7.4% (11) vs. 4.1% (23), $p=0.10$], as did in-hospital mortality [8.7% (13) vs. 4.7% (26), $p=0.06$]. The proportion of patients who had pneumonia was similar between groups ($p=0.88$). After adjustment, patients with a c-collar had significantly higher odds of needing swallow therapy for dysphagia [OR (CI): 1.9 (1.3, 2.8)] and for respiratory failure [OR (CI): 2.8 (1.6, 5.1)]. After adjustment, wearing a c-collar did not significantly increase the odds of aspiration [OR (CI): 1.9 (0.9, 3.9)], pneumonia [OR (CI):0.8 (0.3, 2.3)] or death [OR (CI): 1.6 (0.7, 3.6)].

Conclusions: Although there was no difference in the rate of aspiration between groups, patients with c-collars were at an increased risk for needing swallow therapy for dysphagia and respiratory failure. Screening for dysphagia and aspiration among patients with a c-collar may reduce the risk of subsequent complications.

Poster #40

PEDIATRIC PEDESTRIAN INJURIES: STRIKING TOO CLOSE TO HOME

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Purpose: Pediatric pedestrian injuries (PPI) are a major health care concern, especially in urban trauma centers. Identifying clusters of events can help influence public policy.

Methods: PPI injuries ≤ 18 years treated at our Level 1 trauma center from 10/2013-3/2020 were retrospectively reviewed. Demographics, injuries, and outcomes were analyzed. ArcGIS Pro 2.6.1 was used to geocode home and injury locations to measure Euclidean distance from home to each incident. Incidents were aggregated to zip codes and the Local Indicators of Spatial Association (LISA) statistic was used to test for spatial clustering of injury rates per 10,000 children.

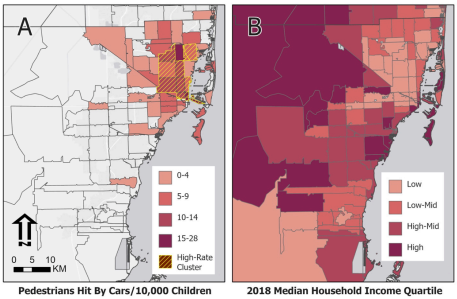

Figure 1. A. County distribution of pediatric pedestrian hit by car injuries (per 10,000 age 0-18 years) aggregated by zip code, treated between October 2013 and March 2020. B. County distribution of 2018 median household income quartiles.

Results: There were 176 cases of PPI identified, for an incidence of 6% of pediatric traumas. Most patients were African American (51%), male (58%), >13 years (59%), and had Medicaid insurance (67%). The most common injuries were traumatic brain injuries (26%) and orthopedic (26%). Injuries occurred primarily (84%) during non-school hours (2PM to 8AM) and in zip codes with lower household income (Figure 1B). The mean distance of injury location from home was 5.8 ± 10.7 kilometers (km), with 40% and 51% of injuries occurring within 1 km and 2 km from home, respectively. Nine zip codes encompassing several interstate exists and the connected heavy-traffic roadways comprise a statistically significant cluster of PPI rates (Figure 1A).

Conclusions: Pediatric pedestrian injuries most often occur near the home and in zones corresponding to low-income neighborhoods in close proximity to major roadways. This analysis, along with multidisciplinary injury prevention collaboration, can direct local safety programs and provide a model at the national level.

Poster #41

A NATIONAL TRAUMA DATA BANK® ANALYSIS: MORTALITY IN PATIENTS WITH PSYCHIATRIC COMORBIDITY

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Background: Pre-existing psychiatric comorbidity (PSYCH-COMD) is over-represented in patients who experience injury, with a reported prevalence of 11.5-63% at the time of admission. Prior works are mixed on the effects of PSYCH-COMD in terms of outcomes and are limited to single-center studies and studies that do not distinguish psychiatric illness from other mental altering comorbidities. In this study we aimed to use a nationally representative dataset to determine short-term outcomes in injured patients with concomitant PSYCH-COMD at the time of admission. We hypothesize that those with PSYCH-COMD will have worse short-term outcomes compared to those without.

Methods: A total of 751,459 patients from the National Trauma Data Bank (NTDB) in 2017 who were 18 years or older and admitted for at least 24 hours were analyzed. 177,708 patients were in the PSYCH-COMD group, and 573,751 patients in the no PSYCH-COMD group. Descriptive statistics were performed to compare demographics, injury characteristics and hospital outcomes between the two groups. A multivariate logistic regression model was created to assess mortality based on prior trauma literature on mortality risk assessment.

Results: Patients with PSYCH-COMD were more likely to be white women, have a blunt mechanism of injury, and to be less severely injured. After adjusting for predictors of mortality risk based on existing trauma literature as well as controlling for dementia, substance use disorder, and alcohol use disorder separately, PSYCH-COMD was associated with a decreased risk of mortality, longer hospital lengths of stay and increased risk of complications including unplanned ICU admission, unplanned intubation, alcohol withdrawal, and sepsis.

Conclusion: This is the first analysis of clinical outcomes of injured adults with pre-existing PSYCH-COMD using the NTDB. While patients with PSYCH-COMD had decreased risk of mortality, they also had increased risk of complications. Identifying this at-risk population early in their hospital course may facilitate reduced complication rates. Further study is needed to determine the reasons for the disparate outcomes.

Poster #42

BLOOD PRESSURE AT ENDOVASCULAR AORTIC OCCLUSION INITIATION IS ASSOCIATED WITH SURVIVAL IN TRAUMA

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Introduction: Resuscitative endovascular balloon occlusion of the aorta (REBOA) is a minimally invasive resuscitative maneuver to preserve central blood pressure. The physiologic parameters at which to initiate REBOA treatment in order to improve outcomes are poorly defined. This study examined the impact of systolic blood pressure (SBP) at the time of REBOA procedure initiation on survival.

Methods: The Aortic Occlusion for Resuscitation in Trauma and Acute Care Surgery (AORTA) database (October 2013-July 2020) was queried for patients who underwent REBOA. Patients were divided into three groups based on SBP at time of procedure initiation: ≤60mmHg (Group 1), 61-80mmHg (Group 2), and >80mmHg (Group 3). Patients without measurable SBPs at any time were excluded. Data related to demographics, injury severity, treatment, and outcomes were collected. Survival was assessed using Kaplan-Meier log-rank testing.

Results: 333 patients were included (Group 1: n=99; Group 2: n=123; Group 3: n=111). Injury severity scores were similar across groups (p=0.078). Arrival SBP was lowest in Group 1 compared to Groups 2 and 3 (median SBP 90 vs 93 and 108, p=0.003). Group 1 patients were more acidotic, had higher lactic acid and INR levels, and lower base deficit levels (all $p<0.05$). Group 1 patients also received more pRBCs, plasma, and platelets (all $p<0.05$). There were no differences in time to initiation, procedural time, or access technique (all $p>0.05$). Group 1 had the highest in-hospital mortality rate (51.5% vs 42.3% and 30.6% in Groups 2 and 3, respectively; log-rank p=0.007). On logistic regression, SBP at REBOA initiation was not a significant predictor of 24-hour mortality. With the exception of need for patch angioplasty, there were no differences in any procedure-related complications between groups ($p>0.05$).

Conclusion: REBOA procedure initiation at lower SBPs was associated with decreased survival. Increasingly deranged pH and INR levels in this group reflected a diminished physiologic reserve that likely contributed to mortality. Given the similar rates of procedure-related complications regardless of SBP at the time of placement, early initiation of REBOA should be considered.

Poster #43

INCREASED INCIDENCE OF VIOLENT INJURIES AT A LEVEL 1 TRAUMA CENTER FOLLOWING THE POLICE KILLING OF GEORGE FLOYD

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Introduction: Hospital admissions for violent injuries have increased in some US trauma centers during the COVID-19 pandemic. The police killing of George Floyd, which sparked widespread protests and resulted in a national reckoning with racial injustice, is a potential stressor that could explain this increase. In this study, we explored the incidence of violent injuries during the course of the COVID-19 pandemic, paying special attention to the dates of containment policy enactment and the police killing of George Floyd. We hypothesized that violent injuries would increase in response to both events.

Methods: We conducted an interrupted time series analysis for violent injuries between January 1, 2016 and October 29, 2020 at an urban ACS-verified Level 1 Trauma Center. Violent injuries were defined as gunshot wounds, stab wounds, and blunt assaults. The interruption variables of interest were the start of local COVID-19 containment policies (March 16, 2020) and the police killing of George Floyd (May 25, 2020). We assessed temporal associations between these two events and violent injuries using Poisson regression.

Results: There were a total of 5,811 violent injuries during the study period (252 weeks). There was a mean of 22.0 (SD 6.0) violent injury incidences per week in the 229 weeks prior to the killing of George Floyd and a mean of 33.2 (SD 5.8) incidences per week in the 23 weeks after his killing. The result was a 40% increase in violent injury counts per week (incidence rate ratio [IRR] = 1.4; 95%CI: 1.20, 1.64) following the police killing of George Floyd (Figure 1). COVID-19 containment policy enactment was not associated with any change in violent injury incidence (IRR = 0.93; 95%CI: 0.80, 1.08).

Conclusion: Violent injuries significantly increased following the police killing of George Floyd. There was no association between increasing violent injuries and the enactment of COVID-19 containment policies, unlike other studies. Just as hospitals planned for the COVID-19 pandemic, trauma centers should be prepared to respond to higher levels of violent injury during times of social unrest.

Poster #44

OUTCOMES OF REBOA UTILIZATION IN TRAUMA PATIENTS WITH AND WITHOUT TRAUMATIC BRAIN INJURIES: A NATIONAL ANALYSIS OF THE ACS-TQIP DATASET

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Background: Hemorrhage remains a leading cause of death among trauma patients. Resuscitative endovascular balloon occlusion of the aorta (REBOA) has grown in popularity as an efficient, less invasive alternative to managing patients with non-compressible hemorrhage. We aim to investigate the use of REBOA in adult civilian trauma patients with and without concomitant traumatic brain injury (TBI).

Methods: We conducted a secondary analysis of the American College of Surgeons Trauma Quality Improvement Program (ACS-TQIP) database from years 2015-2017. Adult trauma patients with and without TBI and who had a REBOA placed were included in our analysis. Patients who were deceased on arrival, required resuscitative thoracotomy, or had missing information regarding TBI-status were excluded. Inpatient mortality, complications, and transfusion requirements were assessed based on TBI status.

Results: The ACS-TQIP Database consisted of 2,352,542 patients. Of these, 199 met our criteria for inclusion in our final analysis. REBOA+TBI patients were significantly more likely to have a lower GCS $\leq$8 (82.4% vs 54.4%, $p<0.001$) and systolic BP (89$\pm$37.4 vs. 107.2$\pm$39.7; $p=0.002$), and higher ISS >25 (83.5% vs 65.8%, $p=0.01$) compared to REBOA/non-TBI patients. No significant differences in odds of inpatient mortality (62.4% vs 50.9%, $p=0.11$) or complications (17.7% vs 11.4%, $p=0.21$) were observed between groups. Odds of inpatient mortality did not significantly differ between patients with and without TBI based on mechanism of injury, Trauma Center level, teaching hospital status, and pelvic fracture status.

Conclusion: TBI status was not associated with higher odds of inpatient mortality in patients receiving REBOA in our investigation.

Poster #45

PREDICTORS OF MORTALITY IN CIRRHOTIC TRAUMA PATIENTS – RESULTS OF ADAPTIVE LASSO REGRESSION ANALYSIS OF TRAUMA QUALITY IMPROVEMENT PROGRAM

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Background: Injured patients with preexisting cirrhosis have high complication and mortality rates. We sought to identify predictors of mortality in cirrhotic injured patients and their association with hemorrhage control interventions.

Methods: We analyzed Trauma Quality Improvement Program (TQIP) 2017 dataset to identify injured patients who were admitted with a history of cirrhosis. We compared patients' demographics, co-morbidities, interventions, and hospital complications between those who died and those who survived. We performed adaptive Lasso regression with cross-validation to identify predictors of mortality. Significance was set at $\alpha=0.05$.

Results: We identified 9,229 trauma patients with preexisting cirrhosis, of those 785 (8.5% died). Patients who died were older (61.1±11.9 vs 57.2±14.7, $p<0.001$), had higher injury severity score (ISS median 18 vs 9, $p<0.001$), and more likely to require hemorrhage control interventions and develop hospital complications. There was no difference in hospital length of stay (LOS), but patients who died had higher median intensive care unit (ICU) LOS (5 vs 3, $p<0.001$). Lasso regression model identified predictors with higher odds of mortality: Age (1.03, 95%CI:1.03 –1.04), ISS (1.09, CI: 1.08-1.11), Glasgow coma scale <8 (5.70, CI:4.24-7.66), any transfusion in the first 24 hours (3.60, CI:2.60-4.99), any intervention for hemorrhage control (2.16, CI:1.06-4.37), pelvic embolization (3.55, CI: 1.11-11.43), development of acute kidney injury (11.09, CI: 6.94-17.71), and unplanned return to ICU (2.59, CI:1.74-3.88). Development of deep venous thrombosis was associated with decreased mortality (OR: 0.14, CI:0.04-0.51). Undergoing gastrointestinal surgery was not associated with mortality in the adjusted model (OR:0.65, CI:0.33-1.25).

Conclusion: High injury severity, hemorrhage requiring transfusion and operative control, and development of acute kidney injury were associated with high mortality among trauma patients with preexisting cirrhosis. Further investigation should explore the interactions between liver disease, hemorrhage, and risk of complications development and mortality.

Poster #46

PREHOSPTIAL PAIN MANAGEMENT IS EFFECTIVE AND SAFE BUT UNDERUTILIZED IN TRAUMA PATIENTS

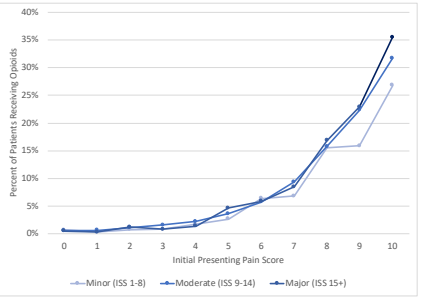
Michael Dalton MD MPH; Alexander Ordoobadi MD; Eric Goralnick MD MS; John Chovanes DO; Ali Salim MD; Molly Jarman PhD MPH
Brigham & Women's Hospital

Introduction: Despite concerns about long-term dependence, opioids remain the mainstay of treatment for acute pain from traumatic injuries. Additionally, early pain management has been associated with improved long-term outcomes in injured patients. We sought to identify the patterns of prehospital pain management across the United States.

Methods: We used 2019 national EMS data to identify the use of pain management for acutely injured patients. Opioid specific dosing was calculated in morphine milligram equivalents (ME). The effects of opioids as well as adverse events were identified through objective patient data and structured provider documentation.

Results: We identified a total of 3,831,768 injured patients, 85% of whom were treated by an ALS unit. There were 269,281 (7.0%) patients treated with opioids, including a small number of patients intubated by EMS (n=1,537; 0.6%). The median opioid dose was 10 ME [IQR 5-10] and fentanyl was the most commonly used opioid (88.2%). Patients treated with opioids had higher initial pain scores documented by EMS than those not receiving opioids (8.5 vs 4.4, $p<0.001$), and had a mean reduction in pain score of 2.8 points (SD 2.7) compared to the final prehospital pain score. Adverse events associated with opioid administration, including episodes of altered mental status (n=453; 0.2%) and respiratory compromise (n=252; 0.1%), were rare. For patients with severe pain (≥8/10), 27.3% of patients with major injuries (ISS ≥15) were treated with opioids, compared with 24.8% of those with moderate injuries (ISS 9-14), and 21.4% of those with minor (ISS 1-8) injuries ($p<0.001$).

Conclusion: The use of opioids in the prehospital setting significantly reduced pain among injured patients with few adverse events. Despite its efficacy and safety, the majority of patients with major injuries and severe pain do not receive opioid analgesia in the prehospital setting.



Poster #47

INTRAVENOUS ANTIBIOTICS FOR OPEN FRACTURES WITHIN 1 HOUR OF ARRIVAL: A REALISTIC GOAL?

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Introduction: Open fractures have a high risk of infection. Organizations such as EAST and TQIP have issued guidelines on antibiotic management of patients with open fractures, aiming to minimize this risk.

Methods: This was a retrospective study of adult patients with open long-bone fractures admitted to 6 level 1 trauma centers in 1/1/18-12/31/19. Adherence to antibiotic guidelines was evaluated. Full guideline adherence was defined as receipt of intravenous antibiotics within 1h of arrival (gram+ antibiotics for types I and II open fractures and gram+ and gram- for type III). Partial adherence was defined as receipt of antibiotics within 6h (gram+, type I/II; gram+ and gram-, type III).

Table 1. Adherence to antibiotic administration guidelines

	Full	Partial	None	P
	n=259 (61%)	n=102 (24%)	n=65 (15%)	
Highest grade				**0.04**
I/II (n=226)	134 (59%)	68 (30%)	24 (11%)	
III (n=178)	125 (70%)	34 (19%)	19 (11%)	
Fracture location				
Humerus (n=40)	30 (75%)	7 (18%)	3 (7%)	0.14
Radius (n=84)	47 (56%)	20 (24%)	17 (20%)	0.35
Ulna (n=85)	51 (60%)	19 (22%)	15 (18%)	0.77
Femur (n=101)	61 (60%)	23 (23%)	17 (17%)	0.86
Tibia (n=183)	116 (63%)	45 (25%)	22 (12%)	0.27
Fibula (n=112)	73 (65%)	25 (22%)	14 (13%)	0.50
Fracture number				0.56
Single (n=262)	154 (59%)	66 (25%)	42 (16%)	
Multiple (n=164)	105 (64%)	36 (22%)	23 (14%)	
Washout performed	240 (93%)	97 (95%)	64 (98%)	0.18

Results: The study included 426 patients (Table 1), of which 259 (61%) received antibiotics in full adherence, and 102 (24%) met partial adherence. Patients with more severe open fractures (type III) were more likely to receive fully adherent administration than those with type I or II (P=0.04). Ninety-four percent of patients received wound washout/irrigation, with a median time from arrival to washout of 3h. Seventeen patients (4%) developed open fracture infection, which was not associated with receiving fully, partially, or non-adherent antibiotics (4%, 5%, 3%; P=0.88).

Conclusion: Despite low adherence to full guidelines (61%), 85% of patients received partially guideline-adherent antibiotics, with a low infection rate (4%). These data may suggest that antibiotic administration within 1h of arrival is a challenging task, but even without reaching that goal, overall infection rate remained low, perhaps because other recommendations such as wound washout and irrigation were followed.

Poster #48

OUTCOMES OF CHEST COMPRESSIONS AFTER CARDIAC ARREST IN OCTOGENARIAN AND NONAGENARIAN PATIENTS IN THE SURGICAL INTENSIVE CARE UNIT

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Cedars-Sinai Medical Center

Introduction: The decision to perform chest compressions in elderly patients in the surgical intensive care unit (SICU) can be challenging due to the uncertainty regarding long term survival. Our aim was to determine the outcomes for patients 80 years and older after chest compressions in the SICU.

Methods: A retrospective, single institution, observational study was performed at a large, urban, academic medical center from July 2009 to September 2017 of all surgical intensive care patients aged 80 years and older who underwent chest compressions. Additional data collection included a review of achievement of return of spontaneous circulation (ROSC), survival days after chest compressions, and post-arrest morbidity and mortality.

Results: Of the 1918 SICU patients reviewed, 1460 patients were aged 80 to 89 years and 458 aged 90 to 99 years. Of the 1460 octogenarians, 37 patients underwent chest compressions with 17 (62.6%) of those achieving ROSC. The 30-day and in-hospital mortality in this group was 100%. Of the 458 nonagenarians, 18 underwent CPR with 13 (72.2%) of those achieving ROSC. The 30-day mortality in this group was 61.1% with 6 patients surviving beyond 30 days. Among these 6 patients, 5 (83.3%) had prolonged hospital courses with multiple hospital acquired infections, ventilator dependency, and parenteral nutritional support, including 3 (50.0%) patients who also developed chronic renal failure and required hemodialysis. None of these 5 patients survived to discharge. The single survivor was a trauma patient who sustained cardiac arrest due to blunt cardiac injury with no known comorbid conditions. This patient was discharged 7 days after admission and was then lost to further follow up.

Conclusion: For patients 80 years and older in the SICU who required chest compressions, mortality was nearly 100%. Although some patients obtained ROSC, long term survival was almost zero. Our findings can provide guidance to practitioners when discussing the utility of chest compressions in this population with patients and families.

Poster #49

SHOULD WE PHENOBARB-IT-ALL? A PHENOBARBITAL-BASED PROTOCOL FOR TRAUMA PATIENTS AT HIGH RISK OF OR EXPERIENCING ALCOHOL WITHDRAWAL

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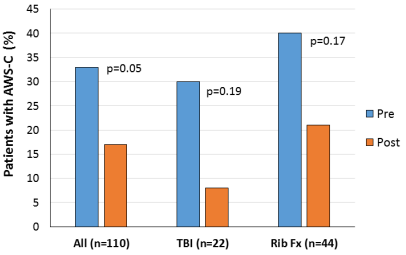
Maine Medical Center

Introduction: Alcohol use is common in trauma patients (pts) and alcohol withdrawal syndrome (AWS) is associated with significant morbidity. Although benzodiazepines (BZD) are commonly used for AWS, they can cause significant side effects including neurologic (CNS) and respiratory depression. Phenobarbital (PHB) has been utilized as an alternative therapy, but data is limited for its use in trauma pts. We hypothesize that a PHB-based protocol is safe and may be more effective than BZDs.

Methods: A retrospective study of adult non-intensive care unit trauma pts at risk of or experiencing AWS before and after implementation of a PHB protocol was conducted. Outcomes evaluated were AWS-related complications (AWS-C), CIWA score > 10, hospital length of stay (HLOS), BZD use, adjunctive medication use, and medication-related adverse events (MRAE). Subgroup analyses were performed on pts with traumatic brain injuries (TBI) and rib fractures (fx).

Results: 110 pts were included, with 51 in the pre-group (PRE) and 59 in the post-group (POST). Seventeen PRE pts developed AWS-C compared to 10 POST pts (33% vs 17%, p=0.05). PRE pts were more likely to receive BZDs (88% vs 42%, p<0.0001) compared to POST pts with only 7% of POST pts receiving BZDs after initiation of PHB. Pts with CIWA scores >10 were reduced in PRE vs POST (84% vs 63%, p=0.01). There were no significant differences in HLOS (11 days vs 8.9 days, p=0.27), adjunctive medication use (49% vs 54%, p=0.60), or MRAE (57% vs 39%, p=0.06) between the PRE and POST groups. There was no significant difference in AWS-C between the PRE and POST TBI and rib fx subgroups with a decrease in CNS depression in POST rib fx pts (55% vs 25%, p=0.04).

Conclusion: A PHB-based protocol in trauma pts is effective in preventing AWS-C, reducing CIWA scores, and decreasing BZD use without an increase in MRAE. Furthermore, PHB appears safe in TBI and rib fx pts without an increase in CNS or respiratory depression.



Poster #50

TOP-DISPO: AN ARTIFICIAL-INTELLIGENCE TOOL AND SMARTPHONE APPLICATION TO PREDICT DISCHARGE DISPOSITION IN TRAUMA PATIENTS

Lydia R. Maurer MD; Sumiran S. Thakur BS; Hamza Tazi Bouardi MS; MBAn; Mohamad El Moheb MD; Annita Vapsi BSc; Leon Naar MD; Anthony Gebran MD; George C. Velmahos MD; PhD; Dimitris Bertsimas PhD; Haytham M.A. Kaafarani MD, MPH
Massachusetts General Hospital

Introduction: Delays due to discharge planning can increase length of stay (LOS). We aimed to use AI technology to create an early predictor of post-acute care (PAC) needs in trauma patients.

Methods: All patients in the 2010-2016 ACS-TQIP database were included. Demographics, ED vital signs, comorbidities, and injury characteristics (e.g. severity, mechanism) were included in a novel, interpretable AI technology called Optimal Classification Trees (OCTs). An 80:20 train:test split was used to develop predictive OCTs for blunt and penetrating trauma patients for discharge to PAC (e.g. rehabilitation, skilled nursing facility) vs. home. An interactive, user-friendly application was created. C-statistics were used to validate performance.

Results: A total of 870,475 patients were included. The mean age was 51 years, 91% had blunt trauma, and the mean ISS was 15; 325,867 (41%) of the blunt injury patients and 12,254 (15%) of penetrating injury patients were discharged to PAC. Based on the OCT algorithms [Figure 1], the Trauma Outcomes Predictor discharge DISPOsition (TOP-DISPO) phone application was created. TOP-DISPO accurately predicted discharge to PAC in patients with blunt (c-statistics: 0.817 train, 0.815 test) and penetrating (c-statistics: 0.82 train, 0.79 test) injuries [Figure 2].

Conclusions: We recommend TOP-DISPO as an accurate AI-based tool for predicting PAC need in trauma patients. TOP-DISPO could prove useful for early discharge planning and reducing LOS in trauma patients.

Figure 1: Optimal Classification Trees

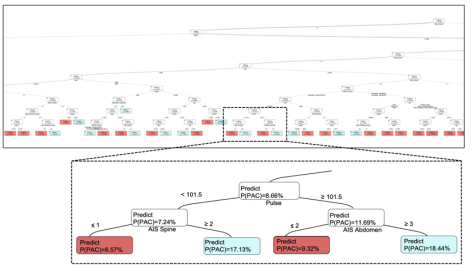
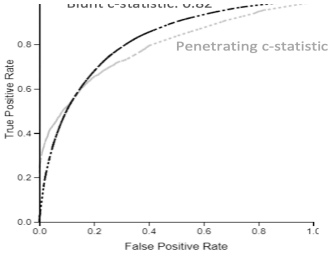


Figure 2: Receiver Operator Characteristic Curves for Test Datasets for Blunt and Penetrating Mechanisms



Poster #51

ASSESSMENT OF MACHINE LEARNING METHODS TO PREDICT MASSIVE BLOOD TRANSFUSION IN TRAUMA

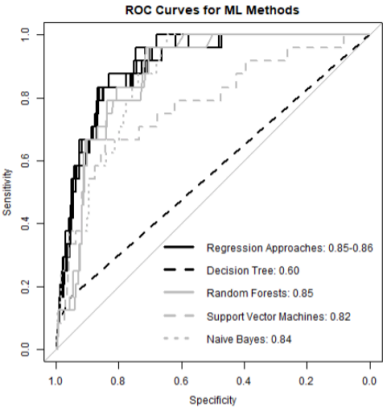
Matt Strickland MD; Anthony Nguyen MEng; Shinyi Wu PhD; Sze-Chuan Suen PhD; Yanda Mu; Brandon Shin; Tej Kalakuntla; Kazuhide Matsushima MD
University of Southern California

Introduction: Development of predictive models to assess the need for massive transfusion (MT) has been extensively explored. The purpose of this study is to explore the use of modern machine learning (ML) methods to develop and validate a model that can accurately predict the need for MT using a comprehensive set of variables available to physicians at the time of the decision. We hypothesized that a predictive model using ML can predict the need for MT more reliably than currently used scoring systems.

Methods: Trauma patients (≥16 years) who presented to an academic Level 1 trauma center as a trauma team activation between 2015-2019 were included. We explored multiple ML methods including logistic regression with forward and backward selection, logistic regression with lasso and ridge regularization, support vector machines, decision tree, random forest, and naive Bayes. Models are assessed using AUC, sensitivity, specificity, NPV and PPV. Performance was compared to that of existing scores.

Results: 2438 patients are included in the study with approximately 5% receiving MT. All models besides decision tree attained an area under the curve (AUC) of above 0.80 (0.82-0.86). Our regression models have higher sensitivity (0.79-0.83) than the ABC and RABT score (0.47 and 0.45 respectively) while maintaining similar specificity (0.80-0.82; ABC 0.84 and RABT 0.81). Our regression results suggest that SpO_2, respiratory rate (RR), and age may be novel meaningful predictors.

Conclusion: Most of the ML models performed significantly better than existing scores. Patient age, SpO_2, and RR may be important clinical indicators for MT decision. Implementing an ML model in mobile computing devices or EMR-based tool has the potential to improve results. Future research should test feasibility, usability, and acceptability of implementing an ML-informed MT decision support.



Poster #52

CHARACTERIZATION OF PLATELET DYSFUNCTION IN TRAUMATIC BRAIN INJURY

R. Chace Hicks MD; M. Victoria P. Miles MD; Caroline Brown BS; Abigail Edwards BS; Kathryn Stewart RN; Robert Maxwell MD

Introduction: Thromboelastography (TEG) with platelet mapping measures platelet inhibition through the adenosine diphosphate (ADP) and arachidonic acid (AA) pathways. We hypothesized that antiplatelet use, increased head abbreviated injury scale (head AIS), and increased injury severity score (ISS) would increase platelet inhibition measured by TEG in patients with traumatic brain injury (TBI) and predict an increased morbidity and mortality.

Methods: A retrospective review was conducted at a level one trauma center of all patients presenting with TBI from December 2019 to July 2020. A TEG with platelet mapping was performed on TBI patients with intracranial bleed. Patient characteristics, hospitalization data, and laboratory values from presentation were collected and evaluated.

Results: A total of 245 patients were included in the study. For patients with ADP inhibition > 60%, ISS was increased over those who were not inhibited (median 17 versus 13, p=0.0085). An increase in ADP nor AA inhibition was found to be associated with a worsening head AIS (data now shown). Of patients taking antiplatelet medications, the incidence of AA inhibition was greater than ADP (74% versus 26%). Patients with admission platelet count less than 150 were not more likely to demonstrate platelet inhibition (ADP OR 0.74, p=0.8005; AA OR 1.83, p=0.2374). Finally, decreased MA (OR 0.94, p=0.0082) was associated with higher risk of mortality.

Conclusion: Higher ISS is associated with an increase in ADP inhibition in patients with TBI. However, head AIS was not associated with increased incidence of platelet dysfunction (ADP or AA). Therefore, platelet dysfunction does not appear to be associated with worsening brain injury alone. Patients sustaining TBI should have platelet dysfunction assessed with TEG, especially in those taking antiplatelet medication, although the specific relationship between platelet inhibition and degree of injury remains to be determined.

Poster #53

IS THERE HOSPITAL VARIABILITY IN ADMINISTRATION OF BALANCED TRANSFUSIONS TO INJURED PATIENTS? A TQIP ANALYSIS

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Northwestern University

Introduction: Annually, trauma leads to 214,000 deaths in the United States. Balanced 1:1:1 transfusion reduces mortality. Given this recent finding and guideline recommendations to provide balanced transfusion during initial trauma resuscitations, we aimed to examine if significant hospital variability existed in administration of balanced transfusion one year following the publication of the PROPPR Trial.

Methods: We performed an observational cohort study of injured patients presenting to Trauma Quality Improvement Program (TQIP) facilities in 2016. Inclusion criteria were patients receiving at least one transfusion of packed red blood cells, fresh frozen plasma, or cryoprecipitate. Hierarchical multivariable logistic regression was used to adjust for patient and hospital characteristics and assess whether there was significant variability in balanced transfusion rates at 4 and 24 hours at the hospital level.

Results: Among the 20,067 patients who received transfusions, 6.5% (1,304) received balanced transfusions in the first 24 hours after arrival to the hospital. Increased odds of balanced transfusion included disposition from the ED to the ICU (OR: 1.40, 95%CI: 1.19-1.64). Patients had lower odds of receiving balanced transfusion if they underwent thoracotomies (0.41, 0.29-0.58) or extremity hemorrhage control (0.50, 0.36-0.69) within the first 24 hours from arrival compared to no hemorrhage control. No hospital level predictors were significantly related to increased or decreased odds of balanced transfusion. 35 hospitals were high outliers (better performing) in administration of balanced transfusion and 4 hospitals were low outliers at 24 hours. 17.8% of variability can be associated to differences between hospitals ($p<0.001$). Attached figure is a caterpillar plot that shows odds of balanced transfusion by hospital at 24 hours.

Conclusion: In 2016, there was significant variability in administration of balanced transfusion between hospitals after controlling for hospital and patient characteristics.

Poster #54

A PILOT STUDY TO EVALUATE THE NEED OF POST-OPERATIVE SYSTEMIC ANTICOAGULATION IN PATIENDS WITH POST TRAUMATIC MEDIUM SIZED PERIPHERAL ARTERY REPAIR: A RANDOMISED CONTROL TRIAL

Sushma Sagar MS, FACS, FRCS; Abhishek Kumar; Subodh Kumar MS, FACS, FRCS; Pratyusha Priyadarshi MS; Atin Kumar MD; Shivanand Gamangatti MD; Amit Gupta MS, FACS, FRCS
JPN Apex Trauma Center, All India Institute of Medical Sciences

INTRODUCTION: Over the past few decades peripheral vascular trauma has emerged as growing concern due to rising number of road traffic injuries, Railway associated injuries and physical assaults which includes firearm and penetrating injuries. There are wide agreement on principles for vascular repair and intra-operative anticoagulation. However, when it comes to postoperative management of vascular trauma, anticoagulation is highly variable in practice amongst surgeons, and there is lack of consensus on its applicability, dose, timing, length of use, efficacy, or adverse effects. The use of systemic anticoagulation to prevent thrombosis is a standard protocol for vascular surgeons during elective repair of blood vessels. However, in the setting of traumatic vascular injuries, concomitant intracranial hemorrhage, soft tissue injury, or solid organ lacerations may preclude its use for vascular repair. A prospective randomized control pilot study was conducted to address the issue of SPAC (systemic post-operative anticoagulation) at a Level-I trauma center. The purpose of this study was to formulate an institutional protocol directing the use of SPAC in medium size arterial repair.

METHODS: The study was conducted in the Division of Trauma Surgery & Critical Care at JPN Apex Trauma Centre, All India Institute of Medical Sciences (AIIMS), New Delhi from Feb. 2019 to August-2020. Total 32 patients were enrolled during time of study period fulfilling inclusion and exclusion criteria. All these patientsreceived intra-operative bolus heparin @ 80 IU/Kg body weight at the point of starting arterial repair. After completion of the primary end to end anastomosis patients were randomized in two groups (Group A and Group B) using sealed envelope method. In post-operative period Group A continued with maintenance intravenous heparin @ 18 IU/Kg body weight for 3 days while Group B did not receive any systemic anticoagulation in postoperative period. Color Doppler evaluation was done to evaluate the vessel patency in post operative period.

RESULTS : The study conducted at our level 1 trauma center ensures comparability among cohorts, received SPAC and without anticoagulation in terms of age in years (mean 30.9 vs. mean 29.7, p=0.918), time of injury-presentation in hours (median 6.5 vs. 5, p=0.560), nature of injury (75% vs. 93.8% were blunt, 25% vs. 6.3% penetrating, p=0.166), crush component (93.8% vs. 75%, p=0.166) associated injuries (37.6% vs. 50%, p=0.506) and severity of injury (MESS: 5.3 vs. 4.5,p=0.072; GHOISS: 4.18 vs. 3.18, p=0.493; ISS: 7.75 vs. 7.06, p=0.504). Our study showed no statistical difference in terms of Vessel patency and limb salvage among the patient received SPAC and without anticoagulation (75% vs. 87.5%, p=0.654) and (87.5% vs. 87.5%, p=0.513) respectively at the time of discharge. However there are significant differences in terms of post operative bleeding/hemorrhage (31.3% vs. 0%, p=0.03), re-exploration rate (37.5% vs. 18.75% p=0.03) and requirement of blood product (50% vs. 12.5%, p=0.04) among SPAC and without anticoagulation cohorts.

CONCLUSION: Post-operative systemic anticoagulation has no benefit in traumatic medium size primary arterial repair of the extremity to improve vessel patency. This study has shown an increase in negative outcomes with anticoagulation use as rise in bleeding tendency, increased rate of re-exploration, more blood products requirements in post-operative periods, increased number of operative procedures and prolong hospital stay. When compared with the upper extremity,limb loss rate is significantly higher in the lower extremity.

Poster #55

INITIAL EMS SHOCK INDEX IS THE MOST ACCURATE PREDICTOR OF PATIENT OUTCOMES

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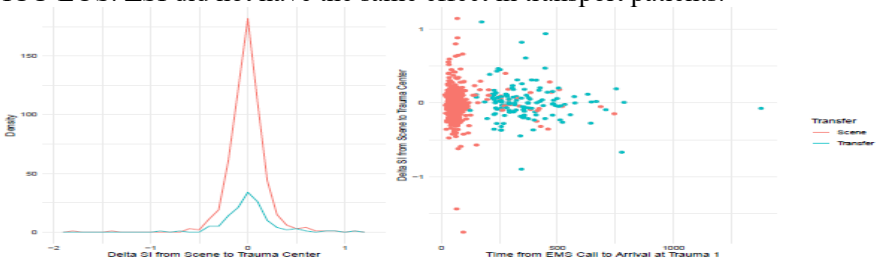
West Virginia University

Introduction: Shock index (SI) and delta shock index (ΔSI) predict mortality and blood transfusion. This study aimed to evaluate the predictive ability of SI and ΔSI in a rural environment with prolonged transport times, and transfers from critical access hospitals or level IV trauma centers.

Methods: We completed a retrospective database review at an ACS Level 1 trauma center over 2 years. Adult subjects analyzed sustained blunt chest or abdominal trauma. Subjects with missing data or severe head trauma were excluded. For analysis poisson regression and binomial logistic regression were utilized to study the effect of time in transport and SI/ΔSI on resource utilization and outcomes. $P<0.05$ was considered significant.

Results: Complete data was available on 588 scene patients and 130 transfers. Mean ISS was 11 (IQR9.0) for scene and 13.3 (IQR8.0) for transfers. Initial EMS SI was the most significant predictor for blood transfusion and ICU care in both scene and transferred patients (effect size for blood 5, $p<0.0001$) compared to trauma center arrival SI or transferring center SI. A positive ΔSI was significantly associated with the need for transfusion and the number of units transfused. Longer transport time also had a significant relationship with increasing ICU LOS. Cohorts were analyzed separately. In the scene cohort there was a positive relationship between ΔSI and the need for transfusion and ICU LOS. ΔSI did not have the same effect in transport patients.



Conclusion: Providers must maintain a high level of clinical suspicion for patients who had an initially elevated SI. EMS SI was the greatest predictor of injury and need for resources. Enroute SI and ΔSI were less predictive as time from injury increased. This highlights the improvements in enroute care, but does not eliminate the need for high-level trauma intervention.

Poster #56

IS LOW-TITER GROUP O WHOLE BLOOD TRULY A UNIVERSAL BLOOD PRODUCT?

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McGovern Medical School

Background: Based on AABB guidelines, whole blood (WB) has been historically transfused as a type-specific product. Given recent advocacy for low-titer blood group O WB (LTO-WB) as a potential universal blood product, we sought to examine patient outcomes associated with the use of LTO-WB across various recipient blood groups.

Methods: All trauma patients (16 years and older) receiving prehospital or ED transfusion of LTO-WB (11/17-07/20) were evaluated. Patients were divided into blood groups (O, A, B, AB). Major complications and survival were then compared. Statistical analyses performed using STATA 12.2.

Results:736 patients met inclusion; 368 group O, 236 group A, 101 group B, and 31 group AB. There were no differences in demographics, injury severity, hemolysis panels, or prehospital vitals or resuscitation. However, arrival systolic pressure was lower and lactate worse in blood group B patients (TABLE). While survival and most major complications were similar, acute kidney injury (AKI) was significantly higher among those with blood group B (TABLE). A multivariate model controlling for arrival physiology, lactate, and early transfusions noted group B patients had 2-fold increased likelihood of AKI (OR 2.12, 95% C.I. 1.15-3.90, P=0.015). This analysis was repeated in patients receiving emergency release RBCs and plasma (rather than WB). Group B (15%) was noted to have increased likelihood of AKI compared to other groups (O: 7%, A: 10%, AB: 11%); p=0.041.

Conclusions: LTO-WB appears to be a safe product for universal use across all blood types. While group B recipients experience greater incidence of AKI, this is also observed in patients receiving standard universal products of RBCs and plasma. More research is needed to evaluate the risk of early shock, higher transfusion requirements, and development of AKI among trauma patients with group B blood type.

Poster #57

LOW INITIAL TRAUMA BAY END-TIDAL CARBON DIOXIDE PREDICTS POOR OUTCOMES AND IS A USEFUL ADJUNCT

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WakeMed

Introduction: Appropriate triage of the trauma patient is critical. Low end-tidal carbon dioxide (ETCO2) is associated with mortality and hemorrhagic shock in trauma, but the relationship between low ETCO2 and other important clinical variables is not known. This study investigates the association of initial in-hospital ETCO2 and patient outcomes, as well as the utility of ETCO2 as a predictive aid for early trauma management.

Methods: Adult patients who presented to a Level One trauma center from 2019-2020 were eligible. Trauma bay ETCO2 measured by side stream capnography was prospectively obtained for all trauma activations at time of initial evaluation. Using the Liu method of cut point estimation, patients were stratified as having low ETCO2 (≤29.5 mmHg) or normal ETCO2 (>29.5 mmHg). Multivariable regression was used to estimate association of low ETCO2 with patient outcomes. An unadjusted predictive model for blood transfusion using ETCO2 was then built.

Results: Median time from arrival to ETCO2 measurement was 4 minutes (IQR 3-6). Among 493 admitted patients, 241 (48.9%) had low ETCO2. Compared to patients with normal ETCO2, those with low ETCO2 were older (median age 53 vs 46, p=0.01) and more likely to have the highest trauma activation (27.4% vs 19.8%, p=0.048). There was no difference in head injury. After adjustment, patients with low ETCO2 had greater odds of blood transfusion (OR 4.2, 95%CI 1.8-9.9), mechanical ventilation (OR 2.2, 95%CI 1.1-4.6), inferior disposition (OR 1.6, 95%CI 1.0-2.5), and complications (OR 3.1, 95%CI 1.4-6.8). Among all patients (N=955), the addition of ETCO2 to trauma bay SBP and HR was most predictive of early blood transfusion (area under ROC curve=77.1%).

Conclusion: Low trauma bay ETCO2 remains significantly associated with inferior clinical outcomes after adjustment. Low ETCO2 values, along with vital sign abnormalities, are highly predictive of the need for blood transfusion. Further studies are needed to evaluate the role of ETCO2 as a triage tool for early trauma management.

Poster #58

PERFORMANCE IMPROVEMENT PROGRAM REVIEW OF INSTITUTIONAL MASSIVE TRANSFUSION PROTOCOL ADHERENCE: AN OPPORTUNITY FOR IMPROVEMENT?

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Introduction: Much has been written about the impact of massive transfusion protocols (MTPs) on patient outcome. However, little data is available about compliance with established protocols and its impact on outcome. This performance improvement study was undertaken to evaluate institutional adherence with our MTP's intended plasma to red blood cell ratio (FFPR) and platelet to red blood cell ratio (PLTR), and the impact of nonadherence on patient outcomes.

Methods: The registry of an urban Level I trauma center was queried for adult patients who received at least 6 units of packed red blood cells within 4 hours of presentation over a 43-month period; we excluded patients who presented in cardiac arrest or died within 1 hour of presentation. Bivariate and multivariable logistic regression analysis were performed to identify variables associated with noncompliance in FFPR and PLTR in the first 4 hours after presentation, and their effects on inpatient mortality.

Results: 516 patients met study inclusion criteria, with median ISS 25 and inpatient mortality 31.6%. Target FFPR was achieved for 42.8% of patients, and target PLTR for 65.1%. All anatomic and physiologic severity markers were similar between groups. In bivariate analysis, inpatient mortality was not different when FFPR was not achieved (34.6 vs 27.1%, p=.072) but was higher when PLTR was not achieved (39.4% vs 27.1%, p<0.001). After adjusting for age, ISS, Revised Trauma Score, INR, and total blood products transfused, achieving intended FFPR and PLTR in the first 4 hours reduced mortality, OR 0.594 (p=0.044) and 0.313 (p<0.001) respectively.

Conclusion: Large proportions of critically injured patients were transfused fewer units of plasma and platelets than our MTP dictated; failure to achieve intended ratios at 4 hours was strongly associated with inpatient mortality. MTP processes and outcomes should be critically assessed on a regular basis as part of a mature performance improvement program to ensure protocol adherence and optimal patient outcome.

Poster #59

POINT OF CARE TESTING FOR ACIDOSIS AND OUTCOMES IN TRAUMA

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Introduction: Maximized utilization protects scarce resources. Cellular hypoperfusion values guide shock resuscitation. We sought to determine if any or all rapidly available values supported as by the trauma literature reliably predict survival to limit consumption and thereby conserve low reserve assets. A pH of 7.0 defines a "fatal" value.

Methods: Retrospective review of Level 1 activations for pH, lactic acid (LA) and base deficit (BD) from 12/19 -11/20. We recorded age and gender, survival, ISS, and INR, Receiver operator characteristic (ROC) curves were performed using SPSS Version 26. SAS version 9.4 created a logistic regression model.

Results: Of the 573 patients, 117 patients died and there were significant ($p < 0.02$) differences compared to survivors with respect to age, ISS, LA, pH, BD, but not gender. ROC curves for LA and pH were significant (AUC) = 0.69, $p < 0.001$, {95% CI 0.61 – 0.76}; at a LA of 1.85, sensitivity was 80.5% and specificity 33.8%. pH AUC = 0.57, $p = 0.02$, {95% CI 0.51 – 0.64} and at 7.24, sensitivity was 81.7% and specificity 31.4%. In the Logistic Regression, age (OR= 1.06), ISS (OR=1.1), LA (OR=1.7) and INR (OR=36.7) are all associated with an increased risk of death. BD and pH were not. For every 1 point increase in LA, mortality odds increased 74.7%. Only one patient with a pH < 7.0 or lactic acid >19 survived (0.8% survival rate).

Discussion: Resources at many centers are and predicting death early in a resuscitation would conserve resources. Scoring systems are strong predictors, but there is not an ultimate value. Anecdotal reports of survival also invalidate an application of a finite number. We tried to define an easily collected limit defining death-using pH, LA and BD. We found that while sensitive and specific, they are not absolute. While we demonstrate an strong association, a prospective study using these cutoffs would assure death because of lack of intervention. Our next steps are to apply these values to a new dataset of patients to verify validity of pH and LA levels.

Poster #60

REAL TIME DETECTION OF GLYCOCALYX DEGRADATION FOLLOWING TRAUMA: A CONCEPTUAL USE OF THROMBOELASTOGRAPHY

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Introduction: Endothelial injury and glycocalyx (EGX) shedding occur early after trauma hemorrhagic shock (T/HS) and may be key factors in the development of inflammation, coagulopathy and subsequent mortality. Real time detection of EGX degradation is hampered by current methodologies including measurement of EGX degradation products in serum and video microscopy (sublingual microscopy). These methodologies are either not available in real time or used only at trauma centers with specialized expertise. EGX components such as syndecan-1 (syn-1) or heparan sulfate (HS) have been linked with the development of acute traumatic coagulopathy due to their "heparin like" effects. We therefore compared the anticoagulant effect of syn-1 and HS using thromboelastography (TEG) and standard coagulation testing (activated clotting time; ACT) *in vitro.*

Methods: EGX components syn-1 and HS were added to blood samples of healthy volunteers at clinically relevant concentrations. TEG values included R time (clot initiation), K value (clot amplification) and MA (maximum amplitude, overall strength and stability). The heparinase TEG cartridge was used to compare the citrated kaolin R time vs. R time with heparinase to detect a heparin like effect. The ACT test was subsequently performed using the HS blood samples to compare a standard coagulation test with TEG R times.

Results: Mean ± SD (N = 5 for each group)

	Whole blood	Whole blood + HS (35µg/ml)	Whole blood + HS (70µg/ml)	Whole blood + HS (100µg/ml)	Whole blood + Syn-1 (40 ng/ml)
CK R time	6.0 ± 0.7	7.9 ± 0.3*	10.3 ± 1.2*#	11.6 ± 0.5*#	6.4 ± 0.6
CKH R time	6.4 ± 0.3 (Δ 0.4)	5.4 ± 0.5* (Δ 2.5)	5.6 ± 0.2* (Δ 4.7)	5.5 ± 0.3* (Δ 6.1)	5.8 ± 0.6 (Δ 0.6)
MA	57.2 ± 3.3	53.9 ± 4.5	51.4 ± 4.8*	49.3 ± 2.8*	57.7 ± 2.9
Angle	70.1 ± 6.2	65.6 ± 4.2	58.9 ± 3.8*	55.5 ± 4.1*#	70.1 ± 2.5

*p<0.05 vs. Whole blood, #p<0.05 vs. Whole blood + HS (35µg/ml). ACT values were 123 ± 3.3, 132 ± 4.6 and 151 ± 4.2 for whole blood and whole blood + 70 or 100 µg/ml HS (*p< 0.05 vs. whole blood).

Conclusions: The anticoagulant effect of EGX degradation products were a result of HS in this study. Syn-1 shedding is a useful biomarker for EGX shedding and may have non coagulant effects on the endothelial barrier. The relative R time (citrated kaolin vs. citrated kaolin + heparinase) may be a novel, real time and readily available test to identify EGX degradation in the clinical setting. This may impact future treatment modalities and be predictive of outcome.

Poster #61

DO ALL PATIENTS WITH ACUTE RIB FRACTURES NEED TO BE TRANSFERRED TO A LEVEL 1 TRAUMA CENTER?

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Background: Patients with acute rib fractures are commonly transferred to regional trauma centers (TC). This could impose a strain on tertiary care centers, especially during crises. We hypothesized that a proportion of these transfers are avoidable and sought to identify factors that predict need for transfer to a level 1 TC.

Methods: We analyzed Trauma Quality Improvement Program (TQIP) 2017 dataset to identify adult patients with isolated rib fractures who were transferred to level 1 TC. We defined patients who were considered to benefit from transfer as those who underwent surgical rib fixation, epidural analgesia, or had a length of stay of ≥48 hours (*justified*). Stepwise logistic regression was performed to identify predictors of beneficial transfer.

Results: We identified 2,757 trauma patients with isolated rib fractures who were transferred to level 1 TC. Of those, 1,716 (62.2%) were considered justified. Compared to those who would have not benefited from transfer (*unjustified*), patients in the *justified* group were older (66.3±16.1 vs 58.1±16.7, $p<0.001$), had higher rate of flail chest (4.6% vs 1.6%, $p<0.001$), and a higher risk of requiring ventilator support (6% vs 0.6%, $p<0.001$). Only 2 patients in the *unjustified* group had a reported complication (0.2%). Stepwise logistic regression identified age>45 years, flail chest, history of COPD, heart failure, dementia, or dependent functional status as predictors of *justified* transfer. For every additional predictor, there were 2.05 higher odds of needing transfer to level 1 TC (95%CI: 1.84-2.27). Only 42.6% of those without any of the identified predictors had a *justified* transfer.

Conclusion: Transfer policies for patients with acute isolated rib fractures should strongly consider patient's comorbidities. Avoiding unjustified transfers could decreased the burden on tertiary centers without added risk of negative outcomes, especially during high demand crises.

Poster #62

DOES INTER-FACILITY TRANSFER AFFECT IN-HOSPITAL MORTALITY IN PATIENTS WITH RIB FRACTURES? A RETROSPECTIVE STUDY

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Background: Understanding the risks and benefits associated with inter-facility patient transfers to tertiary care centers is necessary to optimize patient outcomes and resource utilization. We hypothesize that interfacility transfer impacts the outcomes of trauma patients in a rural state, particularly in patients diagnosed with rib fractures. Our primary goal is to determine if inter-hospital transfer is associated with increased mortality in this population.

Methods: We used the institutional trauma registry and enterprise data warehouse to conduct a retrospective review of severely injured patients (ISS>15) with blunt traumatic rib fractures at the only ACS-verified level 1 adult trauma center in a rural state between 2010 and 2019. The key exposure variable was transfer status. The key outcome variables were in-hospital mortality, hospital days, and ICU days. We used multivariable logistic regression for analysis and directed acyclic graphs to identify variables for adjustment.

Results: We identified 1,834 eligible patients with rib fractures, including 796 (43%) who were transferred and 1,038 (57%) were transported directly to our tertiary center. Compared to patients who were transported directly to our facility, those who were transferred were more likely to be white (p<0.001) and to have a lower ISS (22 v. 24; p<0.001). Multivariable regression analysis showed that inter-hospital transfer was not significantly associated with an increase in in-hospital mortality even when accounting for effect size (p=0.07; BF=3.97). The analysis also showed that transfer status had no significant effect on days admitted to the hospital (p=0.93) or days spent in the ICU (p=0.39).

Table 1. Descriptive analysis for demographics and outcomes by transfer status

	Interfacility Transfer (N=796)	**Direct Transport** (N=1038)	P-value
Age*			
18-45	328 (41.2)	510 (49.1)	0.01
46-64	297 (37.3)	360 (34.7)	
65+	171 (21.4)	168 (16.2)	
Mean ± SD	49 (18)	47 (17)	0.002
Gender			
Male	560 (70.4)	750 (72.3)	0.206
Female	236 (29.6)	288 (27.7)	
Race*			
White	669 (84.0)	795 (76.6)	<.0001
Black or African American	86 (10.8)	209 (20.1)	
Others	41 (5.2)	34 (3.3)	
AIS Thorax body region	3 (3, 3)	3 (3, 4)	0.01
ISS	22 (17, 29)	24 (18, 33)	0.02
Total Hospital days	8 (4, 14)	8 (4, 16)	0.161
Total ICU days	3 (0, 7)	3 (0, 8)	0.179
Total Vent days	0 (0, 4)	0 (0, 5)	0.07

AIS: Abbreviated injury score; ISS: Injury severity score; ICU: Intensive care unit; VAP: Ventilator-associated pneumonia; ARDS: Acute respiratory distress syndrome
Results are presented as n (%), mean ± SD, or median (IQR), as appropriate.
*Missing data are not included in the summary.

Conclusion: In trauma patients with rib fractures in a rural state, inter-facility transfer is not associated with an increase in mortality, hospital length of stay, or ICU length of stay. These findings have implications for transfer decision-making within our trauma system.

Poster #63

EVIDENCE OF EARLY CHRONIC VASCULAR INJURY IN A MURINE BLUNT THORACIC TRAUMA MODEL

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Introduction: Previously, in a murine model, we demonstrated that blunt thoracic trauma leads to endothelial activation and pulmonary arterial thrombosis (PAT). Acute management of PAT with therapeutic anti-coagulation remains controversial and is dependent upon factors such as burden and distribution of thrombi as well as risk of additional bleeding from concomitant injury. Long-term potential consequences after PAT are less well studied but potentially include vascular derangement, remodeling, and chronic thromboembolic pulmonary hypertension (CTEPH). We hypothesized that acute blunt thoracic trauma would result in chronic pulmonary arterial injury.

Methods: Adult male C57BL/6 mice were divided into two groups: sham control, and experimental injury using a medium velocity lateral blunt thoracic trauma model. Mice are administered (i.p.) non-reactive IgG_1 at 30 minutes post-injury. At 14 days after initial injury, 5-micron sections of 10% neutral buffered formalin perfused, fixed, paraffin-embedded lungs were stained in hematoxylin and eosin (H&E) or Masson's trichrome, for evaluation of lung alveolar tissue leukocytes /mm and Ashcroft (1988) method fibrosis scoring, or arterial cross section medial thickness and perivascular collagen accumulation, respectively, from ≥10 (200X) images.

Results: At 14 days, median alveolar leukocyte density increased by 20.6% (injury coup) ($p < 0.05$). Fibrosis scores increased on the right side (1.40 vs. 0.65; $p < 0.05$) trending similarly on the left (1.35 vs. 0.65; ns). Arterial perivascular fibrosis (collagen) increased (39.7%; $p < 0.05$) on the contrecoup side only; Medial thickness decreased (10.9% (right), 19.4% (left); $p < 0.05$).

Conclusions: We demonstrate evidence of early chronic pulmonary vascular injury in our murine blunt thoracic trauma model. This finding will enable us to use this model to test therapeutics aimed at preventing or decreasing chronic pulmonary vascular injury after trauma. This model will therefore have clinical relevance for management of potential long-term consequences of blunt trauma such as may be seen in crush injuries, motor vehicle crashes, or blast injuries.

Poster #64

FEMALE SEX INDEPENDENTLY ASSOCIATED WITH REDUCED INPATIENT MORTALITY AFTER ENDOVASCULAR REPAIR OF THORACIC BLUNT AORTIC INJURY

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Objective: Female sex has been associated with increased mortality following blunt chest trauma. Whether sex influences outcomes of thoracic endovascular aortic repair (TEVAR) for traumatic blunt thoracic aortic injury (BTAI) is unknown.

Methods: The Vascular Quality Initiative (VQI) registry was queried from 2013-2020 for patients undergoing TEVAR for BTAI. Univariate Student's t-tests and chi^2 tests were performed, followed by multivariate logistic regression for variables associated with inpatient mortality.

Results: 211 (26.2%) of 806 patients were female. Female patients were older (47.9 vs. 41.8 years, $p<0.0001$) and less likely to smoke (38.3% vs. 48.2%, $p=0.044$). Most patients presented with grade III BTAI (53.6% of men, 54.5% of women), followed by grade IV (19.5% men, 19.0% women). Mean Injury Severity Scores (30.5 ± 18.8 in men, 30.9 ± 20.3 in women) and regional AIS did not vary by sex. Postoperatively, women were less likely to die as inpatients (7.9% vs. 3.8%, $p=0.042$) and to be discharged home (41.4% vs. 52.2%, $p=0.008$).

On multivariate logistic regression ($\chi^2= 132.97$, $p<.0001$), female sex (OR 0.05, $p=0.002$) was associated with reduced inpatient mortality. Advanced age (OR 1.06, $p< 0.001$), postoperative transfusion (OR 1.05, $p=0.043$), increased Injury Severity Score (OR 1.03, $p=0.039$), postoperative stroke (OR 9.09, $p= 0.016$), postoperative myocardial infarction (OR 9.9, $p=0.017$), and left subclavian coverage (OR 2.7, $p= 0.029$) were associated with inpatient death.

Conclusion: Female sex is associated with reduced inpatient mortality following TEVAR for BTAI, independent of age, injury severity, BTAI grade, and postoperative complications. Further study of the influence of sex on post-discharge outcomes is needed.

Poster #65

PREDICTORS OF HOSPITAL READMISSION AFTER BLUNT THORACIC TRAUMA

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Introduction: Hospital readmissions are resource intensive, associated with increased morbidity and mortality, and utilized as a hospital level quality indicator. The factors that determine hospital readmission after blunt thoracic trauma are not sufficiently defined. Our group sought to identify predictors of hospital readmission of our patients with thoracic trauma.

Methods: We performed a 10 year (2009-2019) retrospective chart review of blunt thoracic trauma patients at a Level one trauma center who required unplanned readmission within 30 days of hospital discharge. Patient characteristics, injury severity, and hospital complications were examined with quantitative analysis performed to identify readmission risk factors.

Results: There were 13,046 total trauma admissions during the study period. 3,724 patients were admitted for blunt thoracic trauma, with 206 readmitted. The readmission cohort was 68% male, 87% Caucasian, encompassed a variable age range, 16% had a hemothorax, and 45% were admitted to the ICU. On univariate analysis, use of anti-coagulation (11.0 vs 5.4; P:0.029), diagnosis of a mental/psychiatric disorder (10.2 vs 5.3; P: 0.01), and smoking (7.3 vs 5.0; P: 0.008) were predictors of hospital readmission. In addition, fractured ribs >7 (7.5 vs 4.8; P: 0.045), associated hemothorax (8.3 vs 5.2; 0.009), higher abdominal AIS (33.3 vs 8.4 vs 6.5; P: 0.002), rapid response activation (8.9 vs 5.2; P: 0.005), need for ventilator (9.0 vs 5.7; P: 0.001), admission to ICU (7.7 vs 4.5; P 0.001) and diagnosis of in-hospital pneumonia (10.1 vs 5.4; P:0.02) were all predictors of hospital readmission. Cardiac complications (arrythmias, cardiac arrest, and CHF), CAUTI, and VTE complications were not significant risk factors. On multivariate analysis, an associated hemothorax (OR: 1.5; P: 0.071), diagnosis of mental/ psychiatric disorder (OR: 1.9, P: 0.04), presence of smoking (OR:1.6; P: 0.005), higher abdominal AIS (1.5, 0.08), and anticoagulation use (OR: 1.7, P:0.181) predicted hospital readmission.

Conclusions: In blunt thoracic trauma, the injured patient with cognitive impairment, an associated hemothorax, or associated abdominal injuries are most at risk for rehospitalization following discharge. Quality improvement should focus on strategies, and protocols directed towards these groups to reduce non-elective readmission.

Poster #66

PREDICTORS OF READMISSION FOLLOWING TREATMENT FOR TRAUMATIC HEMOTHORAX

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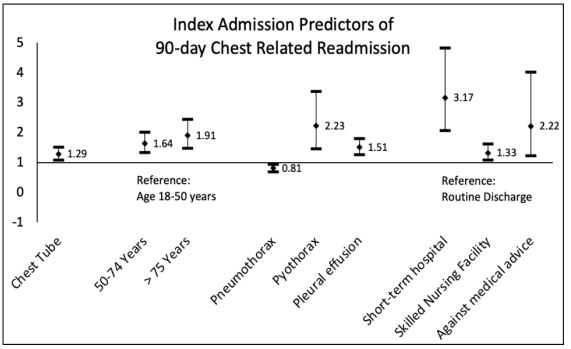
Introduction: The natural history of retained hemothorax is associated with prolonged hospitalization, empyema, pneumonia, readmission and need for additional intervention. We sought to define readmission rates and identify predictors of readmission to reduce patient morbidity.

Methods: The Nationwide Readmission Database for 2017 was queried for patients with an index admission for traumatic hemothorax during the first 9 months of the year. Deaths during the index admission were excluded. Data collected includes demographics, injury mechanism, outcomes and interventions including chest tube, VATS, and thoracotomy. Chest-related readmissions (CRR) were defined as hemothorax, pleural effusion, pyothorax and lung abscess. Univariate and multivariate analysis were used to identify predictors of readmission.

Results: There were 13,903 patients admitted during the study period with a mean age of 54 ± 22, 75.2% were admitted after blunt vs. 18.3% penetrating injury. The overall 90-day readmission rate was 20.8% (n=2890). The 90-day CRR rate was 5.7% (n=794), with 80.5% of these occurring within 30 days. Of all CRR, 62.1% (n=495) required an intervention (chest tube 72.7%, Thoracotomy 26.9%, VATS 0.4%). Mortality for CRR was 6.2%. Index admission predictors for CRR are shown in the figure.



Conclusion: A majority of CRR after traumatic hemothorax occur within 30 days of discharge and frequently require invasive intervention. These findings can be used to improve post discharge follow up and monitoring.

Poster #67

RISK FACTORS OF EMPYEMA IN PENETRATING DIAPHRAGMATIC INJURIES.

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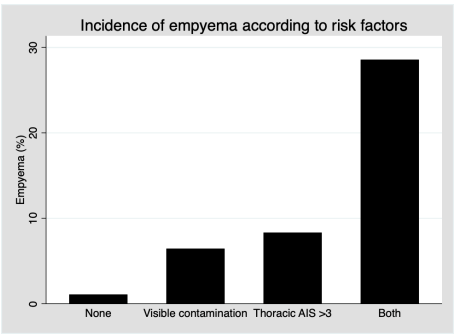
Introduction: Penetrating diaphragmatic injuries are associated with a high incidence of posttraumatic empyema (PE). We analyzed the contribution of trauma severity, specific organ injury, contamination severity, and surgical management to the risk of PE in patients who underwent surgical repair of diaphragmatic injuries at a level 1 trauma center.

Methods: This is a retrospective review of the patients who survived more than 48 hours. Univariate OR calculations were performed to identify potential risk factors. Multiple logistic regression (MLR) was used to calculate adjusted ORs and identify independent risk factors.

Results: We included 192 patients treated from 2011 to 2020. There were 169 (88.0) male. The mean interquartile range, (IQR) of age was 27 (22 - 35) years. Gunshot injuries occurred in 155 subjects (80.7%). Mean (IQR) NISS and ATI were 29 (18 - 44) and 17 (10 - 27), respectively. Thoracic AIS was >3 in 38 patients (19.8%). Hollow viscus was injured in 105 cases (54.7%). Stomach in 65 (33.9%), colon in 52 (27.1%), small bowel in 42 (21.9%), and duodenum in 10 (5.2%). Visible contamination was found in 76 patients (39.6%). Potential thoracic contamination was managed with a chest tube in 128 cases (66.7%), with transdiaphragmatic pleural lavage in 42 (21.9%), and with VATS or thoracotomy in 22 (11.5%). Empyema occurred in 11 patients (5.7%). MLR identified thoracic AIS >3 (OR 6.4, 95% CI 1.77 – 23. 43), and visible contamination (OR 5.13, 95% IC 1.26 – 20.90) as independent risk factors. The individual organ injured or the method used to manage the thoracic contamination did not affect the risk of PE.



Conclusion: The severity of the thoracic injury and the presence of visible abdominal contamination were identified as independent risk factors of empyema after penetrating diaphragmatic trauma.

Poster #68

THE SCAPULA: A MARKER OF INCREASED INJURY SEVERITY AND COMPLICATIONS?

LEAVE BLANK

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Introduction: Blunt thoracic trauma comprises 42% of polytraumatic injuries and carries a mortality rate up to 20%. The scapula is considered in the upper extremity abbreviated injury score (AIS), but it constitutes a component of the chest wall. We postulate concomitant scapula and rib fractures infers a higher mechanism of force and leads to worse outcomes.

Methods: A retrospective review of the 2017 National Trauma Database (NTDB) identified 139,857 patients diagnosed with rib fractures, using ICD-10 codes S22-S22.49XS. A subgroup of these patients was identified as having a diagnosed scapula fracture, using ICD-10 codes S42.102S-S42.199S. This created a rib fracture only (RFO) cohort of 129,296 patients and a rib and scapula fracture (RSF) cohort consisting of 10,561 patients. The patients in each group had their data extracted from the NTDB to compare outcomes and injury characteristics. Univariate analysis was performed using Pearson's chi2 and Wilcoxon rank test. Multivariate analysis was performed using a binary logit regression.

Results: The median age in RSF cohort was lower (51[35-62] vs 57[41-70], $p<0.0001$) and tended to be males (78.3% vs 65.4%, $p<0.0001$). Median ICU length of stay (2[0-5] vs 0[0-3], $p<0.0001$), hospital length of stay (6[4-12] vs 5[3-9], $p<0.0001$) and ISS (17[14-24] vs 13[9-18], $p<0.0001$) were all higher in the RSF cohort. The rates of DVT (2% vs 1%, $p<0.0001$), PE (0.9% vs 0.6%, $p<0.0001$), post-admission intubation (3% vs 2%, $p<0.0001$), development of ARDS (1.6 vs 0.7%, $p<0.0001$), CVA (0.8% vs 0.4%, $p<0.0001$), unplanned admission to ICU (3% vs 2.5%, $p=0.0016$), ventilator-associated pneumonia (2.5% vs 1.01%, $p<0.0001$), and death (8.1% vs 6.5%) were higher in the RSF cohort. Comparing discharge disposition, the RSF cohort was more likely to be discharged to inpatient rehab (16.7% vs 12.0%, $p<0.001$) and LTCH (2.5% vs 1.4%, $p<0.001$), whereas the RFO cohort was more likely to be discharged to home (49.8% vs 47.8%, $p<0.001$), home with services (8.0% vs 6.5%, $p<0.001$) and SNF (12.9% vs 9.4%, $p<0.001$). Our binary logit regression demonstrated an increased odds ratio of 1.182 (1.095-1.276) of death in the RSF cohort.

Conclusion: Concomitant scapula and rib fractures led to increased ICU and hospital length of stay, higher rates of complications, and death. These findings suggest this injury pattern demonstrates a higher injury severity and can be a marker for worse outcomes when compared to rib fractures alone.

Poster #69

CHEST X-RAY IS NOT A RELIABLE SCREENING TOOL FOR BLUNT THORACIC AORTIC INJURY

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Introduction: Traditional teaching continues to emphasize the value of initial trauma chest x-ray (CXR) as a screening tool for blunt thoracic aortic injury (BTAI). The hypothesis of the present study is that initial CXR performs poorly in this regard and should not be relied upon to exclude the need for computed tomographic angiography (CTA).

Methods: The AAST / Aortic Trauma Foundation (ATF) prospective BTAI registry was utilized to identify initial CXR findings in patients with a BTAI confirmed on computed tomographic angiography (CTA). Correlation between severity of BTAI, as assessed by Society for Vascular Surgery (SVS) injury grade, and presence of initial CXR findings was undertaken.

Results: From 2015-2021, there were 614 confirmed BTAIs with recorded CXR findings and grading by CTA reported to the ATF. The presence of any of the classic CXR findings was observed in only 50.5% of injuries, with increasing presence correlating with advanced SVS BTAI grade (28.0% G1; 50.6% G2; 58.0% G3; 69.2% G4) [Table 1]. The most consistent single finding identified was widened mediastinum, but this was present in only 27.4% of all confirmed BTAIs and only 47.7% of G4 injuries (7.6% G1, 22.4%, G2, 34.5% G3, 47.7% G4).

Conclusion: CXR is not a reliable screening tool for the detection of BTAI, even at the highest grades of
injury. Further investigations of specific high-risk criteria for screening that incorporate imaging, mechanism and physiologic findings are warranted.

	All injuries (N = 614)	SVS Grade 1 (N = 157)	SVS Grade 2 (N = 85)	SVS Grade 3 (N = 307)	SVS Grade 4 (N = 65)
Any classic CXR finding, % (n/N)	50.5% (310/614)	28.0% (44/157)	50.6% (43/85)	58.0% (178/307)	69.2% (45/65)
Widened mediastinum	27.4% (168/614)	7.6% (12/157)	22.4% (19/85)	34.5% (106/307)	47.7% (31/65)
Left hemothorax	12.7% (78/614)	3.2% (5/157)	15.3% (13/85)	14.7% (45/307)	23.1% (15/65)
Clavicular fracture	6.7% (41/614)	5.7% (9/157)	5.9% (5/85)	7.8% (23/307)	4.6% (3/65)
Sternal fracture	2.6% (16/614)	2.5% (4/157)	1.2% (1/85)	2.3% (7/307)	6.2% (4/65)
Multiple left-sided rib fractures	2.6% (16/614)	2.5% (4/157)	1.2% (1/85)	2.3% (7/307)	6.2% (4/65)
Apical cap	1.3% (8/614)	0% (0/157)	2.4% (2/85)	2.0% (6/307)	0% (0/65)
Scapular fracture	4.1% (25/614)	5.1% (8/157)	1.2% (1/85)	3.9% (12/307)	6.2% (4/65)
Deviated trachea or nasogastric tube	3.4% (21/614)	0.6% (1/157)	1.2% (1/85)	4.9% (15/307)	6.2% (4/65)
Loss of AP window	0.7% (4/614)	0.6% (1/157)	0% (0/85)	1.0% (3/307)	0% (0/65)

Poster #70

RIGID PLATE FIXATION FOR CLOSURE OF DAMAGE CONTROL STERNOTOMIES

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Introduction: Rigid plate fixation of the sternum may have advantages in certain cardiac patients at high risk for sternal wound infections and malunion. Due to its ease of use, it may provide advantages for trauma surgeons performing damage control sternotomy.

Methods: We performed a retrospective cohort study of all patients who underwent emergent sternotomy from 1/1/2018-1/31/2021. Outcomes in patients closed with wire cerclage group (WC) were compared to patients who underwent rigid plate fixation (RPF).

Results: Twenty-two patients underwent emergent sternotomy. All sternotomies were performed and closed by trauma surgeons. There were 11 patients in each group (WC vs. RPF). There was no significant difference in admission demographics, ISS or admission characteristics between the two groups. While ICU and hospital length of stay were not significantly different, patients who underwent RPF vs. WC had significantly fewer ventilator days (2.5 ± 4.1 vs 14.3 ± 18.1, $p = 0.04$). All patients survived to discharge. Complication rates were not significantly different.

Discussion: This is the first study comparing RPF and WC for sternotomy closure in the setting of trauma. Our study suggests there is a significant improvement in ventilator days as well as a trend towards improved length of stay in trauma patients. RPF is safe and technically easy to perform which may make it a superior method for closure in patients undergoing damage control sternotomy.

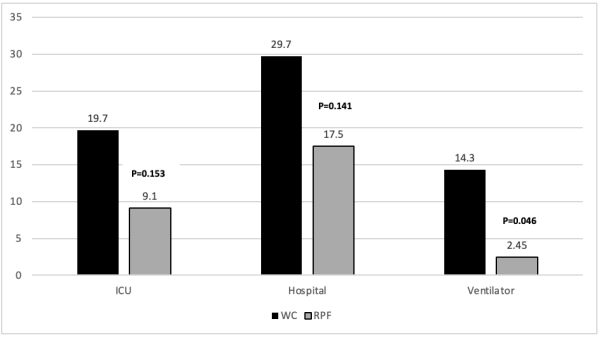

Figure: ICU length of stay (days), Hospital length of stay (days) and Ventilator days in patients undergoing Wire Cerclage (WC) versus Rigid Plate Fixation (RPF)

Poster #71

DEMOGRAPHIC AND HOSPITAL FEATURES OF FIREARM INJURY VICTIMS CAN DIRECT INTERVENTION SERVICES

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Introduction: Firearm injury recidivism represents a failure of the medical system to identify and provide intervention services to patients who present with an index firearm injury. However, with over 100,000 firearm injuries annually in the US, it is not feasible or cost effective to provide intervention services to all victims. Identification of those likely to become recidivists can help direct intervention services to a high-risk population.

Methods: A retrospective review of the trauma registry and of the local police death records of 7 geographically disparate, high volume, level 1 trauma centers was completed from 2000-2019. Recidivists were identified as any patient presenting twice with firearm injury or presenting once and dying at a second incident. Descriptive statistics and T-tests identified groups who are at higher risk on initial presentation at index injury.

Results: 31,522 patient records were reviewed, 4437 of whom died at index injury, leaving 27,115 at risk of recidivism. 947 (3.5%) became recidivists, with recidivism rate by center ranging from 0.5% to 6.3%. At index injury, those who go on to become recidivists are more likely to be young, (23.8 vs 28.5 years; $p<0.05$), male (97.7% vs 85.5%; $P<0.05$), and African American (92% vs 56%, $p<0.05$). Future recidivists have a lower ISS (8.9 vs 10.5, $p<0.05$), shorter hospital length of stay (5.5 vs. 10 days, $p<0.05$), and are more likely to have been treated and released from the emergency department (41% vs. 17% $p<0.05$). The median time to second injury was 693 days (1.89 years) and the mortality rate for recidivists at second injury is higher (0.18 vs 0.14, $P<0.05$).

Conclusion: Although urban firearm injury affects many individuals, those who go on to a second injury fit a narrow demographic profile of being young, African American males who have short hospitalizations or are treated and released from the emergency department. Targeted intervention programs for firearm injury recidivism should be directed at this demographic for maximal efficacy and cost-effectiveness.

Poster #72

DOES IMPROVED URBAN UNDERTRIAGE CONFER A SURVIVAL DISADVANTAGE?

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Introduction: The appropriate and expeditious triage of critically injured trauma patients to accredited trauma centers within established trauma systems is vital for improved patient survival. The purpose of this investigation was to characterize and compare undertriage within urban and rural segments of Pennsylvania's statewide trauma system. We hypothesized that undertriage would be significantly lower and outcomes significantly improved in urban sectors compared to rural counterparts.

Methods: The Pennsylvania Trauma Outcome Study was retrospectively queried from 2003-2017. All adult (age ≥15) trauma admissions with valid county of injury code data were extracted. Undertriage was defined as a trauma patient with an Injury Severity Score (ISS) ≥15 not being triaged as a trauma team activation. Rates of undertriage and patient characteristics were compared between urban (county code pop. ≥284 persons per square mile) and rural segments. Multilevel mixed-effects logistic regression modeling, controlling for age, ISS, SBP, motor GCS, and penetrating injury mechanism and adjusted for clustering of case volume, was used to assess adjusted rates of undertriage and mortality between subgroups.

Results: 455,222 trauma patients met inclusion criteria, of which 70.3% (n=320,095) were urban and 29.7% (n=135,127) were rural. Overall undertriage rate was 8.85% (n=40,305) and was significantly lower in urban sectors in unadjusted analysis (urban: 8.69%, rural: 9.24%; $p<0.001$). Penetrating injury mechanism (urban: 9.73%, rural: 4.45%, $p<0.001$) and dead on arrival/death in the ED (urban: 1.71%, rural: 0.58%, $p<0.001$) were more prevalent in the urban patient population. In multilevel modeling, urban designation remained significantly associated with decreased rates of undertriage (AOR: 0.90, 95%CI: 0.86-0.95; $p<0.001$), with higher rates of mortality (AOR: 1.32, 95%CI: 1.25-1.40; $p<0.001$).

Conclusion: Patients presenting in urban segments of Pennsylvania's mature trauma system have lower rates of undertriage, but higher rates of mortality compared to rural counterparts. The lower rate of undertriage seen in urban settings is related to a frameshift of the place of death from the field to the ED associated with presumed improved and expeditious urban prehospital care.

Poster #73

NATIONWIDE ANALYSIS OF THE DISTRIBUTION OF ACS-COT VERIFIED LEVEL 1 AND LEVEL 2 TRAUMA CENTERS AND POPULATION GROWTH UTILIZING GIS MAPPING TECHNOLOGY

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Background: Trauma centers decrease injury mortality and improve patient outcomes. Few investigations detail the nationwide geographical distribution of ACSCOT-verified L1TCs and L2TCs with respect to MVC-related injuries/fatalities. We aim to utilize GIS mapping to investigate the nationwide distribution of L1TCs and L2TCs in relation to motor vehicle collision (MVC)-related injuries at the county level, to determine if heavily burdened counties experienced appropriate trauma coverage.

Methods: Retrospective Cohort analysis of ACSCOT-verified L1TCs and L2TCs, US Census Bureau, and NHTSA Fatality and Injury Reporting System Tool database from 2010-2018.

Results: 198 ACSCOT L1TCs across 41 states and 124 counties and 215 L2TCs across 39 states and 151 counties were identified. The L1TCs were comprised of 107 adult L1TCs, 29 adult/pediatric L1TCs, 31 level 1 adult/level 2 pediatric TCs, and 31 pediatric L1TCs with a mean distance of 1,104 miles between L1TCs. In contrast, L2TCs included 197 level 2 trauma centers, 12 level 2 adult/level 2 pediatric trauma centers, and 6 level 2 pediatric trauma centers with a mean distance of 1160 miles between L2TCs. The Southern and Western US has the greatest number of L1TC and L2TCs, respectively. The majority of ACSCOT TCs are located in metropolitan and urbanized areas. 21/103 counties (20.4%) containing only one L1TC and 13/151 counties (8.6%) containing only one ACSCOT-verified L2TC experienced upward trends in population size, upward trends in MVC-related injuries, and upward trends MVC-related fatalities from 2010-2018.

Conclusions: One-fifth of US counties containing an ACSCOT-verified Level 1 and nearly nine-percent of counties containing an ACSCOT-verified Level 2 Trauma Centers experienced increased population size, increased MVC-related injuries and increased fatalities from 2010-2018. Revision of state limitations regarding the distribution of ACSCOT-verified Level 1 and Level 2 Trauma Centers, frequent evaluation of local community need, and more widespread establishment of ACSCOT-verified level 1 and level 2 TCs may improve patient outcomes for heavily burdened counties.

Poster #74

OPTIMAL TIME FOR IMPLEMENTATION OF ADVANCED RESUSCITATIVE CARE: A TQIP REVIEW OF EMS CONTACT TIME AND MORTALITY

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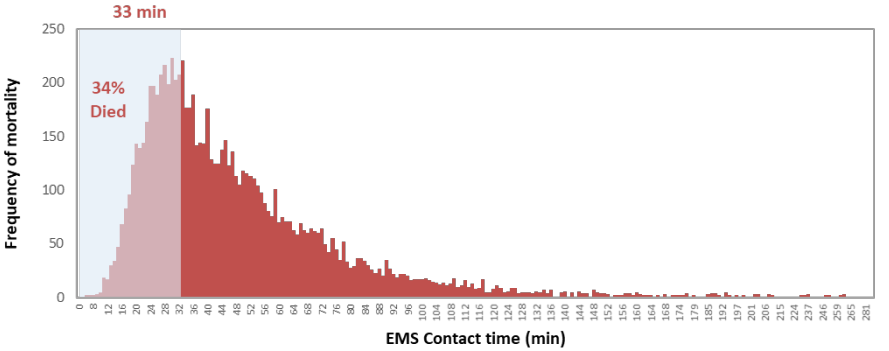
Introduction: In patients with non-compressible truncal hemorrhage (NCTH) mortality occurs within the first 15-30 minutes. The military codified the use of whole blood and REBOA as Advanced Resuscitative Care (ARC) interventions in NCTH. We aim to identify the optimal EMS contact time for implementation of pre-hospital ARC.

Methods: The TQIP database (2012-2017) was utilized to identify hypotensive patients with SBP ≤ 90 mm on the scene. EMS contact time was defined as time of EMS on the scene plus transport time to ED. Decision Tree and Receiver Operating Characteristic analyses were employed to identify optimal EMS contact time for ARC interventions.

Results: 6,434 trauma patients were hypotensive at the scene with overall mortality of 25.3% (n= 1,672). EMS contact time was shorter for patients that survived compared to those that died (28 minutes vs. 30 minutes, p<0.001). The optimal cutoff EMS contact time was 33 minutes with 34% of mortalities occurring before that time and 66% of deaths occurring at 33 minutes or greater of EMS contact time.



Conclusion: This is the first analysis on optimal EMS contact time for meaningful application of ARC. Implementation of ARC within the first 33 minutes of EMS contact time can potentially decrease prehospital mortality by a third. Prospective validation is needed.

Poster #75

THE COVID-19 PANDEMIC AND ITS IMPACT ON MASS SHOOTINGS IN SIX MAJOR US CITIES

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Introduction: The COVID-19 pandemic has significant impacts on the US socioeconomic structure. Gun violence is a major public health issue and the effects on this area have not been well-elucidated. The objective of this study was to determine the impacts of the pandemic on mass shootings in six major United States cities with historically high rates of gun violence.

Methods: Mass shooting data were extracted from an open-source database, Gun Violence Archive. Mass shooting was defined as 4 or more people shot at a single event. Six cities with the highest incidence of mass shootings were analyzed (Chicago, Baltimore, New Orleans, Detroit, Philadelphia, St. Louis). A map was created using ArcGIS.

Results: In 2020, the overall percentage of mass shootings increased by 46.7%. In the six cities analyzed, the total proportion of mass shooting events was unchanged (n=91/417, 21.8% vs n=126/611, 20.6%, p=0.64). Chicago, the US city with the highest incidence of mass shootings, did not experience a significant change in 2020 (n=34/91, 37.3% vs. n=53/126, 42.1%, p=0.57). Baltimore had a significant decrease in mass shooting events (n=18/91, 19.8% vs. 10/126, 7.9%, p=0.01). The other four cities had no significant change in the number of mass shootings (p>0.05).

Conclusion: This study demonstrated that while some types of gun violence shifted during the COVID-19 pandemic, the number of mass shootings in six US cities remained largely unchanged. Future studies should focus on the changing patterns of homicides in high-risk communities and other possible influencers such as gang-related violence and drug trafficking.

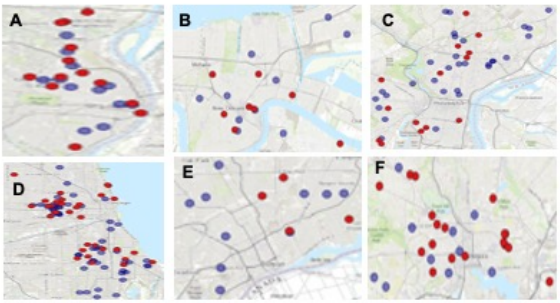

Figure 1. Maps generated from ArcGIS comparing mass shooting events from 2019 (red) and 2020 (purple) for six major US cities: A. St. Louis, B. New Orleans, C. Philadelphia, D. Chicago, E. Detroit F. Baltimore

Poster #76

THE IMPACT OF MARITIME DEPLOYMENTS ON THE SURGEON'S PRACTICE

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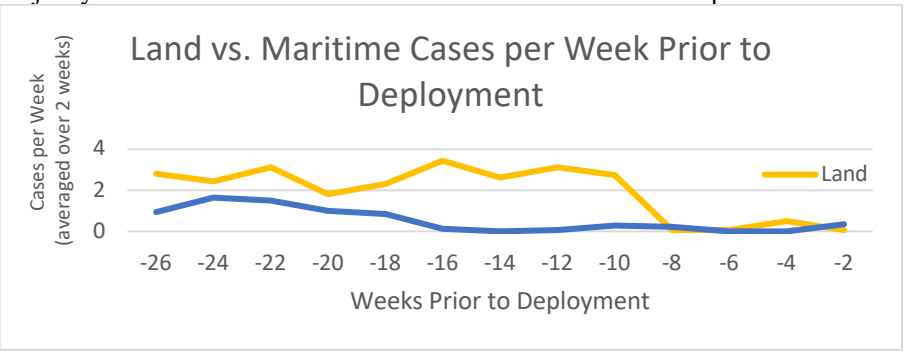
Introduction: The U.S. Navy routinely deploys 10 aircraft carriers and 9 amphibious assault ships throughout the world in support of U.S strategic interests, each with an embarked surgical team. Surgeons are required to participate in lengthy pre-deployment shipboard certifications prior to each deployment. Given the well-established relationship of surgeon volume to patient outcome, we aim to compare the impact of land versus maritime deployments on Navy general surgeon practice patterns.

Methods: Case logs and pre-deployment training initiation of land (n=8) vs. maritime-based (n=7) U.S. Navy general surgeons over a three year period (2017-2020) were compared. Average cases per week were plotted over 26 weeks prior to deployment. Student's t-test was utilized for all comparisons.

Results: Six months prior to deployment, maritime surgeons performed an average of 14 vs 50.3 cases (p=0.009). At 16 weeks, this difference persisted (2.1 vs 25.3 cases, p=0.003). These differences resolved in the 8 to 2 weeks pre-deployment time period when land deploying surgeons commenced pre-deployment training. While deployed, maritime surgeons performed 0.6 vs 1.5 (p=0.081) cases per week compared to land-based surgeons. However, the majority of these cases were at the robust Kandahar Role 3 Hospital.



Conclusion: The surgeon is a critical component of the combat causality care team. In this initial analysis, we have demonstrated that shipboard surgeons have prolonged periods away from clinical care compared to their land based colleagues. This prolonged pre-deployment deficit in surgical volume may negatively impact patient outcomes in the deployed maritime environment.

Poster #77

THE IMPACT OF MODE AND TIME OF EMS TRANSPORT ON TRAUMATIC DEAD ON ARRIVAL PATIENTS TRANSPORTED TO ACS-VERIFIED TRAUMA CENTERS

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Kendall Regional Medical Center

Background*:* As of 2019, unintentional injury remains the leading cause of death for individuals up the age of 44 and is the third overall leading cause of death across all ages. Motor vehicle collisions are responsible for a significant proportion of these deaths and inflict significant financial burdens on the economy. Although multiple studies emphasize the significance of ISS and transport times to predict patient outcomes, little emphasis is placed on patients who are dead on arrival (DOA). We aim to assess the impact of mode of transport and time of transport on DOA or trauma patient survivability, according to the level of trauma center destination.

Methods: This retrospective study utilized the American College of Surgeons Trauma Quality Improvement Program (ACS-TQIP) PUF datafile to examine the mode of transport and time of transport of adult patients who were DOA. This study only considered direct admissions and did not examine DOA patients with documented interfacility transfer. DOA was defined according to the ACS-TQIP datapoint, "arrived with no signs of life and did not recover". AIS score >9 was collected/reported to adjust for ISS scores that may have changed at autopsy. Patients were subdivided into 3 groups based on injury classification – low (ISS <15), intermediate (ISS 15-24), and severe (ISS ≥25). Each group was subsequently categorized by the mechanism of injury (blunt vs. penetrating), mode of transportation (ground vs. air), time of transport, and level of trauma center destination. The primary outcome of our study was to investigate the prevalence of DOA patients according to mode of transportation, time of transport, and trauma center level in relation to trauma patient survivability. Statistical analysis was performed by IBM SPSS Statistics v26.0 (Armonk, NY) and significance was defined as $p<0.05$.

Results: The majority of DOA patients suffered from blunt injuries and comprised larger proportions than their counterparts with penetrating injuries in all ISS groups. Intermediate ISS DOA patients demonstrated the least mortalities. Air transport was longer than their ground transport counterparts across all ISS groups. The number of DOA patients was low when transported within 15 minutes. Ground EMS transport time varied significantly across ISS groups for patients transported to any ACS-verified trauma center level. Air EMS transport times were only significantly different between ISS groups when transported to a level 1 trauma center. DOA patients transported by ground EMS decreased across all ISS groups when comparing those transported within 16-30 minutes vs. those arriving within 31-45 minutes and decrease thereafter. The majority of patients who were deemed DOA were transported within 45 and 75 minutes via ground and air transport, respectively. Patients who traveled by helicopter experienced less deaths than those traveling by ground despite longer transportation times.

Conclusion: Patients who were transported within 15 minutes experienced fewer deaths across all injuries, mode of transportation, and ISS groups. The number of DOA patients transported by ground EMS decreased as transport time increased. Intermediate ISS groups display lower rates of mortality compared to their low or severe ISS counterparts among all modes of transportation, EMS transport time, and trauma center level, except those with blunt injuries with air transport to a level 3 trauma center. Despite lower mortality in the intermediate ISS group, the median EMS transport time of this group was not significantly longer than the other ISS groups. Future studies should investigate the prevalence of DOA patients with intermediate ISS and assess DOA and mode of transport of patients with record of interfacility transfer.

Poster #78

THE UNTOLD AND UNCOUNTED SEQUELAE NEUROLOGIC FIREARM INJURY

Rachel Cowan BA; Ann Tufariello MPH; Peter Yonclas MD; David H. Livingston MD; Bernadetter Hohl PhD; Catherine Colvin MA; Stephanie Bonne MD
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Introduction: Gunshot wound (GSW) mortality data count those who die at the index event and not those die prematurely as a sequelae of firearm injury. The aim of this study was to describe disability and late mortality from neurologic GSW injury and quantify the burden to the healthcare system.

Methods: This is a retrospective series of patients between 2000-2015 surviving a GSW to the brain or spinal cord. Social Security Death index and national obituary registry identified subjects date of death. Regional healthcare exchange records were reviewed, for number and primary diagnoses of subsequent hospital admissions and emergency department (ED) encounters.

Results: 159 patients met inclusion criteria: 73 brain (BI) and 86 spinal cord injuries (SCI). Median age was 27 years, 80% black, 92% male. Initial admission accounted for 3922 hospital days with a median stay of 13 days for BI and 18 for SCI patients. 20 BI and 32 SCI patients were lost to follow up but presumed alive. 20 (13%) patients (9 BI, 11 SCI) died. Average time to death was similar for BI and SCI (1091 and 1097 days). Neurologic GSWs accounted for 1,226 premature years of life, representing a willingness to pay estimate of over $122 Billion of economic loss. The remaining 106 patients accounted for 745 encounters, (200 admissions, 545 ED visits). BI patients presented with neurological complaints and skin and soft tissue infections, compared to urinary infection and decubiti issues in SI patients.

Conclusion: Late sequelae and death resulting from neurologic injury from GSW are poorly captured in public health data. These patients experience significant health care problems, and become significant users of the “ED” health care system. Data surveillance systems and better long term follow-up for these patients need to be developed to accurately capture this health care burden, decrease costs, and improve overall outcomes.

Poster #79

TRAUMA RESEARCH PROGRAMS OF ACADEMIC AND NON-ACADEMIC HOSPITALS: ON EQUAL FOOTING?

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Introduction: American College of Surgeons level 1 trauma center verification requires an active research program. This study investigated differences in the trauma research programs of academic and non-academic ACS-verified level 1 trauma centers.

Methods: A 28-question survey was administered to all 175 ACS-verified level 1 trauma centers nationwide in 11/12/2020-1/11/2021. The survey included questions on center characteristics (patient volume, staff size), peer-reviewed publications, staff and resources dedicated to research, and funding sources.

Results: The survey had a 31% response rate (42 responses to 137 successful invitations), with 36 (86%) academic and 6 (14%) non-academic centers responding. Academic and non-academic centers reported similar median annual trauma patient volume (2,190 vs. 2,450), number of beds (545 vs. 440), and years as an ACS-verified level 1 center (20 vs. 14), respectively. Academic centers had significantly more full-time trauma surgeons (median 8 vs 6 for non-academic centers) and general surgery residents (median 30 vs 7). A greater percentage of academic centers had biostatisticians (65% vs 50%), basic scientists (35% vs 17%), dedicated lab space (25% vs 17%), and student employees or volunteers (70% vs 50%) available when conducting trauma research. Non-academic centers more frequently ranked trauma surgery (100% vs. 36% academic), basic science (50% vs. 6% academic), neurosurgery (50% vs. 14% academic), and nursing (33% vs. 0% academic) in the top three types of studies conducted. More academic centers reported using the traditional 20-publication route to fulfill ACS research criteria (74% vs 67%). Academic centers were more likely to report non-profit status (86% academic, 50% non-academic) and utilized research funding from external governmental/non-profit grants more often (76% vs 17%).

Conclusion: Survey results suggest that academic centers may have more staff and financial resources available to dedicate to trauma research, which may make fulfillment of ACS level 1 research requirements easier for these centers. This could potentially lead to overrepresentation of academic centers among ACS-verified level 1 trauma centers in the United States, suggesting that non-academic trauma centers may benefit from increased resources devoted to and prioritization of trauma research.

Poster #80

UNDERSTANDING OBSTACLES TO EFFICIENT TRANSFER OF TRAUMA PATIENTS: AN EVALUATION OF RE-TRIAGE PROCESSES FROM LOW-LEVEL TRAUMA CENTERS

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Northwestern University

Introduction: Under-triage of severely injured patients is associated with higher mortality. Nonetheless, 30-50% of severely injured under-triaged patients are never re-triaged to high-level trauma centers. We sought to identify barriers or failures in the re-triage process among low-level trauma centers in a 9-hospital health care system.

Methods: We conducted a Failure Modes Effects and Criticality Analysis of five low-level trauma centers in a single health care system. We leveraged a Learning Collaborative framework to create a process map of the trauma assessment and re-triage process with guidance from 27 trauma surgeons, emergency medicine physicians, trauma nurses and coordinators working at one of the five low-level trauma centers. Participants identified failures during each step in the process and rated each failure 1-10 on impact, frequency, and detection safeguards to generate a risk table of failures in the re-triage process and calculate each failure's Risk Priority Number (RPN).

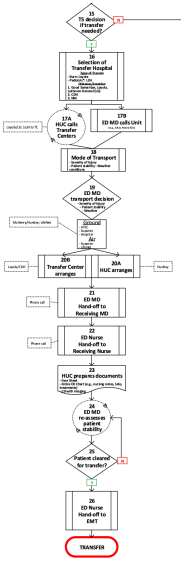

Figure 1: Patient Transfer Map

Results: A re-triage process map (Figure 1) was generated and consisted of 26 steps, where 91 failures in the re-triage process were identified. The most impactful failures were (1) patient decompensates after seeming stable, (2) difficult airway, and (3) insufficient providers for critical procedures. The most frequent failures were (1) re-triage requiring conference with receiving MD, (2) delay in consultant calling back, and (3) trauma team interruptions during EMS bedside handoff. The failures with the least safeguards for detection were (1) patient injury under-categorized after initial review, (2) transfer center does not call back, and (3) weather change prevents air transport after arrangements have been made. The three most critical failures in the re-triage process were: (1) delay in consultant calling back (RPN=232), (2) difficult airway (210), and (3) critical care transport cannot be obtained (200).

Conclusions: Failures in consultant call back and critical care transport are modifiable processes that present opportunities for interventions which could increase timely re-triage of injured patients to high level trauma centers.

Poster #81

CLUSTER ANALYSIS OF HOSPITALS BY FEATURES OF ORTHOPEDIC CARE IN AN INCLUSIVE TRAUMA SYSTEM

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Harborview Medical Center

Introduction: While criteria for different levels of trauma center (TC) verification are clear, few studies have evaluated the real-life variability in trauma care provided by different level TCs. As orthopedics is a key component of trauma care, we evaluated if hospitals clustered by features including volume and type of orthopedic procedures aligned with TC level.

Methods: We conducted a cluster analysis with state hospital discharge data from 2016. We included all hospitals, regardless of TC designation, and all major orthopedic procedures. Patient and hospital factors (Table) were analyzed in a principal component analysis. This reduced the feature space dimensionality from 2,770 to 16 components that accounted for 90% of the variation. We identified clusters on key features and determined if clusters aligned with TC designation.

Results: The key features of the six clusters are summarized in the table. Unsupervised learning separated hospitals by multiple feature similarity which only partially aligned with TC designations. Of all major orthopedic procedures (MOP), knee replacements in non-trauma patients, and humeral, radial and tibial fixations in the trauma patients had the greatest contribution to cluster assignments.

Conclusions: Unsupervised learning can generate meaningful clusters of TCs and non-TCs in a mature trauma system that identify key features beyond designation level that group clinical orthopedic trauma care. This is a promising first step in developing complex optimization models for mature trauma systems.

Selected key features of hospital clusters[a]

Cluster	# of each TC level	% Trauma transfer	% trauma admission	% ISS >15	% Male	# MOP for trauma	% Private insurance	Age (yrs)
1	I (1/1)	51	38	21	64	5088	29	53
2	II (5/6),III (6/24) IV (1/35), Non (4/15)	12	5	13	44	554	40	55
3	II (1/6),III (14/24) IV (16/35), V (2/14)	2	5	4	43	156	27	60
4	IV (1/35), Non (2/15)	0	2	0	59	1	47	64
5	IV (6/35)	1	3	8	37	8	16	34
6	III (4/24), IV (4/35), Non (1/15)	1	4	5	36	159	48	37

a. Variables not listed in table: Median ISS, % trauma transferred out, % non-trauma transferred in, % non-trauma transferred out, % low-income payor, % blunt, % penetrating, % burn, % of all major procedures that were MPO, # MOP for non-trauma, % of each MOP of all hospital MOPs in trauma, % of each MOP of all hospital MOPs in non-trauma

Poster #82

THE CANADIAN IMPACT OF COVID-19 ON SEVERE INJURIES FROM INTENTIONAL, UNINTENTIONAL AND SUICIDE CAUSES.

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Introduction: The impact of COVID-19 on trauma epidemiology amongst the Canadian population is likely distinct from that within the United States. Differential realities include: universal health care coverage, a narrower socioeconomic spectrum, and more limited access to firearms. The primary aim was to evaluate the impact of COVID-19 on Canadians following unintentional injuries, intentional violence, and suicide attempts.

Methods: All severely injured (ISS$\geq$12) patients who presented to a level-1 trauma center for 3 months following the declaration of a public health emergency (March 15, 2020) were analyzed. These patients were date/volume matched to the previous year ($p<0.05$ = significant).

Results: 357 severely injured patients from each of the pre- and post-COVID-19 eras were compared. Median patient age (50.1 vs. 52.3 years; p=0.493), ISS (19 vs. 18; p=0.322) and hemodynamic instability at presentation remained static. The number of severely injured female patients decreased (29.1% vs. 21.0%; p=0.012). Although fewer overall ED visits, similar severe injury patient admissions (373 vs. 357 over the same preceding year's dates) were noted. While the overall number of severe injuries following motor vehicle crashes and intentional violence (blunt assaults, stabbings, gunshots; 21.3% vs. 22.7%; p=0.651) remained stable, the mechanistic composition changed substantially. Blunt assaults decreased (7.3% vs. 3.4%; p=0.020), while penetrating violence escalated (14.0% vs. 19.6%; p=0.045). The increase in penetrating trauma was due to an increase in gunshot wounds (16.0% of penetrating mechanisms vs. 32.9%; p=0.0059). Suicide attempts leading to severe injury in the initial COVID-19 era was static (4.8% vs. 6.2%; p=0.410). The number of women severely injured via assault decreased (5.6% vs. 0.84%; p=0.003), while the number of severe injuries from suicide attempts was unchanged (4.8% vs. 6.2%; p=0.410). Amongst assaults directed towards females, both blunt (2.0% vs. 0.2%; p=0.033) and penetrating (3.6% vs. 0.80%; p=0.012) decreased.

Conclusion: Canadian trauma epidemiology within the initial COVID-19 era is different from both regions within the United States and globally. Intentional gun violence increased despite stable overall trauma admissions, suicide attempts, and a decrease in female-associated severe injuries.

Poster #83

GUN SHOWS AND BACKGROUND CHECK LAWS ACROSS STATE LINES

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Introduction: Handguns are the most commonly used weapon in gun assaults in the US. States that have stronger laws restricting access to handguns—particularly by requiring purchasers to undergo a background check—have fewer gun assaults. However, sales between private buyers and sellers are exempt from background check requirements according to federal and most state laws, meaning that gun shows (i.e., conventions where private buyers and sellers trade firearms) are a potential pathway to accessing a handgun for people who would otherwise fail a background check. The aim of this study was to determine whether gun shows concentrate in counties proximate to states with weaker background check laws.

Methods: This cross-sectional study used gun show data from a public online listing for 2018 (*Gun Shows USA*) aggregated within 3106 counties in the contiguous 48 states. The main independent variable of interest was background check laws in interstate counties, calculated using a population-weighted distance decay function. We controlled for potential drivers of demand for gun shows, including within-state gun laws, interstate gun laws, local and in-flowing population size, and the proportion of the local and in-flowing population who were gun owners. Bayesian conditional autoregressive Poisson models estimated associations between interstate background check laws and the count of gun shows in each county while accounting for spatial dependencies and nesting of counties within states.

Results: There was a total of 1869 gun shows in the contiguous US in 2018, and a total of 20 states had any background check law during that year. Additional interstate background check laws were associated with a greater number of gun shows (IRR: 1.105, 95% CI: 1.033, 1.183).

Conclusion: Gun shows concentrate in US counties that are near to states with stronger background check laws. Gun shows may service demand for handguns among people living interstate who are excluded from handgun purchases due to background check laws.

Poster #84

IMPLEMENTATION OF A SELECTIVE SPINAL IMMOBILIZATION PROTOCOL DOES NOT ALTER PRACTICE PATTERNS IN A REGIONAL TRAUMA SYSTEM

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Introduction: Universal spinal immobilization has been the standard of prehospital trauma care since the 1960s. More recently, selective immobilization has been shown to be safe and effective for Emergency Medical Services (EMS) use, but it is unclear whether such protocols reduce unnecessary and potentially harmful spinal immobilization practices. This study evaluated the impact of a selective spinal immobilization protocol on practice patterns in a regional trauma system.

Methods: All encounters for traumatic injury in the Tidewater EMS Region from 2010 to 2016 were extracted from the Virginia Prehospital Information Bridge. An interrupted time series analysis was used to assess changes in spinal immobilization practices after systemwide protocol implementation in 2013. Intravenous (IV) access was used as a non-equivalent outcome measure in the absence of an appropriate control group.

Results: A total of 63,981 encounters were analyzed. At baseline, 29.5% of patients were immobilized. The pre-protocol slope was slightly positive (0.1% per month, $P<0.001$). Protocol implementation did not result in a significant level change in immobilization rates (35.5% to 35.2%, $P=0.686$). Post-protocol slope change was not significantly different from that observed for IV access (-0.5% vs -0.6% per month, $P=0.529$). Rates of immobilization for isolated penetrating trauma remained unchanged. Urban areas experienced larger slope and level changes after implementation.

Conclusion: A selective spinal immobilization protocol did not reduce prehospital immobilization rates in a regional trauma system. Given the entrenched nature of immobilization practices, more intensive de-implementation strategies are needed. Efforts should prioritize eliminating immobilization for isolated penetrating trauma given its association with increased mortality. Additional training resources should be dedicated to rural areas.

Poster #85

POOLED ANALYSIS OF LEVEL I TRAUMA CENTERS BETTER PREDICTS RISK FACTORS FOR GUN VIOLENCE RECIDIVISM

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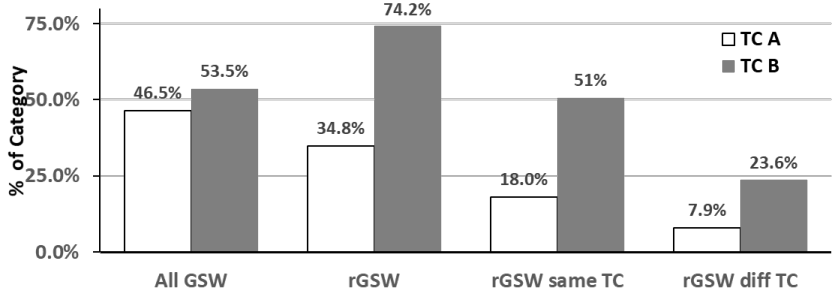
Introduction: Gun violence (GV) is a major public health challenge in the USA. Many trauma centers (TC) use the first GV admit as a teachable moment to mitigate repeat GV (rGV). Understanding rGV is especially difficult in metro areas with multiple TC and laws that prohibit sharing of private health information (PHI). We hypothesized that risk factors for rGV could be better understood using *pooled* data from metro TC.

Methods: Two metro TC registries were queried to identify all GV admits between 2007-17. A pseudo encryption tool allowed sharing of de-identified GV and rGV data without disclosing PHI. Factors associated with rGV admit including, age, sex, race, payor, injury severity, intent, and discharge, were assessed by multivariable logistic regression.



Results: We identified 2244 metro GV patients, 89 (4.0% total) of whom had subsequent rGV admit. Most rGV patients were assaulted (91%), male (97.8%), and black (86.5%). Time to rGV admit ranged from 0.6-12.2 yrs.
The **figure** shows major differences in rGV admit at two metro TC. It was noteworthy that 31.5% of rGV pts were admitted to a different TC. Independent predictors of rGV admit were age (aOR 0.94, P<0.001), male gender (aOR 6.18, P=0.013), Black race (aOR 5.14, P=0.007), or discharge against medical advice (aOR 6.64, P<0.001). Over the 10 yr study period GV admits increased 23.0%, but rGV admits went up 51.7%.

Conclusions: Nearly a third of rGV admits would have been missed in the current study without pooled metro TC data. The incidence of rGV is increasing and so it's important to target those at highest risk of repeat injury for mitigating interventions.

Poster #86

PREHOSPITAL ADVANCED AIRWAY MANAGEMENT FOR TRAUMATIC OUT OF HOSPITAL CARDIAC ARREST PATIENTS

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Background: Traumatic out of hospital cardiac arrest (OHCA) is severe condition. It is expected that advanced airway management (AAM), including endotracheal intubation and supraglottic device, would contribute the favorable outcomes among these patients. However, the benefit of prehospital AAM among traumatic OHCA is not established well. This study aimed to detect the efficacy of prehospital AAM among traumatic OHCA patients.

Methods: We conducted retrospective observational study with using Japanese nation-wide trauma database between 2004-2017. Among trauma patients received cardiac pulmonary resuscitation transferred from trauma scene, excluded age<15 or unknown, burn, missing prognosis, transportation time > 60 minutes or negative, transportation by helicopter medicine, and cardiac arrest at scene, 3,430 patients enrolled in this study. Patients were divided into two groups; those with AAM (N=3,052) during transportation and those without AAM (N=378). We compared two groups with propensity score matching. Primary outcome is in-hospital survival rate and secondary outcome is the rate of return of spontaneous circulation (ROSC) on admission.

Results: After propensity score matched, 644 patients were enrolled (AAM: 322 vs non AAM: 322). Adjusted logistic regression analysis did not show the significant difference between two groups on ROSC (AAM, 20.8%; non AAM 18.9%, p=0.70) and survival rate (AAM 5.3%; non AAM 8.4%, p=0.12). With multiple logistic regression analysis adjusted with ISS>15, head AIS (Abbreviated injury score)>=3, transfusion within 24 hours, and emergent surgical intervention, AAM did not show the significant difference on in-hospital survival rate (Odds ratio 0.61, 95%CI 0.32-1.17, p=0.14)

Conclusions: Prehospital AAM among traumatic OHCA patients did not have potential to improve patients' in-hospital prognosis.

Poster #87

THE ASSOCIATION BETWEEN GUN SHOWS AND FIREARM INJURIES: AN ANALYSIS OF 259 SHOWS ACROSS 23 CITIES

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Introduction: Guns shows are estimated to account for 4-9% of firearm sales in the US and are the location for both private party sales and sales by licensed firearm sellers. Increased regulation of firearm sales at gun shows has been proposed as one approach to preventing firearm injury. This study evaluates the association between gun shows and all-cause firearm injury in the communities where they are held.

Methods: We sought to determine whether there was an increase in rates of firearm injuries during the two weeks following a gun show compared to the two weeks prior within the community where the gun show was held. The *Big Show Journal* was used to determine the dates and locations of gun shows during 2017-2019. We selected a geographically representative convenience sample of US cities where gun shows were held. The primary outcome measure was the rate of all-cause firearm injury hospitalizations in counties within a 25-mile radius of the gun show, which was determined using data derived from trauma centers participating in NTDB whose catchment area included the relevant counties. Poisson regression modeling included a fixed effect for exposure period and was adjusted for seasonality, as well as random effects for both facility and gun-show clustering.

Results: A total of 259 gun shows from 23 cities were selected. Firearm injury data was collected from 36 trauma centers. In total there were 1,662 hospitalizations for firearm injuries pre-show and 1,665 post-show. The unadjusted mean rate of all-cause firearm injury per 1,000,000 population the 2 weeks before 1.76 (1.14-2.72) and 2 weeks after a gun show 1.79 (1.16-2.76) were comparable, p=0.68.

Conclusion: Rates of hospitalization for all-cause firearm injury were not significantly increased after a gun show in the communities where they are held. While there is not an immediate local effect, it is plausible that a longer time horizon and areas outside of the radius could be affected by these events. More detailed analyses of gun show firearm sales are needed to determine their impact on firearm injury rates more specifically.

Poster #88

THE NATIONAL TRAUMA TRIAGE PROTOCOL: HOW EMS PERSPECTIVE CAN INFORM THE GUIDELINE REVISION

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Introduction: The Field Triage Guidelines (FTG) support EMS-decisions regarding the most appropriate transport destination for injured patients. While the components of the algorithm are largely evidenced-based, the step wise approach was developed with limited input from EMS providers. FTG are only useful if they can easily be applied by the practitioner in the field. We sought to gather end-user input on the current guidelines from a broad group of EMS stakeholders to inform the next revision of the FTG.

Methods: An expert panel composed an end-user feedback tool. Data collected included: demographics, EMS agency type, geographic area of respondents, use of the current FTG, perceived utility and importance of each step in the algorithm (1: physiologic, 2: anatomic, 3 mechanistic, 4: special populations). The ACS COT, in partnership with several key organizations, distributed the tool to reach as many providers as possible.

Results: 3,958 people responded to the survey (82% Paramedics/EMTs, 9% physicians, 9% other). 94% responded directly to scene emergency calls and 4% were aeromedical. Steps 2 and 3 were used in 95% of local protocols, Step 1 and 4 in 90%. Step 3 was used equally in protocols across all demographics; however, Step 1 was used significantly more in the air medical services than ground EMS (96% vs. 88%, $p<0.05$). Geographic variation was demonstrated in FTG use based on the distance to a trauma center (table), but Step 3 (not step 1) drove the majority of the decisions everywhere. This point was reinforced in the qualitative data with the comment, "I see the wreck before I see the patient."

Avg Time To Closest TC	Non-Trauma Center Transport	More Likely transported by Air	Step Driving Majority of Decisions
0-30 Minutes	2.69%	11%	3
31-60 Minutes	22.42%	53%	3
61+ Minutes	58.82%	69%	3

Conclusions: The FTG are widely used by EMS in the US. The stepwise approach is useful; however, mechanism (not physiologic criteria) drives most of the decisions and is often the first criteria evaluated. Revision of the FTG should consider the experience of the end-users.

Poster #89

THE PREDICTIVE VALUE OF SHOCK INDEX IN RURAL TRAUMA TRIAGE, MORBIDITY AND MORTALITY

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Introduction: Rural trauma centers often have a dilemma as geography and transportation can pose significant delays to transfer to a tertiary referral center. The initial triage of the trauma patient that occurs in the prehospital and non-tertiary hospital setting is crucial in identifying which patients need expedited transfer to definitive care. Shock index (SI) or (Systolic Blood Pressure/Heart Rate) has been shown in the literature to predict increased risk of mortality and massive transfusion in trauma patients.
No previous studies have evaluated SI levels and looked at patients transferred from smaller centers to definitive care.

Methods: This was a retrospective study of trauma registry data at a rural level 1 trauma center. Shock index was calculated for 1,293 patients. The patient ages ranged from 18 years to 100 years old. Patients were assigned groups according to their shock index numbers (≤ .7, .71-.89, and ≥ .9). The SI was calculated both at the outside hospital and at arrival of our trauma bay. Pearson's correlation was used analyze hospital length of stay, intensive care unit days, ventilation days, and injury severity score with the respective SI scores. Analysis of variance was conducted for hospital stay, intensive care unit days, ventilation days, and injury severity score and blood product usage. Logistic regression was used to evaluate shock index and its relationship to mortality and use of blood products. Finally, chi square was used to determine the significance of patient disposition within the different index groups.

Results: There was no correlation in the field SI transfer group for ranges ≤ .7 and .71-.89 shock index. There were significant weak positive correlations in the prehospital transfers group for ISS, packed red blood cells, plasma, other blood products, and total blood products used in the ≥ .9 group ($p = < 0.05$).
In the Emergency Department (ED) arrival SI of the transfer group, there was no correlation for patients with a normal shock index of ≤ .7. Patients with an SI of .71-.89 showed significant positive correlation for ISS, plasma, platelets, and total blood products ($p =< 0.05$). Patients with a SI of ≥ .9 showed significant positive correlation for ISS, packed red blood cells, plasma, platelets, other blood substitute, and total blood products used ($p = < .05$).
The ED arrival SI of the transfer patients except those with an SI of >.9 demonstrated a statistically significant ($p=0.016$) trend towards increased mortality.

Conclusions: Rural trauma surgery can be complicated by long transfer times, geography, mode of transportation and weather. There has been no widely accepted method of decerning which patients require the most urgent attention. This study demonstrates patients in outside ED with elevated SI have need for more blood products and higher mortality. Outside ED SI should be considered an indicator or need for emergent transfer. SI can be easily taught to rural health care providers and provide a method of selecting which patients require rapid air transport to a definitive tertiary trauma center.

Poster #90

THE ROLE OF GEOGRAPHIC DISPARITIES IN OUTCOMES AFTER ORTHOPAEDIC TRAUMA SURGERY

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Introduction: Healthcare disparities on the basis of patient rurality and socioeconomic status are known to exist, but few studies have examined the effect of urban versus rural status on outcomes after orthopaedic trauma surgery. The aim of this study was to examine the correlation between patient rurality, socioeconomic status, and outcomes after orthopaedic surgery.

Methods: This is a retrospective cohort study of patients diagnosed with a hip or long bone fracture between January 2016 and December 2017. Data were collected from the Nationwide Inpatient Sample, a 20% weighted sample of 95% of the U.S. inpatient population. An ICD 10 diagnosis of hip fracture or long bone fracture was used to identify eligible patients. Patients were stratified into 3 groups: hip fracture, long bone fracture, and polytrauma. Analysis was conducted using population-weighted multivariable logistic regression models, based on a conceptual model derived selection of covariates.

Results: We included 244,344 patients diagnosed with a hip or extremity fracture. These were weighted to represent 1,221,720 patients nationally. In the hip fracture group, rural patient status was associated with higher odds of mortality (OR 1.32, $P<0.001$). In the extremity fracture and polytrauma groups, rural patient status was not associated with significantly higher odds of mortality or complications. In the urban polytrauma group, zip code with below-median income was associated with increased odds of mortality (OR 1.20, $P <0.001$). In the rural polytrauma group, zip code with below-median income was not associated with significantly increased odds of mortality.

Conclusion: We found that rural patients with hip fracture have higher mortality compared to urban patients and that socioeconomic disparities in mortality after a polytrauma exist in urban settings but not rural settings. The former may reflect lower volume of hip fractures seen in rural environments, delays to surgery among the rural group, or decreased access to geriatric co-management in rural hospitals. The latter may reflect health care segregation, wherein low-income patients have lower access to high-quality care.

Poster #91

DELAYED ENDOVASCULAR REPAIR WITH PROCEDURAL ANTICOAGULATION: A SAFE AND EFFECTIVE MANAGEMENT STRATEGY FOR BLUNT AORTIC INJURY

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Introduction: Blunt aortic (BAI) and traumatic brain injury (TBI) remain the two leading causes of death after blunt trauma. The purpose of this study was to identify predictors of mortality in patients with BAI and to examine the impact of systemic heparinization during thoracic endovascular aortic repair (TEVAR) on neurologic outcomes in patients with BAI and TBI.

Methods: Patients with BAI over a 7-year period were identified. Age, gender, severity of injury and shock, time to TEVAR, morbidity and mortality were recorded and compared. Multivariable logistic regression (MLR) analysis was performed to determine independent predictors of mortality. Youden's index was used to determine optimal time to TEVAR.

Results: 129 patients were identified. The majority (74%) were male with a median age and ISS of 40 and 29, respectively. Of these, 26 (23%) also had a concomitant TBI: 15 (57.7%) with severe TBI (GCS 3-8). Patients with BAI and TBI had a higher injury burden at presentation (ISS 37 vs. 29, p=0.002; GCS 6 vs 15, p<0.0001), underwent fewer TEVAR procedures (31% vs. 53%, p=0.039) and suffered increased mortality (39% vs. 16%, p=0.009) compared to BAI patients without TBI. All patients undergoing TEVAR received systemic heparinization regardless of associated injuries, including TBI. In TBI patients undergoing TEVAR, there was no change in CTH post-TEVAR and mean GCS at discharge was unchanged from admission (12 vs 12, p=0.530). The optimal time to TEVAR for all patients was determined to be 15 hours. Mortality was increased in patients undergoing TEVAR prior to 15 hours (8.7% vs 0%, p=0.210). MLR identified lower admission GCS (OR 1.24; 95%CI 1.12-1.38, p<0.0001) and increasing grade of BAI (OR 1.87; 95%CI 1.03-3.41, p=0.040) as independent predictors of increased mortality and use of TEVAR as the only modifiable risk factor significantly associated with reduced mortality (OR 0.11; 95%CI 0.03-0.45, p=0.002) in all patients with BAI.

Conclusions: For BAI patients, higher grade of aortic injury and lower GCS increased mortality. TEVAR use was identified as the only *modifiable* predictor of reduced mortality in patients with BAI. Delayed TEVAR with use of procedural heparin provides a safe option regardless of TBI with improved survival and no difference in discharge neurologic function.

Poster #92

INTRODUCING FIXED-VOLUME AORTIC OCCLUSION FOR FLUOROSCOPY-FREE REBOA

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Objectives: To investigate a new concept of Fixed-Volume Aortic Occlusion (FVAO) in fluoroscopy-free REBOA, a novel 4 French REBOA device, the COBRA-OS, with its unique safety shoulder reservoir, was intentionally over-inflated in porcine models to determine the safety and feasibility of FVAO. Adding to the previously described "fixed-distance" model, FVAO aims to simplify REBOA by enabling safe inflation to a set volume instead of relying on blood pressure to guide aortic occlusion.

Methods: COBRA-OS devices were incrementally inflated in segments of cadaveric swine thoracic aorta until either rupture of the balloon or the aorta occurred. Devices were then deployed in the thoracic aorta of anesthetized swine with an intentionally exaggerated fixed volume of 20mL representing a compliant balloon diameter of 28mm (normal max volume 13mL/25mm).

Results: Six cadaveric swine thoracic aorta segments were tested with a mean baseline aortic diameter of 21±0.098mm. The mean inflation volume for aortic occlusion was 5.85±0.42mL and for balloon rupture was 86.3±6.77mL. No aortic rupture or intimal tissue damage occurred despite >1000% increase in inflation volume above the aortic occlusion volume. The mean circumferential stretch ratio at the intentionally exaggerated fixed volume of 20mL was 1.3±0.12 and at balloon rupture was 1.53±0.04. No circumferential stretch ratio ever reached the known aortic failure threshold of 1.8. The amount of balloon longitudinal deformation at the fixed volume of 20mL was 48±7.5mm and at balloon rupture was 127±1.4mm. Subsequently, 3 adult female swine were tested with a mean Zone 1 thoracic aortic occlusion diameter of 15±0.15 mm. The mean inflation volume for aortic occlusion was 7±2mL and at 20mL fixed inflation volume (186% increase), there were no ruptures of the aorta or balloon and no evidence of intimal tissue damage.

Conclusions: Our study is the first to introduce the concept of FVAO in order to simplify and improve the safety of REBOA procedures. Activation of the unique safety shoulder reservoir of the COBRA-OS allows for significant over-inflation without the risk of balloon or aortic rupture and has acceptable longitudinal deformation values. Further studies to confirm these findings in humans and to determine the ideal fixed volume for aortic occlusion are needed.

Poster #93

THE EARLY USE OF LYOPHILIZED CRYOPRECIPITATE AMELIORATES THE ENDOTHELIOPATHY OF TRAUMA FOLLOWING HEMORRHAGIC SHOCK

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Introduction: Recent studies in severely injured patients suggest an important role of von-Willebrand Factor (VWF) in the endotheliopathy of trauma (EoT). We *hypothesized* that the early use of cryoprecipitate would be effective as an endothelial protector to reverse the EOT by regulating VWF reactivity. We utilized a pathogen-reduced lyophilized cryoprecipitate (LC) that could expedite the early administration of cryoprecipitate to patients in hemorrhagic shock (HS).

Methods: A mouse liver transection model of uncontrolled hemorrhage (UCH, 60 minutes shock) was utilized followed by hypotensive resuscitation (MAP 55-60) x 3 hours with Lactated Ringers (LR), fresh frozen plasma (FFP), or LC to mimic prolonged transport. Blood was collected for syndecan (Sdc), VWF Antigen (Ag), VWF collagen binding (CB), and ADAMTS13 by ELISA. Analysis by ANOVA followed by Bonferroni, n=8-10/group.

Results: Following UCH, blood loss was similar across groups. Mean volume of resuscitation was 1,288ml LR, 294ml FFP, 285ml LC, $p<0.001$. Sdc levels were higher with LR compared to sham, FFP, and LC. VWF:Ag:ADAMTS13 ratio as well as VWF:CB:ADAMTS13 ratio were lower in the FFP and LC groups compared to LR and shams, $p<0.001$. [Table 1]

Conclusion: Lyophilized cryoprecipitate was as effective as FFP in ameliorating the EoT and reducing pathologic hyperadhesive VWF. These results combined with the known hemostatic effects of cryoprecipitate support the early use LC for patients in HS.

Table 1	Sham	LR	FFP	LC	*p*
Sdc	8.6±3.4	17.4±4	8.7±3.6	9.3±3.6	<0.001
VWF Ag:ADAMTS13	2±0.4	1.5±0.4	0.8±0.2	0.6±0.1	<0.001
VWF CB:ADAMTS13	0.5±0.5	0.8±0.3	0.2±0.1	0.3±0.1	<0.001

Poster #94

OPERATIVE TRAUMA VOLUME IS NOT RELATED TO RISK-ADJUSTED MORTALITY RATES AMONG PENNSYLVANIA TRAUMA CENTERS

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Introduction: Higher center-level operative volume is associated with lower mortality after complex elective surgeries, but this relationship has not been robustly demonstrated for operative trauma. We hypothesized that trauma centers in Pennsylvania with higher operative trauma volumes would have lower risk-adjusted mortality rates than lower volume institutions.

Methods: We queried the Pennsylvania Trauma Outcomes Registry (2017-2018) for injured patients ≥18 years at Level I&II trauma centers who underwent an ICD-10p defined operative procedure within 6 hours of admission. The primary exposure was tertile of center-level operative volume. The primary outcome of interest was inpatient mortality. We entered factors associated with mortality in univariate analysis (age, injury severity, mechanism, physiology) into multivariable logistic regression models with tertiles of volume accounting for center-level clustering. We conducted secondary analyses varying the form of the association between the volume and mortality to including dichotomous and fractional polynomial models.

Results: We identified 2,477 patients at 30 centers meeting inclusion criteria. Overall mortality was 16.3% (center-level range 5.5-28.2%). Operative procedure types were cardiopulmonary (7.6%), vascular (20.4%), abdominopelvic (24.2%), and multiple (47.8%). The median annual operative volume was 29 (IQR 23-24) for low volume centers, medium 55 (IQR 51.5-72.5), and high 110 (IQR 102.5-196). After controlling for patient demographics, physiology, and injury characteristics, there was no significant difference in mortality between highest and lowest tertile centers (OR 0.98, CI 0.59-1.63). Further secondary analyses similarly demonstrated no relationship between center operative volume and mortality.

Conclusion: In a mature trauma system, we found no association between center-level operative volume and mortality for patients that required operative intervention for trauma. Efforts to standardize the care of seriously injured patients in Pennsylvania may ensure that even lower volume centers are prepared to generate satisfactory outcomes.

Poster #95

OPTIMIZING ACCESS TO TRAUMA CENTER CARE IN A RURAL STATE WITH A TRAUMA SYSTEM: A GEOGRAPHIC LOCATION ALLOCATION ANALYSIS

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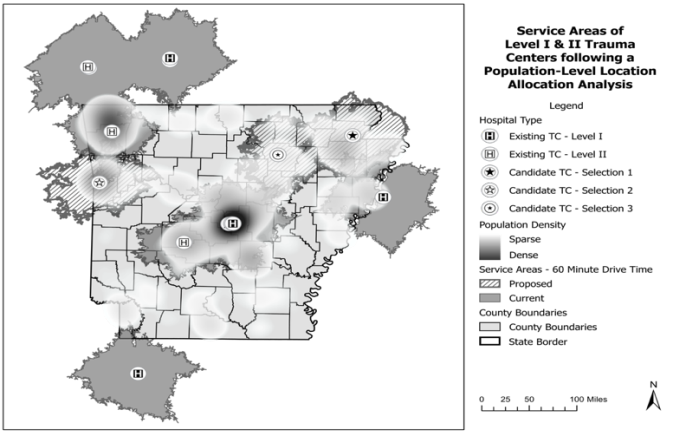
Introduction: Timely (<60 minutes) access to higher level (I/II) trauma center (HLTC) care improves survival and functional outcomes. However, trauma center locations are often driven by factors other than the needs of the population. Additionally, there is a paucity of state/regional level studies identifying optimal HLTC locations that will maximize population coverage. This study analyzes HLTC access in a rural state and utilizes geographic information system (GIS) methods to identify existing hospital targets for upgrade to Level-II, maximizing population access and strengthening the state trauma system.

Methods: Data for all hospitals within the state trauma system- locations, bed capacity, and designation - were collected. Population density, road network layout, and 60-minute EMS ground transport interval were used to construct a location-allocation model and identify the best-fit facilities for upgrade. Adult facilities with any lower-level TC designation, more than fifty beds, and more than fifty miles from an existing HLTC were considered for upgrade.

Results: Location-allocation modeling identified three facilities as potential candidates for upgrade to Level II (Fig.). This increase in system capacity would reduce the proportion of the state population without access to HLTC care within 60 minutes from 43% to 26%.

Conclusions: The study demonstrates the utility of geospatial mapping and location-allocation modeling, to identify gaps in areal access to HLTC care and determine optimal trauma center locations to maximize population coverage. This methodology has potential to objectively identify facilities for targeted capacity improvement and system design which emphasizes more equitable access to trauma center care in any state/region.



Poster #96

THROMBIN GENERATION IN ACUTE TRAUMATIC COAGULOPATHY: FRIEND OR FOE?

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Background: Uncontrolled bleeding associated with acute traumatic coagulopathy remains the most common avoidable cause of death in the multiple injured patient. The pathophysiology of this phenomenon has been widely investigated but is still poorly understood. In this study we focused on thrombin generation as a response to induced severe trauma and haemorhage in a pre-clinical animal model. The role of procoagulant therapy was addressed to clarify both its impact in thrombin generation as well as its relevance in the treatment of trauma-associated coagulopathy.

Method: Four groups of 15 Wistar rats were compared: vehicle (V), Factor II 16 mg (FII 16 mg); Factor II 2 mg (FII 2mg) and Prothrombin Complex Concentrate (PCC). Blood samples were drawn at baseline and after an established shock period of 60 minutes, roughly 105 minutes from initial trauma. Shock severity and coagulopathy was characterized in all surviving animals. Thrombin generation was assessed via calibrated automated thrombogram (CAT) method.

Results: Shock was successfully achieved in all studied animals (mean blood pressure of 30 ± 5 mmHg kept for a period of 60 minutes, and lactate greater than -15mmol/l in all animals. Coagulopathy was established via both viscoelastic and standard coagulation tests. Endogenous thrombin potencial was significantly increased in the group supplemented with 16 mg of factor II (ETP FII16 T60 vs FII16 T0: 1059 □ 164 mM.min vs 334.6 □ 59.3mM.min, $p < 0,0002$; ETP PCC T60 vs PCC T0: 939.3 □ 164 mM.min vs 279 □ 30 mM.min, $p < 0,0001$). In the vehicle group it remained unchanged, and in the group supplemented with a lower dose of factor II there was an increasing trend although notstatistically different.

Conclusions: Thrombin generation seems to be preserved if not enhanced as result of trauma and haemorrhage insult. The use of procoagulant drugs, not only do not present any advantage in treatment of trauma patients as pose increased hazard regarding thromboembolic events. Hence its use should be discretionary in a case-by-case basis.

Poster #97

TWENTY YEARS OF PROGRESS IN PENNSYLVANIA TRAUMA OUTCOMES

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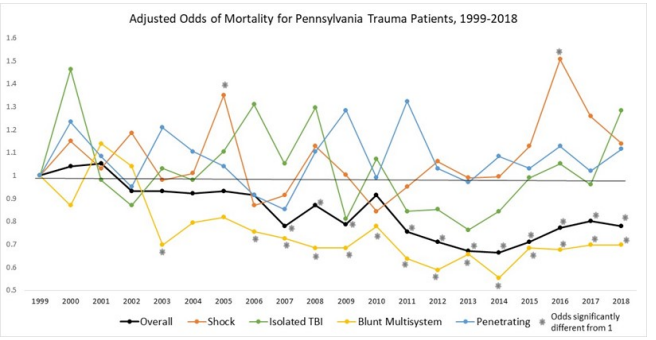
Introduction: Trauma center mortality rates are benchmarked to expected rates of death based on patient and injury characteristics. The expected mortality rate is recalculated from pooled outcomes across a trauma system each year, obscuring system-level change. We hypothesized that risk-adjusted mortality would decrease over time system-wide.

Methods: We identified adult trauma patients presenting to Level I and II Pennsylvania trauma centers, 1999-2018, using the Pennsylvania Trauma Outcomes Study. Multivariable logistic regression generated risk-adjusted models for mortality in all patients, and in key subgroups: penetrating torso injury, blunt multi-system trauma, isolated traumatic brain injury (TBI), and patients in shock.

Results: Of 172,878 included patients, 131,026 (75.8%) were white and 114,922 (66.5%) were male. The mean age was 49, mean injury severity score was 16.7, and 87.5% of injuries were blunt. Overall, 10.6% of patients died, and compared to 1999, no year had significantly higher adjusted odds of mortality. Overall mortality was significantly lower in 2007-2009 and 2011-2018. Of patients with blunt, multi-system injuries, 18.5% died, and adjusted mortality improved over time. Mortality rates were 43.0% for TBI, 26.3% for penetrating torso injury, and 58.0% for shock, with no significant change in these categories (Figure).



Conclusions: Over 20 years, Pennsylvania trauma centers demonstrated improved risk-adjusted mortality rates overall, but improvement was uneven across clinical categories. Identifying change over time can help guide focus to areas in need of improvement.

Poster #98

UNIQUE ROLES OF CALCIUM-INDEPENDENT PHOSPHOLIPASE A_2 IN HUMAN PLATELET FUNCTION

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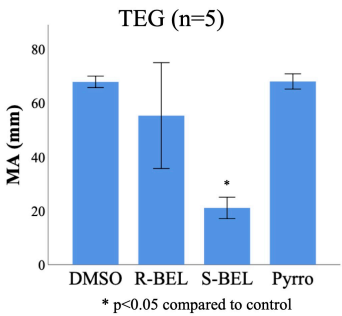
Introduction: Platelet activation plays a key role in the development of sepsis-induced coagulopathy and multiple organ dysfunction. Recent studies have reported that calcium-independent phospholipase A_2 ($iPLA_2$) enzyme in cells such as neutrophils, vascular endothelial cells, and macrophages, is associated with acute inflammation, but its function in platelets remains obscure. Our objective was to evaluate the function of $iPLA_2$ in platelets.

Methods: Blood collected from healthy volunteers was analyzed. Platelet aggregometer (PA) and thromboelastography (TEG) were used for the platelet aggregation study. For the PA analysis, thrombin (0.2 IU/ml) was used as an agonist, and for the TEG analysis, kaolin was used. Furthermore, serotonin and thromboxane B_2 (TXB2) concentrations of the thrombin-stimulated platelets were measured using enzyme-linked immunosorbent assay. For all the studies, the samples were preincubated with the following inhibitors: pyrrophenone (Pyrro) for cytosolic PLA_2 ($cPLA_2$), (S)-bromoenol lactone (S-BEL) for $iPLA_2\beta$, (R)-bromoenol lactone (R-BEL) for $iPLA_2\gamma$, and dimethyl sulfoxide (DMSO) for control.

Results: Platelet aggregation (n=6) was inhibited significantly with S-BEL (S-BEL: 16.0 ± 3.6%; R-BEL: 35.3 ± 7.2%; Pyrro: 87.5 ± 2.0%). Maximum amplitude (MA) in TEG also decreased significantly with S-BEL (S-BEL: 21.0 ± 3.8 mm; R-BEL: 55.2 ± 9.8 mm; Pyrro: 67.9 ± 1.4 mm). Pyrro failed to show any inhibition in both PA and TEG. Serotonin concentration (n=8) was also suppressed by S-BEL (S-BEL: 38.8 ± 12.2 ng/ml; R-BEL: 53.2 ± 24.4 ng/ml; Pyrro: 71.6 ± 35.8 ng/ml). However, these results did not correlate with TXB2 concentration (n=8) as Pyrro significantly inhibited the TXB2 synthesis (S-BEL: 31.2 ± 8.5 ng/ml; R-BEL: 43.0 ±14.6 ng/ml; Pyrro: 9.9 ±4.0 ng/ml).



Conclusion: $iPLA_2\beta$ is strongly associated in thrombin-stimulated aggregation and degranulation, and could possibly be playing a major role in human platelet function.

Poster #99

XSTAT® STOPS BLEEDING AND MAINTAINS HEMOSTASIS 72-HOURS POST-HEMORRHAGE ADMINISTRATION

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Background: Implementation of hemostatic interventions such as tourniquets reduced extremity hemorrhage mortality in US military personnel, however, of the casualties that die, 50% succumb to non-compressible truncal hemorrhage and 20% die due to junctional hemorrhage. XSTAT® was developed to address junctional/non-compressible hemorrhage (J/NCH). It is FDA approved for up to four hours and is currently fielded by the US SOCOM to treat J/NCH. Top priority for military medical capabilities is to expand beyond the 'Golden Hour' of care for austere environments requiring prolonged field care (PFC) with evacuation times to definitive care measured in days as opposed to hours. To bridge this gap, we propose to evaluate the efficacy of XSTAT® administration for 72-hours in a 61-96 kg male Yorkshire swine model of uncontrolled subclavian artery (SCA) and vein (SCV) hemorrhage.

Methods: The left SCA/SCV were isolated by blunt dissection and injured by a 50% transection, followed by 30-seconds of free hemorrhage. Immediately following free hemorrhage, XSTAT®s were administered per manufacturer's instructions until bleeding stopped and remained within subjects for 48-hours (n=4) and 72-hours (n=1) and covered with four 4x4 inch 8-ply cotton gauze secured with Tegaderm™. Gauze was evaluated hourly for indications of sanguineous or hemorrhagic drainage and was changed at 75% saturation. Results were analyzed with two-tailed unpaired t-test, and data is represented as mean±SD with significance as alpha<0.05.

Results: No significant differences observed in 30-second hemorrhage volume, XSTAT® absorbed blood volume and total shed blood volume between 48-hour and 72-hour cohorts (508.3±172.87mL) vs. (863.92mL), (433.97±188.57mL) vs. (278.85mL), and (943.31±110.67mL) vs. (1,142.77mL) respectively. All animals displayed benign serosanguineous drainage manifested without indications of sanguineous, hemorrhagic or purulent drainage throughout the simulated PFC event.

Conclusions: Early indications suggest XSTAT®'s utility for J/NCH control for PFC casualties, but the authors caution that further rigorous investigation with larger cohort populations are warranted to determine the efficacy and safety of the XSTAT® device for deployment in the PFC setting.

Poster #100

TREATMENT EFFECT OF HELICOPTER TRAUMA TRANSPORT: A NATIONAL PROPENSITY SCORE MATCHED ANALYSIS

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Introduction: With a lack of randomized controlled trials and substantial selection bias inherent in observational studies, the benefits of helicopter over ground transport remain uncertain. This study utilizes propensity score matching to quantify the treatment effect of helicopter transport.

Methods: All injured patients transported by emergency medical services from scene within 6-hours in 2017 National Trauma Data Bank were included. Propensity score matched analyses, with Mahalanobis nearest neighbor matching, were used to mitigate selection bias and compare subgroups. Patients were matched on demographics, comorbidities, mechanism, injury severity score (ISS), anatomic injury scales, physiology (respiratory, circulatory, neurologic), transport time, and trauma center (TC) level.

Results: 408,563 patients were included [Helicopter: 31,650 (7.75%); Ground 376,913 (92.76%)]. Helicopter patients were younger, male preponderant, more injured, physiologically deranged and suffered higher mortality (8.74% vs. 5.09%). After propensity score matching, helicopter transport demonstrated a 1.08% (95% CI 1.43-0.72, $p < 0.001$) reduction in mortality. In subgroup analysis, mortality benefit was observed for younger patients (5-64 years), more injured (ISS > 15), in shock (SBP < 90), with low GCS (< 14), and in respiratory distress (RR < 10 or > 29). Benefit of helicopter transport was highest at Level I TCs, followed by Level II and non-existent at Level-III (Figure). The greatest treatment effect was seen for patients in shock, mortality reduction of 11.24% (CI 15.12-7.37, $p < 0.001$).

Conclusions: After propensity matching, helicopter transport for trauma resulted in 1.08% reduction in mortality. The benefit was greatest for patients that were young, more injured, in shock or respiratory distress, and treated at the higher level TCs.

Treatment Effect of Helicopter Transport on Mortality (Overall and by Subgroups)

	ATE	95% CI	p-value	NNT
Overall	-0.0108	(-0.0143, -0.0072)	<0.001	92.9
Age ≥ 65	0.0054	(-0.0103, 0.0211)	0.498	-
Age 5-64	-0.0108	(-0.0173, -0.0043)	0.001	59.0
Age < 5	-0.0113	(-0.0239, 0.0014)	0.081	-
GCS ≤ 13	-0.0313	(-0.0606, -0.0020)	0.037	32.0
GCS > 13	0.0005	(-0.0024, 0.0034)	0.755	-
SBP < 90	-0.1124	(-0.1512, -0.0737)	<0.001	8.9
SBP ≥ 90	-0.0019	(-0.0054, 0.0016)	0.281	-
RR < 10 or > 29	-0.0919	(-0.1347, -0.0491)	<0.001	10.9
RR 10-29	-0.0058	(-0.0088, -0.0027)	<0.001	173.8
ISS > 24	-0.0801	(-0.1185, -0.0417)	<0.001	12.5
ISS 16 - 24	-0.0232	(-0.0329, -0.0134)	<0.001	43.2
ISS 9-14	-0.0033	(-0.0093, 0.0026)	0.277	-
ISS < 9	-0.0018	(-0.0048, 0.0011)	0.219	-
Level I TC	-0.0103	(-0.0159, -0.0047)	<0.001	96.8
Level II TC	-0.0084	(-0.0154, -0.0014)	0.019	119.3
Level III TC	0.0330	(-0.0385, 0.1044)	0.366	-

Abbreviations: ATE (Average Treatment Effect), CI (Confidence Interval), NNT (Number Needed to Treat), GCS (Glasgow Coma Scale), SBP (Systolic Blood Pressure), RR (Respiratory Rate), ISS (Injury Severity Score), TC (Trauma Center)

Poster #101

DEVELOPMENT OF A QUALITY ASSESSMENT/QUALITY IMPROVEMENT TOOL FOR BENCHMARKING PERFORMANCE IN AN URBAN TRAUMA CENTER

Scott Kivitz MS; Nanette Talty RN, MS; Jennifer Feliciano; Dana Schulz BS; Stephanie De Mel BS; Taner Celebi MS; Sonia Amanat BS; Stephen DiRusso MD

Introduction: Current practice is to use externally validated survival prediction models to assess mortality. We take a different approach and use a locally generated prediction model that is internally validated to then assess that Trauma Service's performance over time.

Methods: Retrospective study design used an urban Level-II ACS Trauma Center trauma registry for a 4-year period (2016 to 2019). Patients were excluded if missing demographic or discharge data (N=502). Morality prediction was modeled using logistic regression (LR) and odds ratios (ORs) were calculated for significant variables ($p<0.05$). Discrimination (Area under the Receiver Operator Curve (AuROC)) and calibration (Hosmer-Lemeshow C-statistic (HL-C)) measured predictive capability.

Results: Final model included 3,068 patients, 2,287 (74.5%) in 2016-2018, and 781 (25.5%) in 2019, with AuROC of 0.95 and an HL-C of 3.68 ($p>0.05$). Predicted and observed mortality (95% CI) from 2016-2018 was 3.02% (2.59, 3.45) and 3.0% (2.31, 3.73), respectively. With the 2016-2018 model as a reference, 2019 predicted mortality (3.06%, 95% CI: 2.33, 3.78) did not differ significantly from observed mortality (2.4%, 95% CI: 1.34, 3.53), implying equal performance for the two time periods.

Conclusions: We generated and internally validated a LR model with excellent prediction of survival and used this to assess Trauma Service performance for the subsequent year. We will use this model on a continual basis to benchmark Trauma Service performance.

Table 1. Significant predictors and corresponding ORs. Groups were compared by Student's t test for continuous variables and χ^2 statistic for categorical values (* = $p<0.05$).

	2016-2018 (N = 2287)	2019 (N = 781)	Odds Ratio	95% C.I.for EXP(B) Lower	Upper
Age (Mean ± SD)	49.0 ± 22.9	49.3 ± 22.9	1.032	1.014	1.049
Insurance Type (%)					
Public*	1443 (63.1)	554 (70.9)	1	1	1
Private (Public)	581 (25.4)	179 (22.9)	0.555	0.238	1.296
Out of Pocket (Public)	48 (2.1)	10 (1.3)	8.733	2.444	31.209
Other (Public)*	215 (9.4)	38 (4.9)	0.902	0.259	3.135
Pulse Rate (Mean + SD)	90.1 ± 18.8	89.2 ± 18.4	1.017	1.003	1.032
GCS Motor (Mean + SD)	5.8 ± 0.8	5.9 ± 0.71	0.477	0.391	0.581
Base Deficit (Mean + SD)	0.58 ± 3.8	0.70 ± 4.5	0.907	0.852	0.964
Hematocrit (Mean + SD)	39.6 ± 5.3	39.6 ± 5.4	0.948	0.898	1
NISS (Mean + SD)	12.69 ± 11.4	13.4 ± 11.4	1.052	1.034	1.07
Comorbidities (%)					
Current Smoker*	540 (23.6)	148 (19.0)	0.229	0.063	0.836
Chronic Lung Pathology	331 (14.5)	123 (15.7)	0.199	0.048	0.83
Chronic Liver Pathology*	84 (3.7)	47 (6.0)	7.273	2.592	20.409
Chronic Drug Abuse	173 (7.6)	65 (8.3)	0.187	0.038	0.931
Chronic Kidney Pathology	71 (3.1)	33 (4.2)	3.047	1.052	8.829
Blood Thinners	127 (5.6)	32 (4.1)	7	3.058	16.02

Poster #102

EARLY REPAIR OF ISOLATED HIP FRACTURES FOR PATIENTS ON DIRECT ORAL ANTICOAGULANTS MAY BE SAFELY ACCOMPLISHED WITHOUT REVERSAL

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Ocala Regional Medical Center

Introduction: Definitive surgery within 24 hours for patients with isolated hip fractures (IHF) may be associated with improved outcomes. Patients with IHF on direct oral anticoagulants (DOAC) may have their DOAC held for 24 hours before surgery or reversed preoperatively. The goal of this study is to compare the impact of varying approaches to DOAC management on IHF transfusion requirements and patient outcomes.

Methods: A 3-year multicenter retrospective analysis obtained from a hospital system's clinical data warehouse of patients on DOAC who had IHF surgery. Patients were grouped by surgery ≤24 and 24-72 hours. The primary outcome was the odds of receiving red blood cell transfusion (pRBCTx) during or after surgery. Results were analyzed by DOAC reversal status. Multivariable regression was done using risk adjusted analyses to account for age, gender, ISS, co-morbidity, and hospital practice variation.

Results: 1,806 patients on DOAC were selected, 60% had surgery ≤24 hours. Patients who had surgery at 24-72 hours were more likely to receive pRBCTx either during or after surgery, aOR 9.55 (95% CI: 3.20, 27.58). Patients treated with reversal agents were also more likely to receive pRBCTx with surgery at ≤24 and 24-72 hours, aOR 8.78 (95% CI: 1.13, 68.25) and aOR 3.56 (95% CI: 1.7, 7.44) respectively. For the <24 hour cohort, DOAC reversal was associated with significantly longer hospital length of stay (7.8 ± 7.4 days vs. 5.2 ± 3.2 days, $p<0.001$) and hospital charges ($221,784 ± $178,314 vs. $130,657 ± $68,329, $p<0.001$). Mortality rates were similar between DOAC reversal and no reversal at 1.4% vs. 1.3%, $p=0.94$ respectively.

Conclusion: Definitive IHF surgery for patients on DOAC may be performed ≤24 hours of admission generally without reversal. Reversal of DOAC is associated with higher likelihood of pRBCTx, longer LOS and higher hospital charges with no significant differences in inpatient mortality.

Poster #103

PATIENT AND PROVIDER PERCEPTIONS OF THE TRAUMA AND EMERGENCY GENERAL SURGERY DISCHARGE PROCESS

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Introduction: Trauma and Emergency General Surgery (TEGS) patients face complex barriers that hinder successful recovery after discharge. Improved understanding of the challenges in the hospital discharge process experienced by key stakeholders is necessary to develop interventions applicable to this complex, poorly standardized transition of care.

Methods: We performed a qualitative study of patient and provider perceptions about the hospital discharge process at an urban level 1 trauma center. We performed semi-structured interviews that we recorded, transcribed, coded inductively, and analyzed thematically.

Results: We interviewed 20 patients and providers (10 of each). Most patients (70%) were male, and the mean age was 57 ± 16 years. Providers included attendings, residents, nurse practitioners, registered nurses and case managers. Three key themes emerged. (1) Communication (patient-provider and provider-provider): Providers understood that discharges do not go smoothly when communication with patients is not clear. Many patients discussed confusion about their discharge plan. All lamented that poorly written discharge summaries are an inadequate means of communication between inpatient and outpatient providers. (2) Discharge teaching and written instructions: Patients recalled discharge teaching positively but found written discharge instructions to be overwhelming and unhelpful. Providers want to spend more time teaching patients and understood that written instructions contain too much jargon. (3) Outpatient care coordination: Patients and providers commented on difficulties with coordinating outpatient care. Both groups endorsed that a patient's primary care provider and insurance coverage are central components of the outpatient experience.

Conclusion: TEGS patients face several challenges at discharge. Providers struggle to effectively help their patients with this stressful transition. Future interventions should focus on improving communication with patients using deliberate, closed-loop techniques (e.g., teach-back method), repurposing and standardizing the discharge summary to serve primarily as a means of care coordination, insisting that written discharge instructions be truly patient-centered, and assisting the patient with navigating the transition.

Poster #104

THE DECLINING USE OF OPIOIDS AT A LEVEL 1 TRAUMA CENTER

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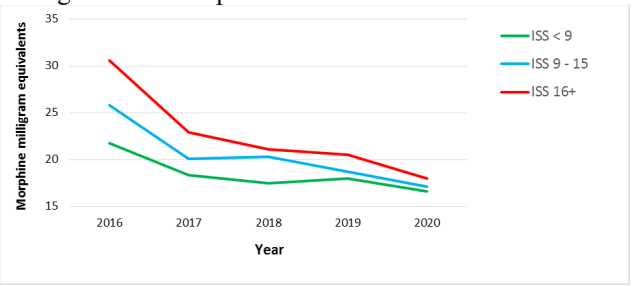
Background: The epidemic of opioid-related overdose in the U.S. prompted a public health response that included implementation of opioid-prescribing rules and restrictions. Such directives, however, were not applicable to trauma patients while hospitalized. We hypothesized that although prescribing mandates did not apply to hospitalized trauma patients, inpatient opioid administration had nonetheless decreased over time.

Methods: Opioid administrations for each patient admitted to a Level 1 trauma center between January 1, 2016 and July 31, 2020 were converted into oral morphine milligram equivalents (MME) and summed at the patient level to obtain a total amount of MME administered. MME was natural log transformed to achieve a normal distribution. General linear models were then used to determine the average patient MME administered by year. Patients who were pregnant or mechanically ventilated were excluded.

Results: 6594 patients were included in our analysis, of which 5037 (76.4%) were treated with opioids during their hospitalization. The percentage of patients administered an opioid decreased stepwise from 79.3% in 2016 to 71.4% in 2020 ($P<0.001$). For patients administered opioid, a 29% decrease in average total MME from 2016 to 2020 ($P<0.001$) was observed. With stratification by ISS (<9, 9-15, 16+), average total MME consistently trended downward (Figure).

Conclusion: Our trauma center realized a stepwise reduction in opioid administration in the absence of restrictions surrounding in-hospital opioid prescribing. Although patient satisfaction with pain management over this time is unknown, it appears that regardless of injury severity trauma patients can be managed with less opioids than have been used in the recent past.



Poster #105

ELECTRONIC HEALTH RECORD ARTIFICIAL INTELLIGENCE MODEL PREDICTS TRAUMA INPATIENT MORTALITY IN REAL-TIME

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Introduction: Patient outcome prediction models are underutilized in clinical practice due to lack of integration with real-time patient data. The electronic health record (EHR) has the ability to utilize artificial intelligence (AI) to develop predictive models. While an EHR AI model has been developed to predict clinical deterioration, it has yet to be validated for use in trauma. We hypothesized that the Epic Deterioration Index (EDI) would predict mortality and unplanned ICU admission in trauma patients.

Methods: This is a retrospective analysis of patients admitted to a level 1 trauma center from October 2019 to July 2020 for >24 hours, identified in the trauma registry. We evaluated the performance of EDI, obtained from the EHR, in predicting mortality and unplanned ICU admissions by examining the area under the receiver-operating-characteristic curve (AUC) and benchmarking it against existing predictors, including injury severity score (ISS). We performed a 5 to 1 match on age as it is a major component of EDI.

Results: The study cohort consisted of 1433 patients admitted with a mean age of 52.7 years and 90.7% following blunt injury. The in-hospital mortality rate was 1.9% and unplanned ICU admission rate was 2.8%. In predicting mortality, the max EDI within 24 hours of admission performed better than ISS in both matched and unmatched analysis (Table 1), with both predictors having an AUC > 0.90. An EDI of 80 had a 93% sensitivity, 94% specificity, and 23% positive predictive value (PPV) for mortality. For unplanned ICU admission, the prediction model for max EDI within 24 hours of ICU admission had a modest performance (Table 1); an EDI of 67.5, had a 26% sensitivity, 94% specificity, and 17% PPV.

Table 1 – Summary of Model Performances

Model	AUC	Age Matched AUC
Max EDI vs Mortality	0.981	0.981
ISS Probability vs Mortality	0.921	0.909
Max EDI vs unplanned ICU Admission	0.667	0.610

Conclusion: EDI appears to predict in-patient mortality similarly to ISS. This real-time EHR AI-based decision support tool can be used to predict in-patient mortality and unplanned ICU admission in trauma patients.

Poster #106

FACTORS ASSOCIATED WITH LIMITATION OF CARE AFTER FATAL INJURY

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Background: There is substantial variability in end-of-life (EoL) care practices in trauma patients. For those who survive initial resuscitation, most deaths occur in the intensive care unit after life-sustaining care is limited by patients or family. This study investigated predictors of limitation of care (LoC) for patients dying in a level I trauma center.

Methods: All adult trauma mortalities admitted between 1/1/16 - 6/30/20 were included. Patients were stratified into full code vs. any LoC (do not resuscitate, no escalation, withdrawal of care, or brain death). Patients who died in the emergency department were excluded given lack of time for EoL conversations. Data were further stratified based on time to LoC. Kruskal-Wallis test, Fisher exact test, and unadjusted logistic regression were used to compare groups. Results report n (%), median (interquartile range [IQR]), and odds ratios (OR) with 95% confidence intervals (CI). Alpha = 0.05

Results: 181 patients were reviewed. Age increased the odds of implementing LoC, whereas number of anatomic injuries and in-hospital complications decreased likelihood of LoC. 82% of patients had LoC initiated <14 days after admission. Those with late initiation of LoC had lower injury severity scores (ISS) and frequency of severe head injury (Head/Neck Abbreviated Injury Scale score >3).

Parameters	Full Code (n=16)	Care Limited (n=165)	OR	95% CI	p-value
Age (years)	66 (53, 76)	81 (71, 87)	1.05	1.02, 1.08	0.001
Gender (male)	12 (75)	86 (52)	0.36	0.11, 1.17	0.090
FHS Score (independent)	9 (56)	56 (45)	0.27	0.08, 1.06	0.061
ISS	22 (09, 35)	13 (09, 26)	0.97	0.94, 1.01	0.104
Number of Injuries (median/patient)	10 (02, 19)	4 (02, 08)	0.91	0.85, 0.97	0.004
Complications					
0	9 (56)	140 (85)	Reference		
1	4 (25)	14 (08)	0.22	0.06, 0.82	0.024
≥2	3 (19)	11 (07)	0.23	0.06, 0.99	0.049

Conclusion: Most LoC occurred within 14 days of admission. Patients with late LoC had less severe head injury and lower ISS. Number of injuries and in-hospital complications correlated with decreased odds of LoC, likely because they acted as proxies for overall patient acuity. Earlier consideration for LoC in patients with less severe injury may decrease ultimately futile hospital utilization.

Poster #107

FACTORS ASSOCIATED WITH MORTALITY OR WITHDRAWAL OF LIFE SUSTAINING TREATMENT IN POLYTRAUMA PATIENTS WITH SEVERE TBI

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Introduction: For polytrauma patients with severe TBI, it is unknown whether specific patient or injury factors are associated with higher odds of death or withdrawal of life sustaining treatment (WLST). We hypothesized that patient comorbidities and severe injuries would be associated with a composite outcome (death or WLST) in this group.

Methods: Polytrauma patients (defined as AIS > 2 for head and at least one other body region) were identified from the 2016 TQIP database. Patients who died or were discharged within 24 hours of admission were excluded. Bivariate analysis of patient and injury factors was performed between patients with and without the composite outcome. Logistic regression model was created using significant factors identified from bivariate analysis, and AUC was calculated.

Results: 15,106 patients were included; median age 48 years, 72% male, 97% blunt mechanism of injury, median AIS head of 3, and median ISS of 27. The composite outcome was noted in 2,194 (15%) patients. Bivariate analysis identified age, comorbidities (bleeding disorder, CHF, CKD, and cirrhosis), penetrating mechanism, ISS, and AIS scores for head, neck, thorax, abdomen, and spine as being associated with composite outcome (all $p<0.05$). The logistic regression model identified age, CHF, CKD, cirrhosis, penetrating mechanism, and AIS scores for head, neck, thorax, abdomen, and spine as independent risk factors for composite outcome (all $p<0.05$). History of alcohol abuse, smoking, HTN, and ADHD were protective of the composite outcome (all $p<0.05$). AUC for this model was 0.786.

Conclusions: Age, CHF, CKD, cirrhosis, penetrating mechanism, and severe injuries to head, neck, thorax, abdomen, or spine are independent risk factors for mortality or WLST in polytrauma patients with severe TBI. Providers should identify these patient and injury-related factors present on admission and use these results for prognostication in this severely injured population.

Poster #108

RE-EVALUATING VTE PROPHYLAXIS IN TRAUMA PATIENTS USING THROMBOELASTOGRAPHY WITH PLATELET MAPPING: IS LMWH REALLY ENOUGH?

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Introduction: Despite widespread use of low-molecular-weight-heparin (LMWH) following major trauma, venous thromboembolic events (VTEs) have not been eliminated. We hypothesized that thromboelastography with platelet mapping (TEG-PM) could: (1) better differentiate between patients with and without VTEs, and (2) identify individual's source of hypercoagulability to better tailor anticoagulation treatment.

Methods: TEG-PM was assessed at the time of VTE diagnosis and compared to TEG-PM of patients without VTE, with hospital stay >7 days and injury-related immobility. Patients with catheter or fracture associated thromboses were excluded. Comparisons were made using univariate analysis.

Results: Among 40 patients studied (77.5% male), those in VTE group (n=20) had higher Injury Severity Score, prolonged mechanical ventilation, upper extremity fractures and leukocytosis compared to non-VTE patients (n=20). Lower extremity fractures and pelvic injuries resulting in immobilization were equivalent between the two groups. VTE patients exhibited hypercoagulable TEG parameters (table), despite more frequent use of LMWH, p=0.0285. TEG-PM frequently identified inadequate LMWH dosing and platelet hyperactivity in the VTE group.

TEG factors	DVT [N=20]	No DVT [N=20]	p-value
R			
mean +/- SE	4.6 ± 0.2	6.4 ± 0.3	<0.0001
Median (IQR)	4.6 (4,5)	6.1 (5,8)	0.0003
α			
mean +/- SE	76.4 ± 0.8	72.3 ± 1.5	0.0024
Median (IQR)	76.1 (74,79)	73.1 (70,77)	0.0324
MA			
mean +/- SE	75.7 ± 0.9	72.7 ± 1.9	0.1575
Median (IQR)	76 (74,77)	73 (70,78)	0.2715
MA-AA			
mean +/- SE	74.9 ± 2.2	48.1 ± 4.4	<0.0001
Median (IQR)	78 (73, 81)	55.8 (31,62)	<0.0001
MA-ADP			
mean +/- SE	63.8 ± 3.2	49.5 ± 4.7	0.0157
Median (IQR)	64.5 (60,73)	51.5 (34,68)	0.0478
ActF			
mean +/- SE	37.4 ± 4.1	24.7 ± 2.5	0.0119
Median (IQR)	31 (27,39)	20.5 (17,29)	0.005

Conclusion: Hypercoagulable TEG-PM parameters may: (1) delineate patients at risk for VTE formation following trauma regardless of their immobilization status, and (2) better facilitate individualized, treatment-targeted approach to VTE prophylaxis. TEG-PM may better identify thrombotic mechanisms (hypercoagulable factors or platelets) and even allow for tailored dosing to mitigate VTEs.

Poster #109

THE PREGNANT TRAUMA ACTIVATION - DOES IT AFFECT PERINATAL OUTCOME?

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Background: Trauma during pregnancy is associated with significant maternal and fetal morbidity; however, this morbidity has previously been defined for index hospitalization only. The majority of pregnant trauma activations are discharged home still gravid, and the effect of trauma on subsequent birth outcome remains unknown. The goal of this study was to examine longer term perinatal outcomes of neonates whose mothers met criteria for trauma activation at a level 1 trauma center while pregnant.

Methods: All births at a single hospital with a level 1 trauma center from January 2014 to April 2020 were cross-referenced with the trauma registry to identify patients who were pregnant at the time of trauma activation. Patients already enrolled in the high-risk obstetrics program and those with multiple gestations were excluded from analysis. The group of neonates with maternal prenatal trauma activations (Trauma Neonates) was compared with controls (Non-trauma Neonates).

Results: Among 22,504 births, 239 were identified as Trauma Neonates. Gestational age at time of trauma activation stratified by trimester was 3.3% for trimester 1, 47.7% for 2, and 49.0% for 3. The primary mechanism of injury was motor vehicle crash (72.6%) followed by fall (13.9%). The majority of mothers did not suffer a documentable injury (177: 74.1%). Amongst the 62 mothers with injuries, ICD-10 ISS was 1 (69.4%), 2 (6.5%), 4 (12.9%), 5 (9.7%), and 9 (1.6%). 16 (6.7%) Trauma Neonates were born during the mother's trauma hospitalization. Outcomes of Trauma Neonates were similar to Non-trauma Neonates with respect to preterm delivery 13.8% vs. 11.5%; P=0.273), cesarean section (29.3% vs. 28.7%; P=0.769), birth weight (3270 g vs. 3320 g; P=0.416), APGAR less than 9 at 1 and 5 minutes (40.2% vs. 40.8%; P=0.854; 8.4% vs. 10.0%; P=0.438), NICU admission (13.8% vs. 10.5%; P=0.103), and fetal death (0.4% vs. 1.2%; P=0.284).

Conclusion: At a level 1 trauma center with a high-volume labor and delivery center, perinatal outcomes were not significantly different for babies whose mothers were trauma activations while gravid. Following trauma activation, pregnant patients may be reassured that their pregnancy is unlikely to be adversely affected with respect to birth outcomes.

Poster #110

EFFECTS OF EXTENDED REALITY ON INITIAL CARE OF TRAUMA PATIENTS: THE NASA TASK LOAD INDEX

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Background: Recently, extended reality (XR), which integrates virtual reality, augmented reality, and mixed reality technologies, has been applied to the medical field. However, only a few studies have focused on the effectiveness of XR simulation in the initial care of trauma patients. The authors developed a simulation of initial trauma care using XR and assessed its effectiveness.

Methods: In total, 30 physicians (11 emergency physicians, 3 acute care surgeons, 3 interventional radiologists, and 13 residents) were instructed to view computed tomography (CT) images on a conventional flat-screen monitor to develop a diagnosis and treatment strategy according to the scenario of a severe trauma patient. Then, the same CT images were stereoscopically viewed using the online application Holoeyes MD and projected into the air using a holographic lens. The NASA Task Load Index (TLX) (six items of workload assessment scored on a 11-point Likert scale, with 0–5 being positive and 6–10 being negative) was compared before and after the study.

Results: Comparison of NASA-TLX before and after the simulation showed that positive ratings increased after the simulation for all items (mental demands: 23% vs. 70%, $p = 0.001$; physical demands: 40% vs. 60%, $p = 0.196$; time pressure: 17% vs. 57%, $p = 0.003$; work performance: 34% vs. 80%, $p = 0.001$; effort: 10% vs. 63%, $p < 0.001$; and frustration: 30% vs. 70%, $p = 0.004$).

Conclusions: Simulation of initial care of trauma patients using XR could reduce the workload and enhance the development of diagnosis and treatment strategies for initial care of trauma patients.

Poster #111

EPIDEMIOLOGY OF PEDIATRIC SUICIDE DEATHS IN CONNECTICUT

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Introduction: Suicide, is the second leading cause of death in American children, and firearms are used in up to 42% of completed suicides in this age group. Screening at risk children for depression and suicide and providing children who screen positive with lethal means safety counseling is one promising injury prevention strategy. We reviewed 10 years of Connecticut's pediatric suicide deaths in conjunction with the outcomes of a newly implemented suicide screening questionnaire used in the emergency department at our institution.

Methods: Data from the Connecticut Office of the Chief Medical Examiner and the Department of Public Health were retrospectively reviewed from 2008-2018. All deaths among children ages 10-18 were identified and further classified according to manner of death and other demographic data. Suicide deaths were categorized based on the cause of death and type of injury. We used the Ask Suicide Screening Questions tool in the emergency department. This is a brief validated tool approved by the Joint Commissions. Qualitative and quantitative data from the suicide screening questionnaire was reviewed and quantified from August 2019 to March 2021.

Results: During the study period there were a total of 541 deaths among ages 10-18 in Connecticut, of which 16.2% were suicides. Mean age of suicide death was 15.2+/-1.45. More than half (57%) of suicide deaths were male. Among suicide deaths, the majority (77.9%) were by hanging, and 13.9% were by firearm ($p<.001$). Since the implementation of the suicide screening questionnaire nearly 20,000 children (89% of those registered in the ED) were screened with this tool. Five percent screened positive and were referred for a social work consult. The social worker provided a multitude of additional resources for the youth and family.

Conclusion: Suicide is the third leading cause of death for children in Connecticut, and hanging is the most common means. Further work is needed to develop strategies toward incorporating policies that lower the risk of suicide by hanging into lethal means safety counseling and identifying which mental health resources are most effective at lowering suicide risk.

Poster #112

LEFT OUT IN THE COLD: HOMICIDE AMONGST PERSONS EXPERIENCING HOMELESSNESS

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Introduction: The average life expectancy for a person experiencing homelessness (PEH) is 20-30 years less than the general population, largely attributable to higher rates of chronic diseases. Few studies explore other causes. Our goal was to characterize risk factors that exist for PEH who experience a death by violence in this vulnerable population to drive future intervention.

Methods: We reviewed homicide victims in the National Violent Death Reporting System (NVDRS) from 2003-2017, comparing patients identified as homeless at the time of death to those who were not. We also compared victim demographics, circumstances of death, suspect demographics, and relationship to the victim.

Results: 76,344 incidents were included, with 1196 victims (1.6%) identified as homeless experiencing homicide. PEH were primarily male (85% vs. 78%, $p<0.001$), older (43 vs. 30 yrs, $p<0.001$), and white (41% vs. 30%, $p<0.001$). Mental health issues, alcohol and substance abuse were more often identified in PEH. While firearm was the most common homicide weapon, PEH were more likely stabbed or bludgeoned to death. PEH were more likely killed in a natural area or street/road and were more likely to die through random violence/hand of a stranger.

Conclusion: PEH are older, suffer from mental illness, and tend to be killed in natural areas by strangers. While only 0.17% of the population, they are disproportionately represented at 1.6% of homicides.

	Circumstance	Not Homeless (n=75148)	Homeless (n=1196)	p-value
	Mental health problem	1840 (2.4)	72 (6.0)	<0.001
	Alcohol problem, other substance abuse problem	5952 (7.9)	408 (34.1)	<0.001
	Single homicide only	64536 (85.9)	1145 (95.7)	<0.001
	Random violence	1126 (1.5)	58 (4.8)	<0.001
	Suspect thought to be intoxicated: ETOH or drugs	2140 (3.7)	83 (8.9)	<0.001
Location	House/apartment	38220 (50.9)	248 (20.7)	<0.001
	Street, road, sidewalk, alley, public space	23469 (31.2)	695 (58.1)	
	Motor vehicle	4876 (6.5)	36 (3.0)	
	Supervised residential facility (shelter, etc)	203 (0.3)	25 (2.1)	
Weapon	Firearm	51557 (68.6)	426 (35.6)	<0.001
	Sharp instrument	9301 (12.4)	260 (21.7)	
	Blunt instrument	4113 (5.5)	201 (16.8)	
	Other (fists, hanging, fall, poisoning, etc.)	10,177 (13.5)	309 (25.8)	
Relation	Unknown relationship	19378 (34.0)	396 (42.5)	<0.001
	Stranger	5037 (8.8)	118 (12.7)	
	Acquaintance	12499 (21.9)	277 (29.7)	
	Close relationship (friend, sig other, IPV)	19,093 (25.4)	132 (11.0)	

Groupings may not add to 100% due to truncation for space; denominator different for suspect variable.

Poster #113

MAPPING FIREARM SUICIDE – A WAY TO GUIDE PREVENTION EFFORTS

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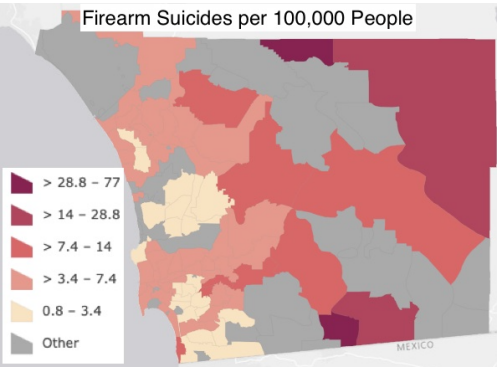
Introduction: Suicides by firearm are a major public health issue in the United States, accounting for over 23,000 deaths in 2017, nearly half the total number of suicides. There are no existing studies that map suicides and provide a geographical analysis that contextualize the demographic groups at risk. We hypothesized that zip codes with higher income would have a lower firearm suicide rate. We also predict there would be an urban and rural split, with firearm suicides occurring more often in rural communities.

Methods: A retrospective review of suicide deaths from a County Medical Examiner from 2011 to 2018, along with demographic data from the United States Census Bureau, was performed. Study population was dichotomized as firearm and non-firearm suicides that occurred in the County. Data was grouped by residential zip code, excluding zip codes with < 3 years of data. These data were mapped using ArcGIS Pro to group suicides by zip codes and townships. Chi-squared analysis was performed to determine the association of suicide method and demographic.

Results: There were 3,299 suicides during the study period, 1,189 of which were by firearm. Of the firearm suicide victims, 34.6% were > 65 years old, and 79.1% were non-Hispanic White. Suicide rates by firearm were significantly higher in males, those > 65 years of age and non-Hispanic Whites. The lowest income quartile (Q1) had the highest firearm suicide rate per 100,000 at 12.4; followed by Q3 at 6.2, Q2 at 5.6, and Q4 at 4.0. ArcGIS mapping demonstrates rural areas had greater firearm suicide rates relative to more urban areas (Figure)



Conclusion: Firearm suicide rates are greatest among older, non-Hispanic White males and in the lowest income quartile. Mapping further contextualized this demographic into suburban and rural communities rather than urban centers providing a target for prevention efforts.

Poster #114

FALLS FROM LADDERS: INJURY PATTERNS AND OUTCOMES

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Introduction: Our contemporary understanding of the impact of falls from ladders remains limited. The purpose of this study was to examine the injury patterns and outcomes of falls from ladders.

Methods: The National Trauma Data Bank was queried for all patients who fell from a ladder (01/2007-12/2017). Participants were stratified into 4 groups according to age: ≤15, 16-50, 51-65, and >65 years. Univariable analyses were performed to compare the injury patterns and outcomes between the groups. Multivariable analysis was used to identify independent risk factors of mortality.

Results: A total of 168,227 patients were included for analysis. Median age was 56 years (IQR: 45-66), 86.1% were male, and median ISS was 9 (4-13). Increasing age was associated with a higher risk of severe trauma (ISS>15: 8.8% vs 13.7% vs 17.5% vs 22.0%, p<0.001). Head injuries followed a U-shaped distribution with pediatric and elderly patients representing the most vulnerable groups. Overall, fractures were the most common type of injury, in the following order: lower extremity 27.3%, spine 24.9%, rib 23.1%, upper extremity 20.1%, and pelvis 10.3%. The overall ICU admission rate was 21.5%; however, it was significantly higher in the elderly (29.1%). In-hospital mortality was 1.8%. The risk of death progressively increased with age with a mortality rate of 0.3%, 0.9%, 1.5%, and 3.6%, respectively (p<0.001). The strongest predictors of mortality were GCS ≤8 on admission (OR 29.80, 95% CI 26.66 – 33.31, p<0.001) and age >65 years (OR 7.75, 95% CI 3.46 – 17.34, p<0.001). Only 50.8% of elderly patients were discharged home without health services, 16.5% were discharged to nursing homes and 15.2% to rehabilitation centers.

Conclusion: Falls from ladders are associated with considerable morbidity and mortality, especially in the elderly. Head injuries and fractures are common and often severe. An intensified approach to safe ladder use in the community is warranted.

Poster #115

MINORITY EFFECTS ON NATIONAL AND REGIONAL FIREARM TRAUMA RATES

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Introduction: Gun violence is a serious healthcare epidemic, both in the United States (US) and worldwide. Racial disparities among victims remain a concern. The aim of this study is to describe the overall incidence of firearm-related traumas based on differing racial or ethnic groups in the US.

Methods: A retrospective review of 27,652 cases from 2019 to 2020 at four Level I trauma centers in California, Oregon, Florida, and Oklahoma. Mechanism of injury (MOI) was standardized across all locations. Pearson chi-square tests were used to compare categorical variables and a multivariable logistic regression was made to assess the risk of a gunshot wound (GSW).

Results: A total of 1,591 cases were queried as GSW. After adjusting for covariates, when compared to white people, black patients had a 5 times more risk of getting a GSW (OR=5.761 CI 5.073-6.541, p< 0.001). We further analyzed by states, black patients in Florida had 8 times more risk of getting a GSW followed by 5 times in Oregon, and 2 times in California, and Tulsa. Hispanic vs. non-Hispanic demonstrated no difference. Overall mortality was 8.5%.

Conclusion: Blacks nationally remain disproportionally affected by GSW. This is true regionally, including in states with varying black populations. Further studies on firearm violence and evaluation of targeted prevention strategies are warranted.

Table 1.
Multivariable logistic regression on risk of GSW for black patients

	OR	CI	P value
Florida	8.562	6.117-11.983	<0.001
Oregon	5.761	5.073-6.541	<0.001
California	2.462	1.174-5.164	0.017
Oklahoma	2.097	1.533-2.870	<0.001

Poster #116

PREVENTING THE OTHER TWO-THIRDS: MODIFIABLE FACTORS RELATED TO FIREARM SUICIDES

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Background: Of the nearly 39,000 American firearm deaths each year, nearly two thirds are due to suicide. State firearm legislation has been shown to decrease these fatalities and firearm ownership increases it. However, comprehensive study including other important factors, including behavioral health indicators, gun ownership and access to care is lacking. We hypothesized that state firearm laws limiting weapon access would be associated with reduced firearm suicide (FS) deaths.

Methods: We acquired 2013-2016 state data for FS deaths from the CDC WONDER database. Firearm laws pertaining to weapon access were obtained from the State Firearms Law Database. Depression rates and access to care were obtained from the Behavioral Risk Factor Surveillance System (BRFSS) of the CDC. Population numbers, poverty rates and access to social services (food assistance) were obtained from the American Community Survey (ACS) of the US Census. Gun ownership estimates were retrieved from the RAND State-Level Firearm Ownership database. Univariate panel linear regression with fixed effect for state was performed with firearm suicide rates as the outcome. A final multivariable panel regression with fixed effect for state was then utilized.

Results: 27 states had laws limiting weapon access ($p=0.003$). Over the study period, only four states endured a change in these laws ($p=0.486$); three states gained at least one law while a single state repealed one law. In univariate analysis, laws and reported depression rates were not associated with FS, but social support, access to care and gun ownership were. In multivariable regression, both lack of health insurance (β -0.06, 95% CI -0.10 to -0.02, $p=0.002$) and gun ownership (β 5.39, 95% CI 1.87 to 8.91, $p=0.003$) were associated with FS rates.

Conclusions: During our time period, very few changes occurred in laws limiting weapon access to specific groups and these changes did not correlate to decreased FS. Access to care and social safety net services had little correlation to death rates. Gun ownership had by far the largest association with firearm suicide rates and remains the largest known modifiable target for reducing suicide deaths.

Poster #117

SYNERGISTIC TRAUMA CENTER'S VIOLENCE INTERVENTION PROGRAM ROLE, IN PARTNERSHIP WITH A FAMILY JUSTICE CENTER

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Background: Intentional injuries are the second leading cause of death in the U.S. between the ages of 1 and 44. Those affected may be victims of domestic or non-domestic violence, intimate partner violence, sexual abuse, elder abuse, or attempted suicide survivors. It is key to note that not all injuries are equal, and in fact each one is unique to the victim. Each individual traumatic event is approached best with a multiagency and multidisciplinary approach. Family Justice Center's (FJC) provide this exact service. Trauma Centers are frequently the first haven for victims, and often the first beacon of light to recovery.

Methods: This is a cross-sectional descriptive study of traumatically injured patients that were evaluated in an adult level II trauma center and were referred to a newly established Family Justice Center (FJC). We included cases from confirmed and suspected assault in our study cohort. Known self-inflicted injuries were excluded. All patients meeting the study criteria regardless of age that were seen and evaluated for the period January 1, 2019, to December 31, 2020, were included in the analysis.

Results: Over the two-year study period, there were 255 trauma admissions for intentional injuries, which accounted for 10.4% of the total admissions (N=2,455). Of these patients, 122 (48%) were evaluated and channeled through the Family Justice Center. Despite referral to alternate services, the remaining 133 (52%) had an open judicial case, thus, were not processed through the FJC due to conflict of interest. The mechanisms of injuries of patients that were referred to the FJC (N=122) were mostly assaults (79%), attempted homicide (11%), domestic violence (4%), and other violent crimes (9%). Majority of the patients that were evaluated in the FJC were of the Hispanic race (73%), while the rest were Caucasian (25%), Asian (1%), African American (1%), and others (1%). There were more males than females (58% vs. 28%). Most of the patients were English speaking (80%), while 20% were non-English speakers. The age group 25-59 consisted 65% of the study cohort, 11% were aged <17, 16% were aged 18-24, and 8% were aged <60. 433 individual services were provided to these patients, including follow-up through: phone conversations (n=111), mail (N=21), text messages (N=9), and 192 other services provided through the 35 partnering agencies including but limited to counseling, employment, legal services, housing, education, support groups, and transportation. None of the patients evaluated through the FJC (N=122) were readmitted in the trauma center for violent incidences within the study period.

Conclusion: By collaborating with FJCs, trauma centers and violence intervention programs can pool resources for enabling services to address important social determinants of health, and promote important research. The outcome contributes to a pathway for healing by using the trauma informed care approach, accountability to those at fault, and most importantly prevention of future acts of intentional injuries. With successful benefit to individual cases comes the trickling effects of community improvement. By investigating the collaboration of trauma centers with an FJC, the road to rehabilitation can become exponentially brighter.

Level of Evidence: VI
Key Words: Intentional injuries, violence intervention program, trauma centers, Family Justice Center

Poster #118

TACTICS FOR HEMORRHAGIC SHOCK: A VIRTUAL COURSE AND VISUAL AID FOR IMPROVED RECUSSITATION

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Introduction: Our trauma performance improvement initiative recognized missed treatment opportunities for patients undergoing massive transfusion. To improve patient care, we developed a novel cognitive aid in the form of a poster entitled "TACTICS for Hemorrhagic Shock." We hypothesized that this reference and corresponding course would improve the performance of trauma leaders caring for simulated patients requiring massive transfusion.

Methods: First, residents and physician assistants participated in a one-on-one, distanced, screen-based virtual patient simulation. Next, they watched a short presentation introducing the TACTICS visual aid. They then underwent a similar second virtual simulation during which they had access to the reference. In both simulations, the participants were assessed using a scoring system developed to measure their ability to provide appropriate pre-determined interventions while leading a trauma resuscitation (score range: 0-100%). Pre and post-intervention scores were compared and participants' feedback was obtained anonymously.

Results: Thirty-two participants (21 residents and 11 PAs) completed the course. The median score for the first simulation without the use of the visual aid was 43.8% (IQR 20.8-75.0). Commonly missed treatments included giving tranexamic acid (success rate: 37.5%), treating hypothermia (31.2%), and reversing known anticoagulation (21.8%). All participants' performance improved using the visual aid, and the median score of the second simulation was 89.6% (IQR 70.8-100) (p-value <0.001). Ninety-two percent of survey respondents "strongly agreed" that the TACTICS visual aid would be a helpful reference during real-life trauma resuscitations.

Conclusion: The TACTICS visual aid is a useful tool for improving the performance of the trauma leader and is now displayed in our emergency department resuscitation rooms. This performance improvement course, the associated simulations and visual aid are easily and virtually accessible to interested trauma programs.

Poster #119

TRAUMA VOLUME INCREASED IN LOWER SOCIOECONOMIC COMMUNITIES DURING THE COVID-19 PANDEMIC

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INTRODUCTION: The effects of COVID-19 on trauma incidence were examined widely. Racial/ethnic minority groups bear a disproportionate burden of trauma and adverse outcomes. This study investigated the change in trauma incidence by socioeconomic subgroups during COVID-19.

METHODS: A retrospective study utilizing Level I trauma center registry data (2017-2020) was conducted. Data collection included trauma and demographic characteristics. Home zip codes were matched to the Community Needs Index (CNI), an aggregate socioeconomic score. CNI was dichotomized (<4.4 vs. ≥4.4). The percentage change in weekly trauma incidence was computed for high- vs. low-CNI groups. A bootstrapped chi-square test was performed to compare patients injured in 2020 vs. 2017-19.

RESULTS: Among 13,202 trauma patients, those injured during the COVID-19 pandemic were significantly ($p < 0.005$) more likely to be non-white (48.1% vs. 42.2%), Hispanic (26.1% vs. 21.6%), homeless (3.2% vs. 1.7%), and living in zip codes with CNI ≥ 4.4 (52.4% vs. 49.6%) compared to the pre-pandemic period. The overall weekly trauma incidence for patients from high-CNI areas increased by 6.5% between pre-and post-COVID periods and decreased by 4.8% for patients from low-CNI areas (dashed, Figure 1).

CONCLUSION: At baseline, lower socioeconomic (high CNI) communities bear a disproportionate burden of injuries; this inequity was exacerbated during the COVID-19 pandemic. This study advocates for developing targeted interventions to address inequities among trauma patients.

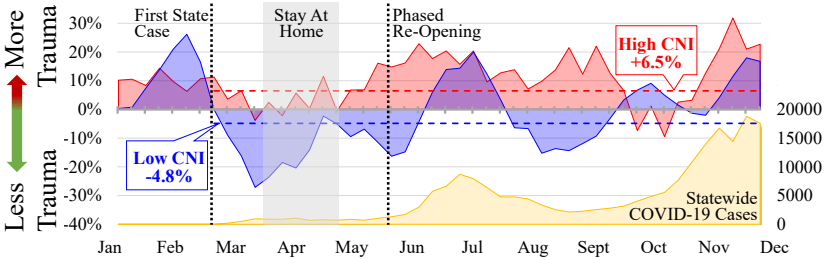

Figure 1. Trauma Volume Percentage Change during COVID-19, 5-week Moving Average (CNI ≥ 4.4, more need; CNI < 4.4, less need)

Poster #120

COVID-19 IMPACT ON OUTCOMES IN EMERGENCY GENERAL SURGICAL PATIENTS: AAST MULTI-INSTITUTIONAL TRIAL

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Introduction: The COVID-19 pandemic has placed additional strain on healthcare systems worldwide, potentially resulting in delayed access to care and late presentations. We hypothesized emergency general surgery (EGS) patients presented with more severe disease in the COVID-19 era and this would be associated with increased morbidity and mortality.

Methods: This is a AAST international multicenter retrospective study of EGS patients age ≥ 18 years admitted during the first 6 months of the COVID-19 pandemic and a control group admitted during the same period one year prior. The primary outcome was postoperative complication rates. Demographics, AAST severity grade, admission SOFA score, and operative information were collected. The COVID-19 era and control groups were compared for severity of presentation and outcomes.

Results: 1,748 patients from 6 centers met our inclusion criteria, of which 898 (51%) were admitted during the COVID-19 pandemic. More severe presentations AAST Grade ≥3) were observed during the COVID-19 era, (34.7% vs 29.4%, p=0.02). COVID-19 era patients did not experience a greater number of overall complications (16.3% vs 15.2%, p=0.53), however there were significantly more cases of acute respiratory distress syndrome (2.2% vs 0.9%, p=0.03). The mortality rate was more than twice as high in patients admitted during the pandemic, but the difference was not statistically significant (2.0% vs 0.9%, p=0.07). There was no difference in the frequency of operative intervention (78% vs 75%, p=0.14). On subgroup analysis, there was no difference in mortality for patients with appendicitis, cholecystitis, diverticulitis, necrotizing soft tissue infection, small bowel obstruction, perforated viscous, or perforated ulcer. Patients with necrotizing soft tissue infections experienced an unplanned return to the operating room more often during the pandemic (20% vs 3%, p=0.03).

Conclusions: Disease severity was higher in EGS patients presenting during the COVID-19 pandemic, suggesting a possible delay in presentation or access to care. These results have significant implications in the ongoing and any future pandemics.

Poster #121

ACUTE CARE SURGEONS' PRACTICES AND ATTITUDES REGARDING ELECTIVE SURGERY

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Introduction: The importance of an elective surgery practice to Acute Care Surgeons (ACS) is evolving. In a survey to assess Trauma group scope of practice in 2008, 201/221(91%) of trauma groups performed some elective surgery, including endocrine surgery 64%, pulmonary lobectomy 31%, Whipple's 55%, and peripheral bypass 24%.

Methods: A survey was designed, approved by our institutional IRB. The survey was sent to 1680 members of AAST via email, asking about the scope and variety of professional activities as well as their attitudes toward the importance of elective surgery in their practices. Responses were maintained in a REDCap database and analyzed using Excel. We defined elective surgery as procedures scheduled in advance, including not only general surgery but other areas of interest such as spine exposure, burn/wound management, vascular access, or reconstructive surgery.

Results: We received 130 complete survey responses (7.7%). 113 of the 130 (87%) worked in hospitals with a surgical residency. 83% practiced in Level 1 and 15% in Level 2 trauma centers. The mean number of years in practice was 15.8 years. 23% of respondents reported performing no elective surgery, 33% of respondents had between 1%-5% of their work time dedicated to elective surgery, 30% of respondents had 6-24% of their work time for elective surgery and 14% of respondents had 25% or more dedicated to elective surgery. The scope of elective surgery in the survey included: General surgery 59%, soft tissue/wound 58%, elective endoscopy/ PEG 34%, elective chest wall reconstruction/rib plating 24%, burn 5%, vascular 3%, vascular access 8%, thoracic 8% spine exposure 12% and endocrine 4%. The amount of elective surgery felt about right to 62% of respondents, too little or far too little to 33% and too much to 5%.

Conclusion: The amount of elective surgery performed by acute care surgeons was less than what was reported in previous studies. 40% of respondents dedicate at least 10% of their work activity to elective surgery. The scope of elective surgeries done by acute care surgeons remains broad though also absolute numbers are decreasing from previous reports. The importance of elective surgery to acute care surgeons remains high for those involved in it, with 33% of acute care surgeons feel like they are doing less than they would like. Defining the importance and extent of elective general surgery has implications for the continuing evolution and training of the next generation of acute care surgeons.

Poster #122

COMPARISON OF EMERGENCY DEPARTMENT POINT OF CARE ULTRASOUND VS RADIOLOGY PERFORMED GALLBLADDER ULTRASOUND

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Introduction: We sought to determine if point of care ultrasound (POCUS) and radiology performed ultrasound (RADUS) were clinically similar in patients presenting to the emergency department with right upper quadrant (RUQ) abdominal pain.

Methods: We retrospectively reviewed all adults presenting at a single institution emergency department between 2000-2020 with complaints of RUQ pain who received POCUS followed by RADUS of the RUQ within a 24-hour period. Ultrasound reports were assigned a score for the following parameters: gallbladder wall thickening, gallstones, pericholecystic fluid. For patients with all six components reported, the total score for POCUS was compared to RADUS using Wilcoxon Signed Rank Test.

Results: Of the 289 patients, 109 (37.7%) underwent a procedure (cholecystectomy or cholecystostomy). Although all patients had POCUS and RADUS exams, only 53% had complete reporting on both. POCUS exams were statistically more likely to report all exam components (84.4% vs 61%, $p<0.001$). Total ultrasound scores for this same group showed that POCUS and RADUS were statistically similar ($n=152$, $p=0.55$). When comparing individual components for all exams, presence of pericholecystic fluid and cholelithiasis were similar between POCUS and RADUS ($p=0.06$, $p=0.23$ respectively). Presence of thickened wall differed between the two modalities ($p<0.001$), however it should be noted that wall thickness measurement was reported less frequently on RADUS (81% vs 94.8%, $p<0.001$).

	POCUS	RADUS	p
Stones present	189 (66%)	193 (68%)	0.23
Pericholecystic fluid present	62 (24.1%)	37 (17%)	0.06
Wall thickened (>3mm)	98 (35.8%)	109 (46.6%)	<0.001

Conclusion: POCUS and RADUS are similar in patients with RUQ abdominal pain, and the surgeon can be confident using POCUS for assessment of biliary disease. Incomplete reporting of standard ultrasound components is common. ED and Radiology departments should work to standardize ultrasound reporting.

Poster #123

CUMULATIVE SURGICAL MORTALITY RISK IN EMERGENCY GENERAL SURGERY

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Introduction: It is unknown whether having multiple Emergency General Surgery (EGS) procedures performed in one admission confers additional risk. We hypothesized that having multiple procedures (for example hernia repair plus bowel resection) is associated with higher mortality.

Methods: We identified all adults with non-elective admissions who underwent EGS from the 2017 National Inpatient Sample. EGS procedures types identified by ICD-10 code were counted and included: colon, small bowel, hernia, lysis of adhesions, ulcer procedures, gallbladder, debridement, other laparotomy, and other laparoscopy. We used logistic regression to determine the association between the number of EGS procedures performed and in-hospital mortality, adjusting for: age, sex, payer, race and the Elixhauser comorbidities. Patients with a single procedure was the reference group. Median [IQR], and odds ratios [95% CI] are presented.

Results: 216,317 EGS patients (age 57 [43-70], 50.6% female) were included; 2.8% died. Of these, 33,744 (15.6%) had >1 EGS. Patients with multiple procedures, compared with patients who had 1 procedure, were more likely to die (7.4% vs. 1.9%, $p<0.001$). There was a dose-response relationship whereby having more EGS procedures during a hospitalization was associated with higher odds of death (Table).

Conclusions: Patients who need more than one type of procedure have increased odds of mortality. Four or more procedure types was associated with a 5-fold and higher increase in odds of death.

Table. Logistic Regression

# of EGS Procedures	Odds Ratio	95% CI	P > | z |
2	3.04	2.86 - 3.24	0.00
3	3.92	3.54 - 4.33	0.00
4	5.74	4.83 - 6.83	0.00
5	7.64	5.38 - 10.86	0.00
>5	9.53	4.92 - 18.49	0.00

*Odds Ratios, Adjusted for age, sex, payer, race, Elixhauser count

Poster #124

EFFECTS OF AGE AND GENDER ON WORK-LIFE BALANCE SATISFACTION AMONG TRAUMA SURGEONS

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Introduction: As physician burnout rates have been on the rise, there is an increased focus on how best to mitigate this problem. Because dissatisfaction with work-life balance (WLB) is associated with burnout, improving this balance is a topic that has gained recent popularity. Our study aimed to evaluate the factors associated with WLB in trauma surgeons when stratified by age and gender.

Methods: This was a secondary analysis, based on age (>/= 50 and < 50) and gender, of a AAST survey study investigating factors associated with WLB in trauma surgeons. The survey included detailed questions regarding demographics, clinical practice, family, lifestyle, and emotional support. Each subgroup was analyzed separately and the primary outcome for each group was WLB satisfaction.

Results: Among the 292 (21%) AAST members that completed the original survey, the population was stratified by age [143 older (49%), 149 younger (51%)] and gender [85 females (29%), 207 males (71%)]. The table below shows factors independently associated with satisfying WLB for each subgroup after logistic regression controlling for other variables.

Females	Males	Older (>/=50)	Younger (<50)
-Spending more awake hours at home -Current job well suited to them -Better at meeting deadlines	-Saying 'no' to new tasks -Fair compensation -Healthy diet -Feeling emotionally supported at work	-Working less hours per week -Having hobbies -More years in practice - Saying 'no' to new tasks -Fair compensation -Getting exercise -More vacation time	-Working less hours per week -Having hobbies -Current job well suited to them -Better at meeting deadlines

Conclusions: Factors independently associated with a satisfying WLB in trauma surgeons are comparatively different when stratified by age and gender. This information may be useful to help trauma surgeons understand what factors they can modify in order to improve WLB and avoid burnout. In addition, department chairs and division chiefs should be aware that factors affecting WLB among their trauma surgeons are quite different depending on age and gender of the individual surgeon.

Poster #125

GLOBAL SURGERY PARTNERSHIPS IN LOW- AND MIDDLE-INCOME COUNTRIES: AAST MEMBERSHIP SURVEY

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Introduction: The growing field of global surgery has led institutions in high-income countries (HICs) to establish partnerships with institutions in low- and middle-income countries (LMICs). There is a lack of understanding as to what these partnerships entail. Our objective was to characterize the collaborations between American Association for the Surgery of Trauma (AAST) members' institutions and their LMIC partners.

Methods: A cross-sectional, internet-based global surgery partnership survey was distributed to the AAST membership listserv (1,504 members) between June and August 2020. Respondents from United States (U.S.)-based institutions who completed the survey were included. Responses representing the same institutional partnerships were combined for analysis.

Results: A total of 58 AAST members representing 52 unique U.S. institutions in the Northeast (n=13, 25%), Midwest (n=14, 27%), West (n=13, 25%), and South (n=12, 23%) were included. Nearly two-thirds (n=34, 65%) reported their institution had partnerships or opportunities in LMICs, with sub-Saharan Africa (79%) being the most commonly reported region. LMIC partnerships were more common among university-affiliated compared to community or private institutions (88% vs. 61%, p=0.023), and most commonly supported educational efforts (93%), research (74%), and clinical rotations (70%). Surgical disciplines of focus were most commonly general surgery (88%), trauma/critical care (59%), and pediatric surgery (38%). A small number (21%) described their institutions' international activities as mission trips. Reciprocal opportunities, such as training or research, were available in roughly half (47%) of the partnerships, but only two (6%) responded LMIC partners could rotate at their U.S. institution.

Conclusion: Among AAST members' institutions, most existing partnerships with LMICs were education- or research-focused. Reciprocal opportunities for LMIC partners were less common, suggesting more work is needed to ensure these HIC-LMIC partnerships are equitable, collaborative, and driven by LMIC stakeholder priorities and needs. As global surgery partnerships grow in number, AAST members could leverage the organization's network and resources to work toward this goal.

Poster #126

OUTCOMES OF TOTAL VERSUS PARTIAL COLECTOMY IN FULMINANT CLOSTRIDIUM DIFFICILE COLITIS. A PROPENSITY MATCHED ANALYSIS

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Background: The Total Abdominal Colectomy (TAC) is the recommended procedure for Fulminant Clostridium Difficile Colitis (FCDC), however, occasionally, FCDC is also treated with partial colectomies. The purpose of the study was to identify the outcomes of partial colectomy in FCDC cases.

Method: The National Surgical Quality Improvement Program (NSQIP) database was accessed and eligible patients from 2012 through 2016 were reviewed. Patients 18 years and older who were diagnosed with FCDC and who underwent colectomies were included in the study. Patients' demography, clinical characteristics, comorbidities, mortality, morbidities, length of hospital stay and discharge disposition were compared between the group who underwent partial colectomy and the group who underwent TAC. Univariate analysis followed by propensity matching were performed. A p value of <0.05 is considered as statistically significant.

Results: Out of 491 patients who qualified for the study, 93 (18.94%) patients underwent partial colectomy. The pair matched analysis showed no significant difference in patients' characteristics and comorbidities in the two groups. There was no significant difference found in mortality between the two groups (30.1% vs. 30.15, $P>0.99$). There were no differences found in the median [95% CI] hospital length of stay [LOS] (23 days [19-31] vs. 21 [17-25], $P=0.30$), post-operative complications ($P>0.05$), and discharged disposition to home (43.1% vs. 33.8%) or transfer to rehab (21.55 vs. 12.3%, $P=0.357$) between the TAC and partial colectomy groups.

Conclusion: The overall 30 days mortality remains very high in FCDC. Partial colectomy did not increase risk of mortality or morbidities and LOS.

Poster #127

PRE-MORBID FRAILTY PREDICTS WORSE QUALITY OF LIFE IN EMERGENCY GENERAL SURGERY

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Indiana University Hospital

Introduction: Patient frailty is recognized as a key determinant of poor surgical outcomes. It is unclear how frailty affects health-related quality of life (HRQoL) in emergency general surgery (EGS). We hypothesized frail EGS patients would report lower baseline HRQoL and higher rates of anxiety and depression.

Methods: We performed a single-center, prospective, longitudinal study of patients admitted with an EGS diagnosis. Frailty was assessed by grip strength, an EGS specific survey and psoas diameter. Frailty status at baseline was used to determine an association, if any, with baseline HRQoL using the SF-36 Physical Component [PCS] and Mental Component Summary [MCS]), assessment of activities of daily living (ADLs; Katz Index and Lawton Scale), anxiety (Generalized Anxiety Disorder Assessment; GAD7) and depression (Patient Health Questionnaire; PHQ9).

Results: 46 patients (52yo +/- 14.4; 66% female) admitted with an EGS diagnosis were included and 31 (68%) required surgery. 46% of the patients were classified as frail by their frailty index score. Baseline SF-36 (PCS for frail =24.0; MCS for frail =26.5), Katz Index (5.1 vs 5.9, p =.03), Lawton Scale (6.7 vs 7.8, p =.035) were lower for frail patients on admission compared to non-frail patients. Similarly, frail patients had higher scores for anxiety (10.8 vs 5.8, p =.01) and depression (11.5 vs 6.6, p =.02). After controlling for age and gender, frailty was significantly associated with a lower PCS (-9.26, 95%CI -16.2, -2.4) and MCS (-21.4, 95% CI -34.1, -8.7). Similarly frail patients had lower ADLs, -.787 (95% CI -1.5,-.11) on the Katx Index and -1.1 (95%CI -2.1, -.09) on the Lawton Scale. Finally, frailty was significantly associated with increased anxiety (GAD +6.1, 95%CI 2.6, 9.6) and depression scores (PHQ9 +6.5, 95%CI 2.7, 10.3).

Conclusion: Frail patients have lower quality of life compared to non-frail counterparts on admission to hospital with emergency general surgery conditions. This may aid in the discussion of management options with a patient focus, particularly for invasive therapies such as surgery. Frailty should be measured in at-risk patients admitted to hospital with an EGS condition. Future work is needed to determine the impact of frailty on post-hospitalization quality of life, anxiety and depression.

Poster #128

THE IMPACT OF THE FIRST COVID-19 WAVE ON THE PRESENTATION AND MANAGEMENT OF PATIENTS WITH ACUTE APPENDICITIS

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Introduction: Acute appendicitis (AA) is the most common surgical emergency, with a relatively stable yearly incidence and an inelastic treatment demand. During the first wave of the COVID-19 pandemic, New York City (NYC) hospitals saw a marked decrease in patients presenting with non-COVID-related diseases. The objective of this study was to characterize the effects of the pandemic on the incidence, presentation, and management of AA.

Methods: A retrospective analysis of patients with AA who presented to two academic medical centers during the NYC COVID peak (March 22nd - May 31st, 2020) was performed. This group was compared to a control cohort of patients who presented during the same period in 2019. Primary outcomes included the incidence of AA, complicated disease, and operative vs. non-operative management (NOM). Secondary outcomes included duration of symptoms (DOS), hospital length of stay (HLOS), and complication rates. Statistical analyses were performed using Mann-Whitney U, Chi-square, and Fisher's exact tests.

Results: A 49.1% reduction in the incidence of AA was seen between 2019 (n=114) and 2020 (n=58). Median DOS doubled from one day in 2019 to two days in 2020 ($p<0.02$). Proportionally, the incidence of complicated appendicitis rose from 19.3% in 2019 to 41.4% in 2020 ($p<0.005$). 32.4% of patients with uncomplicated AA underwent NOM in 2020, compared to 12% in 2019 ($p<0.02$). Although three early recurrences were seen in each NOM group, HLOS and complication rates were similar between years.

Conclusion: The COVID-19 pandemic had a direct effect on the hospital presentation of patients with AA, including an overall decline in visits and delays to care, which likely contributed to a higher proportion of complicated disease. Surgeons were also more likely to treat AA with antibiotics alone than they were prior to the pandemic. Further research is needed to understand the long-term consequences of these changes in management.

Poster #129

TIME TO SURGICAL INTERVENTION AFFECTS MORTALITY, COMPLICATIONS, REOPERATIONS, AND READMISSIONS OF EMERGENCY GENERAL SURGERY PATIENTS: A NATIONWIDE ASSESSMENT

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The impact of time to surgery on outcomes of Emergency General Surgery (EGS) patients has not been well studied. We hypothesized that prolonged time from admission to surgical intervention is associated with worse outcomes following low and high risk EGS procedures.

Using the NSQIP database (2013-2017), 9 procedures encompassing 80% of the burden of EGS diseases, performed on an urgent/emergent basis were identified and further classified as low risk (open and laparoscopic appendectomy and laparoscopic cholecystectomy) and high risk (open cholecystectomy, laparoscopic and open colectomy, lysis of adhesions, perforated ulcer repair, small bowel resection, and exploratory laparotomy). The impact of time from admission to surgery on outcomes (mortality, complications, reoperations and 30-d readmissions) was analyzed by univariate and multivariate models.

Of a total of 226,083 patients enrolled, 8% underwent surgical management at or later than 3 days post admission, which was associated with significantly increased mortality (13.8%), complications (22.4%), reoperations (8.3%) and 30-d readmissions (7.2%) when compared to surgical care within the first day of admission. Comparing the impact of surgical care delivered on Day 1 vs. Day 3 on mortality, increase of 5.4-fold was observed for appendectomy, 1.9-fold for laparoscopic cholecystectomy, 1.4-fold for open colectomy, 2-fold for perforated ulcer repair, 1.8-fold for small bowel resection, and 1.2-fold for exploratory laparotomy. Similar results were observed for complications, reoperations, and readmissions.

In conclusion, the described EGS-related outcomes worsen as time from admission to surgery increases, regardless of procedure risk. In fact, the most affected procedure by delaying the operation was appendectomy. Timely surgical intervention remains a cornerstone of high quality EGS care.

Poster #130

IMPACT OF INCREASED USE OF ENDOVASCULAR AND HYBRID TECHNIQUES FOR VASCULAR TRAUMA IN THE AAST PROOVIT REGISTRY

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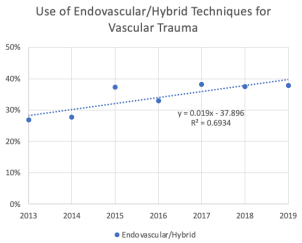
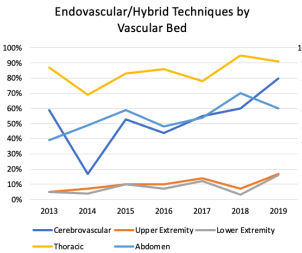
Background: Contemporary management of vascular trauma is undergoing a paradigm shift, and more surgeons are undergoing dual training in both trauma and vascular surgery in order to master both skill sets. However, there is a paucity of data on the utilization of endovascular/hybrid ("endo") techniques across all vascular beds.

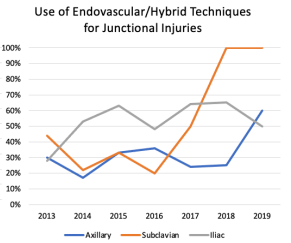
Methods: Patients in the AAST PROOVIT registry from 2013-2019 with repair of arterial injuries were queried. Injuries to radial, ulnar, and tibial arteries were excluded. The primary aim was to evaluate changes in the use of endo operative techniques over time as well as their use by body region (cerebrovascular, thoracic, abdominal, upper extremity, lower extremity). A subset analysis was performed to evaluate these trends specifically for "junctional" injuries (subclavian, axillary, iliac).

Results: 3372 patients (76% male) were enrolled in the registry. Overall treatment type was 42% nonoperative, 44% open, 14% endo. Excluding nonoperative; endo repair increased an average of 2% per year from 2013-2019 (Range: 17-35%, R^2 =.61). This increase for junctional injuries was 5% per year (Range: 33%-63%, R^2 =.89). Endo repairs were most common for thoracic, abdominal, and cerebrovascular injuries, and least likely in upper and lower extremity injuries. Injury severity score (ISS) was higher for endo repairs in every vascular bed except for lower extremity and mortality was lower in thoracic & abdominal. For junctional injuries ISS was 25 vs 21 (p=.003) and mortality was 19% vs 29% (p=.099) for endo vs open repairs.

Conclusion: Use of endovascular and hybrid techniques for management of vascular trauma continues to evolve and expand, especially for junctional injuries, resulting in lower mortality. These findings demonstrate the need for access to novel endovascular technology and hybrid operating rooms for the management of vascular trauma. Importantly, this trend implies the need for an evolution in training paradigms to provide these skills for trainees who plan to treat vascular trauma.







Poster #131

IS REBOA TRULY CONTRAINDICATED IN THE ELDERLY? AN ANALYSIS OF THE AAST AORTA REGISTRY

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Introduction: The indications for the use of resuscitative endovascular balloon occlusion of the aorta (REBOA) in trauma patients continue to evolve. While it has been suggested that the extremes of age may be a relative contraindication for its use, there is no clear evidence supporting this claim. We compared REBOA open AO via resuscitative thoracotomy (RT) in this population.

Methods: We conducted a retrospective cohort study using the AAST AORTA registry (11/2013-11/2020). We included all trauma patients older than 65 years who arrived in the emergency department with signs of life who subsequently required AO. The study groups were defined according to management strategy, either REBOA or RT. The primary outcome was in-hospital mortality. Secondary outcomes were HLOS, ICU LOS, major and minor complications, and need for delayed amputation. Logistic regression analysis was performed to compare outcomes between the groups.

Results: There were 87 elderly patients who underwent RT and 104 who underwent REBOA. The mean age was similar between the groups. (72±10.5 vs 73±12.1, p=0.451). RT patients were more likely to sustain penetrating trauma (19.5% vs 6.7%, p=0.025) and had higher ISS (29±26.0 vs 35±20.5, p=0.023). However, there were no significant differences in the incidence of severe trauma (ISS>15: 25.0% vs 20.5%, p=0.523) and hypotension on admission (90.0% vs 73.5%, p=0.473). REBOA patients were more likely to survive and proceed to hemorrhage control procedures (61.5% vs 32.2%, p<0.001) and had longer HLOS and ICU LOS. On regression analysis, there was no increased mortality among REBOA patients (OR 1.24, 95% CI 0.34-2.79). Similarly, there were no differences in major complications (OR 0.87, 95% CI 0.62-1.87) or delayed amputation (OR 0.86, 95% CI 0.34-1.17). REBOA patients were more likely to develop minor complications (OR 1.22, 95% CI 1.00-2.31).

Conclusion: REBOA in elderly patients was not associated with increased mortality or higher rate of major complications and these patients were more likely to survive to attempts at subsequent hemorrhage control procedures compared to RT with AO.

Poster #132

POPLITEAL ARTERY INJURY: IS ENDOVASCULAR MANAGEMENT MAKING A DIFFERENCE?

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Background: Popliteal artery injury (PAI) remains one of the most morbid peripheral vascular injuries with significant risk of limb loss. There is an increasing utilization of endovascular techniques for vascular trauma, but their role in PAI remains unknown. We compared outcomes for PAI managed with open or endovascular surgery using data from the National Trauma Databank (NTDB).

Methods: Trauma patients aged 16 years and older who experienced an isolated lower extremity injury were identified using ICD codes from the NTDB (2007–2017). Patients were included if they experienced a PAI and required surgical repair, classified as open repair, endovascular repair, or both. Trauma centers were categorized as Level I, Level II, or Level III. Survival analysis was performed to evaluate the association between repair type and amputation.

Results: We identified 6,058 patients for study. The majority of patients underwent open repair (91.9%), followed by both endovascular and open (4.2%), and endovascular repair (3.8%). The overall amputation rate was 15.1%. There was an increasing trend of endovascular repair over the study period (0.8% in 2007 to 5.3% in 2017, trend $p = 0.015$). Mean times to initial operation were 7.0 and 17.9 hours for open and endovascular repair respectively. After stratification by center, multivariable analysis revealed no difference in amputation risk by repair type.

Conclusion: Endovascular management of PAI increased, but required subsequent open repair in the majority of cases. Endovascular management also did not reduce the need for fasciotomy or amputation, calling into question both its appropriateness and effectiveness as a minimally invasive procedure for PAI. Open surgical repair appears to remain the preferred management option for PAI.

Poster #133

PREPERITONEAL PELVIC PACKING VERSUS ANGIOEMBOLIZATION FOR SEVERE PELVIC FRACTURES: A NATIONWIDE STUDY

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Introduction: Preperitoneal pelvic packing (PPP) and angioembolization (AE) are hemorrhage control procedures used for severe pelvic fractures. However, data comparing patient outcomes from such procedures is scarce.

Methods: This is a 3-year retrospective cohort study using the American College of Surgeons Trauma Quality Improvement Program database from January 2016 to December 2018. We included adult (≧16 years) trauma patients with severe pelvic fractures (AIS ≧3) who underwent PPP or AE within 4 h of hospital admission. In propensity score-matched (1:1) patients, in-hospital mortality rates were compared between PPP and AE groups using Kaplan–Meier analysis.

Results: Of a total of 1265 patients with severe pelvic fractures, 243 (19.2%) underwent PPP and 1022 (80.8%) underwent AE. Concomitant hemorrhage control laparotomy was performed in 81% and 27% of PPP and AE patients, respectively. In 394 propensity score-matched patients, a significant difference in the mortality rate between PPP and AE was not found (35.5 vs. 30.5%, $p = 0.335$).

Conclusion: While severe pelvic fractures were managed with PPP or AE with similar mortality rates, their indications appeared significantly different. Further prospective studies are warranted to determine indications for PPP and AE as hemorrhage control procedures for severe pelvic fractures.

Table. Characteristics, types of other procedures and outcomes of pelvic fracture patients between PPP and AE

	Before PSM			After PSM		
Variable	**PPP (n=243)**	**AE (n=1022)**	**P-value**	**PPP (n=197)**	**AE (n=197)**	**SMD**
Age, y	37 (25-53)	47 (31-62)	**<0.001**	37 (26-55)	37 (25-57)	6.4
Sex (Male), n %	171 (70)	750 (73)	0.337	136 (69)	139 (71)	3.3
sBP	106 (80-124)	106 (84-129)	0.327	108 (83-127)	109 (87-131)	6.7
HR	110 (85-132)	107 (86-129)	0.244	111 (85-132)	112 (92-131)	5.8
RR	20 (17-24)	20 (16-24)	0.245	20 (18-25)	22 (18-28)	9.9
GCS	14 (3-15)	14 (6-15)	0.083	14 (4-15)	14 (7-15)	0.9
ISS	34 (25-43)	34 (27-43)	0.126	34 (25-43)	34 (27-43)	5.6
Other procedures, n (%)						
None	29 (12)	645 (63)	**<0.001**	27 (14)	26 (13)	-1.5
Laparotomy	190 (81)	274 (27)	**<0.001**	157 (80)	159 (81)	2.6
Thoracotomy	10 (4.3)	21 (2.1)	0.061	9 (4.6)	8 (4.1)	-2.6
Extremity	5 (2.1)	52 (5.1)	0.055	4 (2.0)	4 (2.0)	0
Outcomes						**P-value**
Transfusion 24H (Unit)	11 (6-18)	7 (4-14)	**<0.001**	12 (6-19)	12 (7-25)	0.202
In-hospital mortality, n (%)	88 (36.2)	236 (23.1)	**<0.001**	70 (35.5)	60 (30.5)	0.335

Poster #134

THE AAST KIDNEY INJURY GRADE DOES NOT EQUALLY PREDICT INTERVENTIONS IN PENETRATING AND BLUNT TRAUMA

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Introduction: The American Association for the Surgery of Trauma (AAST) kidney injury grading scale has been validated to predict mortality, nephrectomy, renorrhaphy, and angioembolization. AAST kidney injury grade is the same regardless of mechanism of injury.

Methods: A 5-year retrospective review of all kidney injuries at an urban, level-one, trauma center was performed.

Results: 143 patients were included (36 blunt/64% penetrating). Nephrectomy was performed in zero blunt trauma victims. Angiography was used in 12% of blunt patients; 0%/9%/13%/9%/67% by AAST Grade I-V ($p=0.03$). Embolization was used in 0% of Grades I-III, 9% of Grade IV and 33% of Grade V ($p=0.05$). Cystoscopy and stenting were used in 27% of Grade IV injuries and 0% of other grades ($p=0.02$).

In penetrating trauma victims, nephrectomy was performed in 4% of AAST I-III injuries, 58% of grade IV injuries, and 86% of grade V injuries ($p<0.001$). Angiography was used in 9% of penetrating patients with a similar rate per AAST Grade I-V (NS). Embolization was used in 0% of Grade I-III, 6% of Grade IV, and 6.9% of Grade V injuries (NS). Cystoscopy (8%) and ureteral stenting (6%) were used similarly across all grades (NS). Distribution of procedures by AAST grade was dissimilar between penetrating and blunt trauma in nephrectomy ($p<0.001$), cystoscopy ($p=0.09$), and stenting ($p=0.07$).

Conclusion: In blunt trauma, increasing AAST grade is associated with angiography, embolization, cystoscopy, and stenting rates, but not nephrectomy. Renal salvage in more severe blunt trauma utilizes embolization (Grade IV/V) and ureteral stenting (Grade IV). In penetrating trauma, increasing AAST grade is associated with higher nephrectomy rates. Nonoperative methods of renal salvage in penetrating trauma appears similar, regardless of grade. On a AAST grade-by-grade basis, blunt and penetrating trauma patients are not treated similarly.

Poster #135

ARE TRAUMATIC ABDOMINAL WALL HERNIAS AN INDICATOR OF INJURY SEVERITY AND THE NEED FOR EMERGENT LAPAROTOMY

Olivia Jagiella-Lodise BS; Deepika Koganti MD; Krystal Archer-Arroyo MD; Stuart Hurst MD; Caroline Butler MD; Richie Sola MD; Keneeshia N. Williams MD; Kahdi Udobi MD; April A. Grant MD; Randi N. Smith MPH, MD; Jonathan Nguyen DO; Patricia Ayung-Chee MD; S. Rob Todd MD; Elizabeth R. Benjamin MD, PhD; Jason D. Sciarretta MD

Grady Memorial Hospital

Introduction: Traumatic abdominal wall hernias (TAWH) are relatively uncommon and non-operative management at initial presentation is reported as safe and practical. The sheering force that results in fascial disruption, however, could indicate an increased risk of visceral injury. The aim of our study was to evaluate whether the presence of a TAWH was associated with intra-abdominal injury requiring emergent laparotomy.

Methods: The trauma registry of a busy urban level I trauma center was queried (1/2012 - 12/2020) for adult patients with blunt thoracoabdominal trauma diagnosed with a TAWH. Demographics, mechanism of injury, ISS, BMI, length of stay, TAWH size, type of TAWH repair and outcomes were analyzed. Chi-Square, ANOVA single-factor, and two-tailed T-tests with descriptive statistics were performed; $P< 0.05$ was considered significant. Univariate analysis was used to compare outcomes in the groups.

Results: Overall, 38,749 trauma patients were admitted over the study period, of which 62 (0.16%) had a TAWH. Types of hernia included: lumbar (n=51, 82%) flank (n=9, 15%), and rectus (n=2, 3%). Patients were commonly male (n=37, 60%); the median age was 35 years (range 16–79 years) and an ISS of 20 (IQR 20). Motor vehicle collisions (MVC) were the most common (58%). Patients 'seat location at impact did not determine TAWH laterality (p=0.109). In general, BMI was associated with pelvic fractures (p=0.0241) and defect size (p=0.0314), with the larger defects observed in BMIs >30. Seatbelt sign (p=0.0455), defect size (p=0.0340), and ISS (p=0.000784) were indicative of an emergent laparotomy (40%). A minority of TAWHs (16%) were repaired at index operation, primary repair (8%), and mesh 18% (6 biologic vs. 5 synthetic). Failed expectant management occurred in 6 (10%) patients. Overall mortality was 5%, with no deaths related to the hernia whether operative or nonoperative.

Conclusion: TAWHs are associated with increased intra-abdominal injury requiring emergent laparotomy for other life-threatening injuries. Further investigation is needed to identify which seriously injured patients benefit from immediate or delayed repair of a TAWH.

Poster #136

EMERGENCY ANGIOGRAPHY AND SUBSEQUENT ACUTE KIDNEY INJURY IN SEVERELY INJURED TRAUMA PATIENTS

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Introduction: Angiography has been conducted as a hemostatic or diagnostic procedure for trauma patients for several decades, and indications for angiography after injury continue to expand. While several complications, such as tissue necrosis after embolization, have been reported, little is known regarding subsequent kidney injury due to contrast media. To elucidate whether emergency angiography would introduce kidney dysfunction in trauma victims, we compared the incidence of acute kidney injury (AKI) between patients who underwent emergency angiography and those who did not.

Methods: A retrospective cohort study was conducted using a nationwide trauma database (2004-2019), and adult trauma patients were included. The indication of emergency angiography was determined by both trauma surgeons and radiologists, and AKI was diagnosed by treating physicians based on a rise in serum creatinine and/or fall in urine output according to any published standard criteria. Incidence of AKI was compared between patients who underwent emergency angiography and those who did not. Propensity score matching was conducted to adjust baseline characteristics including age, comorbidities, mechanism of injury, vital signs on admission, Injury Severity Scale (ISS), degree of traumatic kidney injury, surgical procedures, and surgery on the kidney, such as nephrectomy and nephrorrhaphy.

Results: Among 230,776 patients eligible for the study, 14,180 underwent emergency angiography. The abdomen/pelvis was major site for angiography (10,624 [83.5%]) and embolization was performed in 5,541 (43.5%). Propensity score matching selected 12,724 pairs of severely injured patients (median age, 59; median ISS, 25). While the incidence of AKI was rare, it was higher among patients who underwent emergency angiography than in those who did not (140 [1.1%] vs. 67 [0.5%]; odds ratio = 2.10 [1.57–2.82]; $p < 0.01$). The association between emergency angiography and subsequent AKI was observed regardless of vasopressor usage or injury severity in subgroup analyses.

Conclusion: Emergency angiography in severely injured trauma patients is associated with increased incidence of AKI.

Poster #137

OBESITY AND ITS COMPLEX EFFECTS ON OUTCOMES AFTER PENETRATING ABDOMINAL TRAUMA

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Introduction: Studies have correlated obesity with increased morbidity and mortality after trauma. In penetrating trauma, some studies suggest obesity has a more negligible effect. We hypothesize resuscitation in obese patients is sometimes inadequate and may contribute to poor outcomes. We assessed differences in presentation, management and outcomes of penetrating trauma patients by BMI.

Methods: We evaluated adult penetrating abdominal trauma patients in the 2017 Trauma Quality Improvement Program (TQIP) database. Exclusion criteria were death within 1 hour of admission, missing data on BMI, or significant extra-abdominal injuries (Abbreviated Injury Score (AIS) ≥ 2 for any other body region). We categorized BMI per CDC guidelines. We defined hemodynamic instability as blood transfused within 4, or 24 hours or those with SBP < 90 on presentation.

Results: 4778 cases, with 61% of patients between age 21-40. 88% were male. Stratified by BMI, 1785 (37%) were normal-weight, 1531 (32%) were overweight, 787 (16%) were Obese class I, 339 (7%) were Obese class II, and 237 (5%) were Obese class III. No significant association between hypotension on presentation and BMI was found. No clear differences in the type of surgery for hemorrhage control were found between differing BMI groups. Hospital length of stay (LOS) ($p=0.0001$), ICU LOS ($p=0.0054$), and total time on ventilator ($p=0.0324$) all significantly increased as BMI increased. Disposition was associated with BMI ($p=0.0074$), with highest mortality rate for Obese class II (4.4%).

Conclusions: We found significantly worse outcomes in obese patients after penetrating abdominal injury. While baseline demographics and AIS were similar, obese patients had increased comorbidities which may have contributed to their poorer outcomes. Obese patients had increased hospital LOS, ICU LOS, ventilator days, and mortality. Inadequate resuscitation may contribute to this difference. Therefore, more granular studies may help determine optimal resuscitation strategy and delineate risk for obese penetrating abdominal trauma patients.

Poster #138

RENAL SALVAGE IS THE BEST OPTION FOR OPERATIVE MANAGEMENT OF LOW GRADE RENAL INJURIES

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Introduction: The majority of renal injuries are managed nonoperatively. When operative intervention is required, surgeons must choose between total nephrectomy (TN) or renal salvage (RS), understanding that leaving a patient with single kidney is associated with worse long-term outcomes. However, little is known about short-term outcomes between these two options. We hypothesized that RS is associated with worse short-term outcomes than TN.

Methods: We performed an analysis of the 2017-2018 National Trauma Data Bank using ICD-10 codes to identify patients who underwent TN or RS. The groups were propensity score matched for age, gender, mechanism, admission blood pressure, GCS, and ISS and further stratified by grade of injury, low (I-III) vs. high (IV-V). The primary outcome was mortality and secondary outcomes included hospital and ICU length of stay (LOS), ventilator days, acute kidney injury (AKI), inpatient dialysis, percutaneous drain placement, ureteral stent placement, delayed nephrectomy and total blood transfusions.

Results: After matching, we identified 344 patients with high-grade (IV-V) and 428 patients with low-grade (I-III) renal injuries who underwent surgical intervention. Outcomes of TN vs. RS are shown in the table. There was no difference in LOS and ventilator days between the two groups.

Conclusion: RS should be performed in patients with low grade injuries as it is associated with improved mortality and avoids long term morbidity associated with a single kidney. Caution should be used applying RS to high grade injuries, as there was a non-statistically significant two-fold increase in mortality.

	High Grade Injury			Low Grade Injury		
	TN (n=172)	RS (n=172)	p value	TN (n=214)	RS (n=214)	p value
Mortality	9 (5%)	17 (10%)	0.10	30 (14%)	14 (7%)	0.01
Acute Kidney Injury	13 (8%)	17 (10%)	0.44	26 (12%)	19 (9%)	0.27
Dialysis	4 (2%)	3 (2%)	0.99	9 (4%)	4 (2%)	0.16
Percutaneous Drain	12 (7%)	5 (3%)	0.08	19 (9%)	12 (6%)	0.19
Ureteral Stent	4 (2%)	15 (9%)	0.009	3 (1%)	14 (7%)	0.007
Delayed Nephrectomy	0 (0%)	9 (5%)	0.004	0 (0%)	7 (3%)	0.01
24 Hour Transfusion (mL)	594±1764	958±2908	0.23	623±1792	987±3441	0.25

Poster #139

RISK FACTORS FOR LEAK AFTER INTESTINAL RECONSTRUCTION IN DAMAGE CONTROL LAPAROTOMY

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Introduction: Intestinal injuries are frequent among patients treated with a damage control laparotomy (DCL). The incidence of intestinal reconstruction leak (IRL) and associated risk factors are not completely understood.
We studied the influence of the trauma severity, surgical technics and damage control strategies used for bowel repair as part of damage control on IRL.

Methods: Patients 15 years and older, with hollow viscus injuries who required a DCL and survived more than 48 hours, treated at our Level I Trauma Center between 2011 and 2019 were included. Associations were analyzed by multiple logistic regression (MLR).

Results: One hundred twenty-five patients were included; 113 (90.4%) of them were male. Median, interquartile range (IQR) age was of 29 (23-39) years. Trauma mechanism was penetrating in 114 subjects (91.2%). Small bowel injury was present in 90 cases (72.0%) and in colon 76 (60.8%). The Median (IQR) of NISS and ATI were 41 (29 - 50) and 28 (18- 39), respectively.
In the index surgery, the small bowel was managed with primary repair in 33 cases (37.5%), stoma construction in 1 (1.1%), and resection and discontinuity (R&DC) in 54 (61.4%). There were 28 cases (42.4%) of primary repair in colon, colostomy in 6 (9.1%), and R&DC in 32 (48.5%).
The ligated bowel was reconstructed by hand-sewn anastomosis in 33 cases (44%) and by stapled anastomosis in 42 (56%). Two models of MLR were analyzed

	OR	95% CI	p
Anatomic & physiologic model			
Combined colon & Small bowel	21.21	4.26 – 105.54	<0.001
Pancreatic injury	11.54	2.64 – 50.40	0.001
Cardiovascular SOFA on day 2	1.53	1.08 – 2.15	0.016
Surgical technique model			
Multiple ligation	6.14	1.33 – 28.32	0.02
Handcrafted vs commercial VAC	1.11	0.39 – 3.15	0.84
Sewn vs stapled anastomosis	2.28	0.98 – 5.33	0.06

Table. MLR models for risk of LIR in damage control laparotomy

The combination of colon and small bowel injury, a pancreatic injury and the persistence of cardiovascular dysfunction after 48 hours were associated with IRL. The MLR model which explored the technical aspects, identified multiple resections as a risk factor.

Conclusion: Independent risk factors for intestinal repair leak were a colon and small bowel combined injuries, associated pancreatic injury, and persistent cardiovascular dysfunction. The only technical aspect identified was the need for multiple resections of the intestine.

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In Memory

IN MEMORY

Donald P. Becker, MD
Los Angeles, CA
(1935-2020)
Member Since 1976

Jesse Meredith, MD
Winston-Salem, NC
(1923-2021)
Member Since 1968

Joseph Stothert, MD
Omaha, NE
(1938-2021)
Member Since 1986

Alan Robert Dimick, MD
Birmingham, AL
(1932-2021)
Member Since 1967

J. David Richardson, MD, FACS
Louisville, KY
(1979-2021)
Member Since 1967
Past President of AAST
(1999)

Donal P. Becker, M.D.

(1935-2020)

A native of Cleveland, Ohio, and a Phi Beta Kappa graduate of Williams College, Don received the MD degree from Case Western Reserve University in 1961. He was trained in neurological surgery at University Hospitals of Cleveland and joined the Western Reserve faculty following training.

In 1968, Don moved to UCLA as Assistant Professor and Chief of Neurosurgery at Harbor General Hospital, where he ran a busy clinical service and an active research program. HIs early work in hydrocephalus led to an interest in intracranial pressure dynamics and fundamental studies including use of intracranial pressure monitoring in patients with tumors, vascular disease, and trauma -- foundational work that remains the basis for current treatment.

In 1971, at the age of 36, Don accepted the Chair of Neurological Surgery at the Medical College of Virginia, Virginia Commonwealth University. In 1985, he returned to UCLA as Chief of Neurosurgery and introduced the concept of neurosurgical subspecialization, with recruitment of superior faculty and establishment of NIH supported programs in each of the major subspecialty areas. Don also served as Director of the UCLA Brain Tumor Program (1998 – 2005), and then as Senior Associate Dean until his retirement in 2008.

Among his leadership roles, Don was President of the Neurosurgical Society of America and a Director of the American Board of Neurological Surgery. Honors included the Fitts Award from the American Association for the Surgery of Trauma (1985), the Grass Prize and Medal from the Society of Neurological Surgeons (1986), the William Caveness Award from the National Head Injury Foundation (1988), the Distinguished Service Award from the National Neurotrauma Society (2003), Legend of the Los Angeles Biomedical Research Institute at Harbor-UCLA Medical Center (2007), and the Cloward Award from the Western Neurosurgical Society (2016).

Don was a model surgeon-scientist and educator, and the quality and success of his trainees are a substantial part of his legacy. To memorialize this legacy, the Donald P. Becker Endowed Chair was established at UCLA in 2019 by a group of those trainees along with his longtime colleagues and benefactors.

Don loved horses, skiing and golf. He was a member of multiple organizations where he was beloved, among them the Deep Run Hunt Club, the Rancheros Visitadores and the Charlie Russell Riders. His loss is deeply felt.

Alan Robert Dimick, M.D.

(1932-2021)

Throughout the years, many people have helped elevate the UAB Burn Unit, but none was more influential than Dr. Dimick, who practiced general surgery at what is now UAB Hospital from 1963 to 1999. He also served as director of the hospital's Emergency Department from 1963 to 1974, during which time he founded the UAB Burn Unit and served as its director until 1997.

Dr. Dimick's interest in burns was sparked when then Surgery Chair Champ Lyons, M.D., asked him to learn more about burn care, prompting Dr. Dimick to attend the National Burn Seminar in 1963. In 1967, he hosted the eighth National Burn Seminar in Birmingham, where the American Burn Association (ABA) was established. Today the ABA is the premier national organization dedicated to stimulating and supporting burn-related research, education, care, rehabilitation, and prevention.

In 1963, Dr. Lyons also challenged Dr. Dimick to combine the segregated black and white emergency rooms at University Hospital. As director of the hospital's Emergency Department during a time of racial turmoil in Birmingham, Dr. Dimick witnessed one of the darkest moments in American history: On Sept. 15, 1963, he pronounced the four little black girl's dead who were horrifically injured in the 16th Street Baptist Church bombing.

Since improved pre-hospital emergency care is critical for patients' survival and rehabilitation, Dr. Dimick became a passionate advocate for it, especially with regard to burn patients. In 1972, Dr. Dimick became medical director of a federal grant that provided funds for emergency medical training for 33 firefighters in the fire departments of Birmingham, Homewood, and Vestavia Hills. These 33 firefighters were the first paramedics in Alabama. Since then, the paramedic program has spread and now covers the state.

Subsequently, Dr. Dimick was the medical director of the paramedic training program at the UAB Regional Technical Institute from 1973 to 1985. His influence can still be felt in the Birmingham Emergency Medical Services community today.

Jess H. Meredith, M.D.

(1923-2021)

Jesse Meredith had a remarkable life. Born in the mountains of Fancy Gap Virginia, he grew up with an abiding love of the Appalachian Mountains and its people, and returned to be with family there whenever he could.

He served in World War II as a mechanic and glider trooper. When the war ended, he first pursued a career in engineering, and then medicine. He graduated from The Case Western School of Medicine, and went on to Bellevue Hospital in New York, before beginning his 41 years long career as a surgeon, teacher and mentor to several generations of surgeons at Wake Forest Baptist Hospital.

Dr. Meredith was known and respected for being a pioneer in medicine. Among many other accomplishments at Wake Forest, he developed and ran the first institutional department of biomedical engineering in the country, and organized the first EMT course in the state.

He was a clinical innovator for Wake Forest Baptist Medical Center. He designed and ran the first burn unit, started the transplant program and the bariatric surgery program. In 1965, he led the surgical team that was the first in the nation to successfully reattach a completely severed human hand. In 1967 he became a member of the North Carolina Board of Health, eventually becoming its chairman and serving in that capacity for thirty years. He retired in 1993, after a forty-one year career at Wake Forest Baptist.

Dr. Meredith received many awards, among them the Ron Levine Award for his service to health in North Carolina, and the North Carolina Award for Public Service, the highest award given by the state. In 2011 the American Medical Association presented him with its highest honor, The Distinguished Service Award.

He took great pride in his memberships in numerous professional organizations, including the American College of Surgeons, The Southern Surgical Association, The American Bariatric Association, The America Burn Association, and The American Society of Transplant Surgeons.

J. David Richardson

(1945-2021)

Dr. J David Richardson was a graduate of Morehead State University and then the University of Kentucky School of Medicine in Lexington, KY in 1970. He was recruited as an intern and resident to the Department of Surgery at the University of Kentucky and transferred to complete a general surgery residency and thoracic surgery residency at the University of Texas Health Science Center at San Antonio. His accomplishments included becoming one of the nation's few quadruple board-certified surgeons: in general surgery, thoracic, vascular, and surgical critical care. Dr. Richardson joined the University of Louisville Department of Surgery in 1976 as Assistant Professor, and by 1982 reached the rank of Professor. He served for many years as the Berel L. Abrams, MD Endowed Chair in Surgery, Chief of the Division of General Surgery, and Vice Chair of the Department of Surgery.

Dr. Richardson was a prolific scholar, publishing 375 articles, 58 book chapters, and 1 book.

A gifted and popular speaker, he delivered no less than 50 named lectureships and served as visiting professor at 98 additional institutions. He served on many editorial boards and was the long-time Editor-in-Chief of The American Surgeon.

Dr. Richardson was a leader in many surgical organizations. He served as President of the American Association for Surgery of Trauma, the Southern Surgical Association, the Western Surgical Association, and the Southeastern Surgical Congress. He was Treasurer of the Society for Surgery of the Alimentary Tract and the Society of University Surgeons. He served on the Residency Review Committee for Surgery and became Vice Chair. He was a long-time Director of the American Board of Surgery and became Chair of the ABS. He served in numerous capacities at the American College of Surgeons, eventually becoming Chair of the Board of Regents. In 2015, Dr. Richardson became the 96th President of the American College of Surgeons.

Dr. Richardson was also well known for his passion and success as a champion of thoroughbred racing, horse ownership and breeding throughout the horse racing world. He raised and sold over 1,000 horses that ultimately won races. Dr. Richardson served as Chairman of Thoroughbred Owners and Breeders of America and as chair of its American Graded Stakes Committee. He also served as a long-standing member of the Breeder' Cup and was a past Director on the Board.

Dr. Richardson is survived by his wife and three children as well as extended family and was predeceased by his first wife of many years. He touched the lives of not only his patients, but of his students, trainees, colleagues, and friends. He will be respectfully remembered as a dedicated and invaluable contributor to the Southern and will be missed dearly. We send our deepest condolences to Dr. Richardson's family, friends, and colleagues.

Joseph Stothert, M.D.

(1948-2021)

Dr. Joseph Stothert will be remembered as compassionate and committed to his family, excellent patient care, medical training and education, and service to the City of Omaha.

He was recruited to Omaha in 1993 to develop a hospital trauma system; the first of its kind. His expertise in trauma care built an enhanced model for the emergency medical response systems in place today.

Over the last 20 years, he served as the Medical Director for the Omaha Fire Department, Douglas County 911, Metro Community College and Eppley Airfield. He has also served as Director of Trauma for the State of Nebraska.

Dr. Stothert attended MacMurray College in Jacksonville, Illinois where he received a Bachelor of Science in Chemistry. He earned a medical degree at Saint Louis University and a doctorate in pulmonary physiology and biophysics at the University of Washington in Seattle. Dr. Stothert practiced at Saint Louis University Hospital, UTMB in Galveston, Texas, Creighton University and the University of Nebraska Medical Center. He specialized in trauma surgery and critical care.

Dr. Stothert is survived by his wife, Omaha Mayor Jean Stothert; children, Dr. Andrew Stothert (Alana) and Elizabeth Leddy (Tom); and four grandchildren.

81st ANNUAL MEETING
of
AAST & Clinical Congress
of Acute Care Surgery

SAVE THE DATE

September 21 - 24

2022

CHICAGO

80th Annual Meeting of AAST and Clinical Congress of Acute Care Surgery
Atlanta, GA · September 29-October 2, 2021

TUE. 9/28/2021	FUNCTION	ROOM
12:00 PM – 7:00 PM	Registration	Lobby Level
1:00 PM – 5:00 PM	Pre-sessions: Sponsored by the Associate Membership Council	Room 301
1:00 PM – 5:00 PM	Pre-sessions: Sponsored by the Education Committee	Room 307
1:00 PM – 5:00 PM	Pre-sessions: Sponsored by the Education, Critical Care, Geriatric Committees	Room 308
5:00 PM – 6:00 PM	Pre-session Reception	Room 212
WED. 9/29/2021	**FUNCTION**	**ROOM**
6:30 AM – 5:15 PM	Registration	Lobby Level
6:30 AM – 7:30 AM	Resident/Student/In-Training Fellow Breakfast	Room 303
6:30 AM – 7:45 AM	Committee Meetings Session I	Rooms 215-221
7:30 AM – 8:30 AM	Breakfast	Grand Ballroom
8:00 AM – 8:20 AM	Welcome	Salon
8:20 AM – 11:00 AM	Session I: Plenary Papers 1-8	Salon
11:25 AM – 12:25 PM	Session II: Presidential Address: David Spain, M.D.	Salon
12:25 AM – 1:40 PM	Lunch Sessions	Rooms 301-305
1:40 PM – 5:20 PM	Session IIIA: Papers 9-19	Salon East
1:40 PM – 5:20 PM	Session IIIB: Papers 20-30	Salon West
5:30 PM – 6:00 PM	Session IV: Master Surgeon Lecture: Grace Rozycki, M.D., M.B.A.	Salon East
6:00 PM – 7:00 PM	Welcome Reception	Grand Ballroom
THURS. 9/30/2021	**FUNCTION**	**ROOM**
6:15 AM – 7:15 AM	Committee Meetings Session II	Rooms 215-219
7:00 AM – 3:00 PM	Registration	Lobby Level
7:00 AM – 8:00 AM	Breakfast in Exhibit Hall	Grand Ballroom
7:30 AM – 8:30 AM	Session VI: Papers 31-33	Salon
8:30 AM – 9:00 AM	Session VII: Master Surgeon Lecture: L.D. Britt, M.D., M.P.H.	Salon
9:00 AM – 9:30 AM	Session VIII: Scholarship Presentations	Salon
9:30 AM – 10:50 AM	Session IX: Paper 34-37	Salon
11:10 AM – 12:10 PM	Session X: Fitts Lecture: Tribute to J. David Richardson, M.D.	Salon
12:10 PM – 1:10 PM	Session XI: Poster Session	Rooms 208-214
1:10 PM – 2:25 PM	Lunch Sessions II	Rooms 301-303
2:30 PM – 6:00 PM	Add-on Sessions	Room 308 & Salon
Fri. 10/1/2021	**FUNCTION**	**ROOM**
6:15 AM –7:15 AM	Committee Meetings Session III	Room 215-220
7:00 AM – 3:00 PM	Registration	Lobby Level
7:00 AM – 8:00 AM	Breakfast in the Exhibit Hall	Grand Ballroom
7:30 AM – 10:10 AM	Session XII: Papers 38-45	Salon
10:30 AM – 11:45 AM	Session XIII: Panel: Experts on the Hot Seat	Salon
11:45 AM – 1:00 PM	Lunch Sessions III	Rooms 301-305
11:45 AM – 1:00 PM	Lunch with Exhibitors	Grand Ballroom
1:00 PM – 4:40 PM	Session XIVA: Papers 46-56	Salon East
1:00 PM – 4:40 PM	Session XIVB: Papers 57-67	Salon West
4:45 PM – 6:15 PM	AAST Business Meeting	Salon
7:00 PM – 7:30 PM	Pre-Banquet Reception	Grand Ballroom
7:30 PM – 11:00 PM	AAST Banquet	Grand Ballroom
Saturday 10/2/2021	**FUNCTION**	**ROOM**
7:00 AM – 8:00 AM	New Member Breakfast	Room 303
7:30 AM – 8:30 AM	Breakfast	Grand Ballroom
8:00 AM – 9:18 AM	Session XV: Quickshot Session 1-13	Salon
9:40 AM – 10:58 AM	Session XVI: Quickshot Session 14-26	Salon

SPEAKER READY ROOM: Room 206/207

Tuesday, September 28, 2021	9:00 AM – 7:00 PM	Friday, October 1, 2021	6:00 AM – 6:30 PM
Wednesday, September 29, 2021	6:00 AM – 6:00 PM	Saturday, October 2, 2021	7:00 AM – 11:00 AM
Thursday, September 30, 2021	6:00 AM – 6:00 PM		