



CHICAGO

81ST

ANNUAL MEETING

OF THE AMERICAN ASSOCIATION FOR THE SURGERY OF TRAUMA
& CLINICAL CONGRESS OF ACUTE CARE SURGERY

SEPTEMBER 21-24
2022



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, 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 2,011 members from 30 countries.

ACCREDITATION OVERVIEW
81st Meeting of AAST & Clinical Congress of Acute Care Surgery
September 21-24, 2022
Chicago, IL

Target Audience

This surgical trauma-focused meeting is designed for physicians, residents, students, in-training fellows, and trauma nurses.

Learning Objectives

At the completion of this activity, participants should be able to:

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

Activity Goal

This activity is designed to address the following core and team competencies:

Medical Knowledge, Practice-based Learning, Interprofessional Communication, Professionalism, Employ Evidence-based practice, Roles & Responsibilities, and Provide Patient-centered Care.

Non-Endorsement

The accredited provider verifies that sound education principles have been demonstrated in the development of this educational offering as evidenced by the review of its objectives, teaching plan, faculty, and activity evaluation process. The accredited provider does not endorse or support the actual opinions or material content as presented by the speaker(s) and/or sponsoring organization.

Disclosures

The accredited provider adheres to accreditation requirements regarding industry support of continuing medical education. Disclosure of the planning committee and faculty's commercial relationships will be made known at the activity. Speakers are required to openly disclose any limitations of data and/or any discussion of any off-label, experimental, or investigational uses of drugs or devices in their presentations. - *All employees in control of content have no relevant financial relationships to disclose.*

All relevant financial relationships have been mitigated.

Relevant Financial Relationships

First	Last	Commercial Interest	Role
Kimberly	A. Davis	N/A	
Elissa	Abou	N/A	

Michel	Aboutanos	Department of Criminal Justice System (Consultant/Advisory Board, Technical Assistant Center grant supported by Award No.20-A4739VP18 awarded by the Department of Criminal Justice Services' Victim Services Grant Program, Department of Justice to VHHA Foundation)	Consultant/Advisory Board
Charles	Adams	N/A	
Sasha	Adams	N/A	
Morgan	Adkins	N/A	
John	Agapian	N/A	
Suresh	Agarwal	N/A	
Rida	Ahmad	N/A	
Hasan	Alam	N/A	
Weidun	Alan Guo	N/A	
Roxie	Albrecht	N/A	
Kaitlin	Alexander	N/A	
Tanya	Anand	N/A	
Iver	Andersgaski	N/A	
Devashish	Anjaria	N/A	
Makoto	Aoki	N/A	
Rachel	Appelbaum	N/A	
Dias	Argandykov	N/A	
Dennis	Ashley	N/A	
Michael	Avery	N/A	
Avanti	Badrinathan	Ohio EMS Board (Placeholder 1) (Research Grant includes principal investigator, collaborator or consultant and pending grants as well as grants already received)	Board member, PI, consultant
Emily	Baird	N/A	

Brittany	Bankhead	N/A	
James	Bardes	N/A	
James	Barrett	N/A	
Gary	Bass	N/A	
Devi	Bavishi	N/A	
Marissa	Beiling	N/A	
Michael	Ben Gent	N/A	
Jamie	Benson	N/A	
Andrew	Bernard	N/A	
Cherisse	Berry	N/A	
Stephanie	Berry	N/A	
Sai Krishna	Bhogadi	N/A	
Walter	Biffl	N/A	
Susan	Biffl	N/A	
David	Blake	N/A	
John	Bliton	N/A	
Mary	Bokenkamp	N/A	
Tasce	Bongiovanni	N/A	
Stephanie	Bonne	N/A	
Taylor	Bostonian	N/A	
James	Bradford	NA	
Tejal	Brahmbhatt	Medtronic Surgical Robotics - Consultant Honoraria; Phillips Ultrasound - Consultant Honoraria	Consultant
Scott	Brakenridge	N/A	
Karen	Brasel	N/A	
Erika	Brigmon	N/A	
William	Brigode	N/A	
Mark	Broadwin	N/A	
Karim	Brohi	N/A	
Jacob	Broome	N/A	
Carlos	Brown	N/A	
Jeffrey	Brown	N/A	
Brandon	Bruns	N/A	
Nikolay	Bugaev	N/A	
Eileen	Bulger	N/A	
Miriam	Bullard	N/A	
Clay	Burlew	N/A	
Sigrid	Burruss	N/A	
Jason	Butler	N/A	
Charles	Butts	N/A	
James	Byrne	N/A	
Isabella	Caicedo	N/A	
Rachael	Callcut	N/A	

Jeremy	Cannon	N/A	
Benedict	Capacio	N/A	
Samuel	Carmichael	N/A	
Michael	Carver	N/A	
Thomas	Carver	N/A	
Manuel	Castillo-Angeles	N/A	
Allyson	Chapman	N/A	
Brian	Chen	N/A	
Chih Ying	Chien	N/A	
William	Chiu	N/A	
Nam Yong	Cho	N/A	
Lisa	Choe	N/A	
Jeff	Choi	N/A	
Angelo	Ciaraglia	N/A	
Isabel	Clark	N/A	
Thomas	Clements	N/A	
Mitchell	Cohen	N/A	
Raul	Coimbra	N/A	
Jamie	Coleman	N/A	
Julia	Coleman	N/A	
Mackenzie	Cook	N/A	
Todd	Costantini	N/A	
Bryan	Cotton	N/A	
Roald	Credo	N/A	
Michael	Cripps	N/A	
Michael	Dalton	N/A	
Benjamin	Davis	N/A	
Constanza Inez	de Dios	N/A	
Stephanie	De Mel	N/A	
Margot	DeBot	N/A	
Andrew-Paul	Deeb	N/A	
Marc	deMoya	N/A	
Bradley	Dennis	N/A	
Terri	deRoon-Cassini	N/A	
Jose	Diaz	Springer, Inc. Publications - Honorarium - Editor in chief	Editor in Chief
Rochelle	Dicker	N/A	
Lawrence	Diebel	N/A	
Jody	DiGiacomo	N/A	
Joshua	Dilday	N/A	
Michael	Ditillo	N/A	
Megan	Donnelly	N/A	
Juan	Duchesne	N/A	

Ryan	Dumas	N/A	
Thomas	Duncan	N/A	
Lauren	Dwyer	N/A	
Angela	Earley	N/A	
Shayan	Ebrahimian	N/A	
Mary	Edwards	N/A	
Jessica	Efird	N/A	
Tanya	Egodage	N/A	
A. Peter	Ekeh	N/A	
Adel	Elkbuli	N/A	
Khaled	El-Qawaqzeh	N/A	
Joel	Elterman	N/A	
Natalie	Escobar	N/A	
Rachael	Essig	N/A	
Jordan	Estroff	N/A	
Haley	Etskovitz	N/A	
Susan	Evans	N/A	
Charity	Evans	N/A	
Samir	Fakhry	N/A	
Paula	Ferrada	N/A	
Dina	Filiberto	N/A	
Joseph	Forrester	N/A	
Maximillian	Forssten	N/A	
Shannon Marie	Foster	N/A	
Adam	Fox	N/A	
Christine	Gaarder	N/A	
Brennan	Gagen	N/A	
Barbara	Gaines	N/A	
Joseph	Galante	N/A	
Kevin	Galicia	N/A	
Aravindh	Ganapathy	N/A	
Nilda	Garcia	N/A	
Ravi	Garg	N/A	
Tabitha	Garwe	N/A	
Justin	Gerard	N/A	
Laura	Godat	N/A	
Sabrina	Goddard	N/A	
Amy	Goldberg	N/A	
Michael	Goodman	N/A	
Amy	Gore	N/A	
Julie	Goswami	N/A	
Nicole	Goulet	N/A	
Stephanie	Gray	N/A	
Jordan	Greer	N/A	
Areg	Grigorian	N/A	

		Surgical Infection Society (Placeholder 1) (Research Grant includes principal investigator, collaborator or consultant and pending grants as well as grants already received)	PI, consultant
Christopher	Guidry		
Sundeep	Guliani	N/A	
Oliver	Gunter	N/A	
Rajan	Gupta	N/A	
Jennifer	Gurney	N/A	
Sara	Hajizadeh Barfjani	N/A	
Erin	Hall	N/A	
Kevin	Harrell	N/A	
Jennifer	Hartwell	N/A	
Danielle	Hashmi	N/A	
Melissa	Hausburg	N/A	
Elliott	Haut	N/A	
Mark	Hemmila	N/A	
Sharon	Henry	N/A	
Juan	Herrera-Escobar	N/A	
Amy	Hildreth	N/A	
Amber	Himmler	N/A	
Vanessa	Ho	N/A	
Jessica	Hoffen	N/A	
Daniel	Holena	N/A	
Chantal	Holy	N/A	
Mark	Hoofnagle	N/A	
Morgan	Hopp	N/A	
Melissa	Hornor	N/A	
Hamidreza	Hosseinpour	N/A	
Jason	Hutzler	N/A	
Stephanie	Iantorno	N/A	
Romeo	Ignacio	N/A	
Angela	Ingraham	N/A	
Stephanie	Jarvis	N/A	
Winston	Jiang	N/A	
Laura	Johnson	N/A	
Emma	Jones	N/A	
Kathie-Ann	Joseph	N/A	
Bellal	Joseph	N/A	

D'Andrea	Joseph	N/A	Researcher
Haytham	Kaafarani	Several research grants, including one from CRICO; Royalties from UpToDate	
Lillian	Kao	N/A	
Lewis	Kaplan	N/A	
Morihiro	Katsura	N/A	
Elinore	Kaufman	N/A	
Krista	Kaups	N/A	
Vincent	Kaykaty	N/A	
Jane	Keating	N/A	
Lauren	Kelly	N/A	
Julia	Kelm	N/A	
Natasha	Keric	N/A	
Tareq	Kheirbek	N/A	
Dennis	Kim	N/A	
Mehreen	Kisat	N/A	
Sami	Kishawi	N/A	
James	Klugh	N/A	
Lisa	Knowlton	N/A	
Lisa	Kodadek	N/A	
Mitsuaki	Kojima	N/A	
Lucy	Kornblith	N/A	
Rosemary	Kozar	N/A	
Shreyus	Kulkarni	N/A	
Anastasia	Kunac	N/A	
Souma	Kundu	N/A	
Stanley	Kurek	N/A	
Hayato	Kurihara	N/A	
Matthew	Kutcher	N/A	
Amy	Kwok	N/A	
Lacey	LaGrone	N/A	
Danny	Lammers	N/A	
Sara	Larson	N/A	
Janet	Lee	N/A	
Christine	Leeper	N/A	
Benjamin	Lehrman	N/A	
Stefan	Leichtle	N/A	
Erica	Lester	N/A	
Eric	Ley	N/A	
Kaiwei	Li	N/A	
Amy	Liepert	N/A	
Mark	Lieser	N/A	
Anthony	Lim	N/A	

David	Livingston	N/A	
Sarah	Lombardo	N/A	
Andrew	Loudon	N/A	
Rafael	Lozano	N/A	
Leah	Lucero	N/A	
Stephanie	Lueckel	N/A	
Derek	Lumbard	N/A	
Ellen	MacKenzie	N/A	
Ajai	Malhotra	N/A	
Meghan	Mali	N/A	
Yesha	Maniar	N/A	
Daniel	Margulies	N/A	
Lisa	Marie Knowlton	N/A	
Derek	Marlor	N/A	
Alexander	Marrotte	N/A	
William	Marshall	N/A	
R. Shayn	Martin	N/A	
Matthew	Martin	N/A	
Smita	Mascharak	N/A	
Kazuhide	Matsushima	N/A	
Adrian	Maung	N/A	
Todd	Maxson	N/A	
Robert	Maxwell	N/A	
Addison	May	N/A	
Marta	McCrum	N/A	
Susan	McLean	N/A	
Anna	Meader	N/A	
Ashley	Meagher	N/A	
Jonathan	Meizoso	N/A	
Courtney	Meyer	N/A	
Christopher	Michetti	N/A	
Richard	Miller	N/A	
Sean	Montgomery	N/A	
Sarah	Moore	N/A	
Katrina	Morgan	N/A	
Koji	Morishita	N/A	
Anne	Mosenthal	Springer Nature - honorarium - for role as Editor in Chief, Current Trauma Reports	Editor in Chief
Zongyang	Mou	N/A	
Krislynn	Mueck	N/A	
Kaushik	Mukherjee	N/A	
Cynthia	Muller	N/A	
Jennifer	Munley	N/A	

John	Murfee	N/A	
Quintin	Myers	N/A	
Nicholas	Namias	N/A	
Michael	Nance	N/A	
Avery	Nathens	N/A	
Matthew	Neal	N/A	
Peter	Nguyen	N/A	
Raminder	Nirula	N/A	
Madhuri	Nishtala	N/A	
Sean	Nix	N/A	
Soroosh	Noorbakhsh	N/A	
Kristen	Nordham	N/A	
Mina	Nordness	N/A	
David	Notrica	Atricure (consultant); KLS (consultant)	Consultant, consultant
Kathleen	O'Connell	NA	
Caroline	Park	NA	
Nancy	Parks	NA	
Neil	Parry	NA	
Mayur	Patel	NA	
Purvi	Patel	NA	
Abhijit	Pathak	NA	
Jasmeet	Paul	NA	
Courtney	Pokrzywa	NA	
Travis	Polk	NA	
Michelle	Price	NA	
Timothy	Pritts	NA	
Thaddeus	Puzio	NA	
Seth	Quinn	NA	
Amanda	Radisic	NA	
Walter	Ramsey	NA	
Joseph	Rappold	NA	
Natalie	Reed	NA	
Caroline	Reinke	NA	
Daniel	Ricaurte	NA	
Bryce	Robinson	NA	
Anamaria	Robles	NA	
Edgar	Rodas	NA	
Rachel	Rodriquez	NA	
Selwyn	Rogers	NA	
Anne-Sophie	Romijn	NA	
Samuel	Ross	NA	
Andrea	Rossetto	NA	
Simin	Roward	NA	
Susan	Rowell	NA	
Ashly	Ruf	NA	

Jack	Ruske	NA	
Joseph	Sakran	NA	
Ali	Salim	NA	
Kristin	Salottolo	NA	
Babak	Sarani	NA	
Stephanie	Savage	NA	
Jaswin	Sawhney	NA	
Terry	Schaid	NA	
Morgan	Schellenberg	NA	
Martin	Schreiber	NA	
Mary	Schroeder	NA	
Libby	Schroeder	NA	
Kevin	Schuster	NA	
Mark	Seamon	NA	
Satomi	Senoo	NA	
Anupamaa	Seshadri	NA	
Charles	Shahan	NA	
Matthew	Shawlin	NA	
Meilynn	Shi	NA	
Adam	Shiroff	NA	
Jeffrey	Shupp	NA	
Casey	Silver	NA	
Alex	Simmonds	NA	
Jon	Simmons	NA	
John	Simpson	NA	
Rebecca	Simpson	NA	
Carrie	Sims	NA	
Alison	Smith	NA	
Jason	Smith	NA	
Randi	Smith	NA	
Alison	Smith	NA	
Amir	Sohail	NA	
Audrey	Spencer	NA	
Jason	Sperry	NA	
Shruthi	Srinivas	NA	
Amudan	Srinivasan	NA	
Nicole	Stassen	NA	
Kristan	Staudenmayer	NA	
Deborah	Stein	NA	
Krista	Stephenson	NA	
Ronald	Stewart	NA	
Anne	Stey	NA	
Melvin	Stone	NA	
Rebecca	Stoner	NA	
Jill	Streams	NA	
Bethany	Strong	NA	

Joshua	Sznol	NA	
Masami	Tabata-Kelly	NA	
Matthew	Tadlock	NA	
Sharven	Taghavi	NA	
Leah	Tatebe	NA	
Nicholas	Taylor	NA	
Tarendeep	Thind	NA	
Arielle	Thomas	NA	
Jonathan	Thomas	NA	
Jonathan	Tilsed	NA	
Chandler	Tinsman	NA	
Samuel	Tisherman	NA	
Brett	Tracy	NA	
Zachary	Tran	NA	
Rebecca	Treffalls	NA	
Jeffrey	Upperman	NA	
David	V. Feliciano	NA	
Catherine	Valopulos	NA	
Mujan	Varasteh Kia	DOD/Army Medical Research Acquisition Activity (Research Grant includes principal investigator, collaborator or consultant and pending grants as well as grants already received)	PI, consultant
Michael	Vella	N/A	
Dillon	Wade	N/A	
Rachel	Warner	N/A	
Jessica	Weaver	N/A	
Emily	Weinstein	N/A	
Brian	Williams	N/A	
Jason	Williams	N/A	
Jeroson	Williams	N/A	
Alison	Wilson	N/A	
Robert	Winfield	N/A	
Nolan	Winicki	N/A	
Jared	Wohlgemut	N/A	
Robin	Wright	N/A	
Salina	Wydo	N/A	
Michael	Yaffe	N/A	
Keishi	Yamaguchi	N/A	
Gabrielle	Yee	N/A	

Jay	Yelon	N/A	
Tanya	Zakrison	N/A	
Bardiya	Zangbar	N/A	
Ben	Zarzaur	N/A	
James	Zebley	N/A	
Cheryl	Zogg	N/A	
David	Zonies	N/A	



Accreditation

JOINTLY ACCREDITED PROVIDER
ACCREDITATION COUNCIL FOR CONTINUING MEDICAL EDUCATION

In support of improving patient care, this activity has been planned and implemented by Cine-Med and the American Association for the Surgery of Trauma. Cine-Med is jointly accredited by the Accreditation Council for Continuing Medical Education (ACCME), the Accreditation Council for Pharmacy Education (ACPE), and the American Nurses Credentialing Center (ANCC), to provide continuing education for the healthcare team.

Physicians

Cine-Med designates this live activity for a maximum of 46.25 *AMA PRA Category 1 Credit(s)*[™]. Physicians should claim only the credit commensurate with the extent of their participation in the activity.

Other Healthcare Professionals

All other healthcare professionals will receive a Certificate of Participation. For information on the applicability and acceptance of Certificates of Participation for activities designated for *AMA PRA Category 1 Credits*[™], consult your professional licensing board.

Certificates: To claim your CME credits, complete the online Credit and Evaluation form using the link on the AAST website. You will receive an email that states how to claim CME.

This is a one-time credit submission. Credits should be tracked at the completion of the meeting. Participants will be able to download or print a certificate once the form has been submitted.

AAST Schedule



81ST ANNUAL MEETING OF THE AMERICAN ASSOCIATION FOR THE SURGERY OF TRAUMA AND CLINICAL CONGRESS OF ACUTE CARE SURGERY

GENERAL SCIENTIFIC PROGRAM SCHEDULE

September 19 – September 24, 2022 • Chicago, IL

MONDAY, SEPTEMBER 19, 2022

7:30 AM - 4:00 PM Emergency Surgery Course (additional fee)

TUESDAY, SEPTEMBER 20, 2022

7:30 AM - 4:00 PM Emergency Surgery Course (additional fee)

7:30 AM - 4:30 PM AAST Board of Managers Meeting
Room Location: Michigan 1

1:00 PM - 5:00 PM **Pre-sessions**
*Building Diverse Mentoring Networks:
Peer mentoring for career advancement and promotion
Room Location: Grand Hall GH*

*Hot Topics, Case Challenges, and Current Literature in Trauma and Emergency General
Surgery: The AAST 2022 Continuous Certification Course
Room Location: Grand Hall I*

5:00 PM - 6:00 PM **Pre-session Reception**
Room Location: Randolph Pre-Function Space

12:00 PM - 7:00 PM **Registration**
Room Location: Grand Registration Desk

WEDNESDAY, SEPTEMBER 21, 2022

6:30 AM - 7:30 AM Resident/Student/In-Training Fellow Breakfast
Presenter: Eileen Bulger, MD
*(Pre-Registration Required)
Room Location: Great Hall MN*

6:30 AM - 5:15 PM **Registration**
Room Location: Grand Registration Desk

6:30 AM - 7:45 AM **Committee Meetings I**
*ACS Program Directors
Room Location: Randolph 2*

Communications Committee
Room Location: Randolph 1A

Education Committee
Room Location: Randolph 3

Pediatric Committee
Room Location: Michigan 2

Prevention Committee,
Room Location: Michigan 3

HealthCare Economics Committee
Room Location: Michigan 1 AB

Research and Education Fund
Room Location: Michigan 1C

7:30 AM - 8:30 AM

Breakfast
Room Location: Grand Ballroom Foyer

8:00 AM - 8:30 AM

Welcome
Room Location: Grand Ballroom

8:30 AM - 11:10 AM

Session I: Plenary Papers 1-8

Moderator: David Livingston, MD **Recorder:** Karen Brasel, MD, MPH
Room Location: Grand Ballroom

Paper 1

PROSPECTIVE VALIDATION AND APPLICATION OF THE TRAUMA SPECIFIC FRAILTY INDEX: RESULTS OF AN AAST MULTI-INSTITUTIONAL OBSERVATIONAL TRIAL
Presenter: Bellal Joseph, MD Discussant: Richard Miller, MD

8:30AM - 8:50 AM

Paper 2

NOT SO FAST WITH ABC FOR NONCOMPRESSIBLE TORSO HEMORRHAGE: AN AD-HOC REVIEW OF AAST MIT
Presenter: Juan Duchesne, MD Discussant: Ryan Dumas, MD

8:50 AM - 9:10 AM

Paper 3

WHEN IS ENOUGH ENOUGH? ODDS OF SURVIVAL BY UNIT TRANSFUSED
Presenter: Andrew Loudon, MD Discussant: Michael Goodman, MD

9:10 AM - 9:30 AM

Paper 4

INTO THE FUTURE: PRECISION AUTOMATED CRITICAL CARE MANAGEMENT (PACC-MAN) FOR CLOSED-LOOP CRITICAL CARE
Presenter: Aravindh Ganapathy, MD Discussant: Michael Vella, MD

9:30 AM - 9:50 AM

Paper 5

ESTRADIOL PROVOKES HYPERCOAGULABILITY AND AFFECTS FIBRIN BIOLOGY: A MECHANISTIC EXPLORATION OF SEX DIMORPHISMS IN COAGULATION
Presenter: Julia Coleman, MD, MPH Discussant: Matthew Kutcher, MD, MS

9:50 AM - 10:10 AM

Paper 6

TRENDS IN TRAUMA CARE ACCESS AND SOCIO-DEMOGRAPHIC PREDICTORS OF INJURY MORTALITY IN THE UNITED STATES, 2005 - 2020
Presenter: Jamie Benson, BA, AEMT Discussant: Stefan Leichtle, MD, MBA

10:10 AM - 10:30 AM

Paper 7

TACKLING THE BEDSIDE ARTIFICIAL INTELLIGENCE BARRIER: NATURAL LANGUAGE PROCESSING TO EXTRACT INJURY ICD10 DIAGNOSIS CODES REAL-TIME FROM ELECTRONIC MEDICAL RECORDS
Presenter: Jeff Choi, MD, MSc Discussant: Rachael Callcut, MD

10:30 AM - 10:50 AM

Paper 8

EARLY PNEUMONIA DIAGNOSIS DECREASES VENTILATOR-ASSOCIATED

10:50 AM - 11:10 AM

PNEUMONIA RATES IN TRAUMA POPULATION

Presenter: Robert Maxwell, MD

Discussant: Samuel Carmichael, MD

10:45 AM - 8:00 PM

Exhibit Hours

Room Location: Riverside East

10:45 AM - 7:30 PM

Donor Lounge

Room Location: Riverside East

11:10 AM - 11:35 AM

Break in Exhibit Hall

Room Location: Riverside East

11:35 AM - 12:35 PM

Session II: Presidential Address, "Survivorship"

Presenter: David Livingston, MD

Room Location: Grand Ballroom

12:35 PM - 1:50 PM

Lunch Sessions

Practicing Outside the Box: How to Develop a Multidisciplinary Approach for the Care of Geriatric Surgical Patients

Room Location: Grand Hall I

To Leave or Not to Leave: Navigating the Needs, Rules and Risks of Personal, Paternity, Maternity, and Family Leave

Room Location: Grand Hall L

Galvanizing the International Trauma Community During Times of Conflict

Room Location: Grand Hall MN

The Journal of Trauma and Acute Care Surgery: Tips and Tricks for Authors & Reviewers

Room Location: Grand Hall GH

1:15 PM - 1:45 PM

Break in Exhibit Hall

Room Location: Riverside East

1:50 PM - 5:30 PM

Session IIIA: Papers 9-19

Moderator Roxie Albrecht, MD; Recorder: Ajai Malhotra, MD

Room Location: GR BR A-DNorth

Paper 9

1:50 PM - 2:10 PM

EXTERNAL VALIDATION OF CRASH PROGNOSTIC MODEL IN AN URBAN TERTIARY CARE PUBLIC HOSPITAL

Presenter: Devi Bavishi, MD

Discussant: Joseph Forrester, MD

Paper 10

2:10 PM - 2:30 PM

ASSESSING TRAUMA READINESS COSTS IN LEVEL III AND LEVEL IV TRAUMA CENTERS

Presenter: Dennis Ashley, MD

Discussant: R. Shayn Martin, MD, MBA

Paper 11

2:30 PM - 2:50 PM

ROUTINE POST-OPERATIVE LABS AND HEALTHCARE SYSTEM BURDEN IN ACUTE APPENDICITIS

Presenter: Joshua Sznol, MD

Discussant: Angela Ingraham, MD

Paper 12

2:50 PM - 3:10 PM

RACIAL AND ETHNIC DISPARITIES IN INTERHOSPITAL TRANSFER FOR COMPLEX EMERGENCY GENERAL SURGERY

Presenter: Stephanie Iantorno, MD

Discussant: Adel Elkbuli, MD, MPH, MBA

Paper 13

3:10 PM - 3:30 PM

THE DICHOTOMY OF DEFINING VALUE IN HEALTHCARE: COST ELIMINATION OF A MULTIPROFESSIONAL (MPATH) TEAM LED TO INCREASED LOS

Presenter: Michael Avery, MD

Discussant: Weidun Alan Guo, MD, PhD

Paper 14

3:30 PM - 3:50 PM

EVALUATION OF AN EVIDENCE-BASED, COMPREHENSIVE CLINICAL DECISION SUPPORT SYSTEM IMPLEMENTED AT 9 U.S. TRAUMA CENTERS FOR PATIENTS

WITH TRAUMATIC RIB FRACTURES

Presenter: Emma Jones, MD

Discussant: Daniel Margulies, MD

Paper 15

3:50 PM - 4:10 PM

CASE VOLUME AND RATE ARE ASSOCIATED WITH OUTCOMES IN GERIATRIC TRAUMA: A CASE FOR GERIATRIC TRAUMA CENTERS?

Presenter: Mitsuaki Kojima, MD, PhD

Discussant: Jody DiGiacomo, MD

Paper 16

4:10 PM - 4:30 PM

WHEN MINUTES MATTER: PREHOSPITAL TRANSFUSION REDUCES MORTALITY IN PEDIATRIC TRAUMA

Presenter: Katrina Morgan, MD

Discussant: Jeffrey Upperman, MD

Paper 17

4:30 PM - 4:50 PM

ARE WE WAITING FOR THE SKY TO FALL? PREDICTORS OF WITHDRAWAL OF LIFE-SUSTAINING SUPPORT IN GERIATRIC TRAUMA PATIENTS

Presenter: Avanti Badrinathan, MD

Discussant: Miriam Bullard, MD

Paper 18

4:50 PM - 5:10 PM

PREDICTORS OF CARE DISCONTINUITY IN GERIATRIC TRAUMA PATIENTS

Presenter: Manuel Castillo-Angeles, MD, MPH

Discussant: Jay Yelon, DO

Paper 19

5:10 PM - 5:30 PM

EARLY SURGICAL STABILIZATION OF RIB FRACTURES FOR FLAIL CHEST IS ASSOCIATED WITH IMPROVED PATIENT OUTCOMES

Presenter: Alex Simmonds, MD

Discussant: Babak Sarani, MD

1:50 PM - 5:30 PM

Session IIIB: Papers 20-30

Moderator Christopher Michetti, MD; **Recorder:** Lisa Kodadek, MD

Room Location: Grand BR CSouth-G

Paper 20

1:50 PM - 2:10 PM

TRIAL OF ANTIBIOTIC RESTRAINT IN PRESUMED PNEUMONIA

Presenter: Christopher Guidry, MD

Discussant: John Agapian, MD

Paper 21

2:10 PM - 2:30 PM

ELEVATED PLASMA SERPINB1 IS A MARKER OF IMMUNE DYSREGULATION PREDICTIVE OF POST-INJURY OUTCOMES

Presenter: Terry Schaid, MD

Discussant: Lawrence Diebel, MD

Paper 22

2:30 PM - 2:50 PM

EARLY TRACHEOSTOMY IN POLYTRAUMA PATIENTS IS ASSOCIATED WITH IMPROVED OUTCOMES

Presenter: Edgar Rodas, MD

Discussant: Bryce Robinson, MD, MSc

Paper 23

2:50 PM - 3:10 PM

VENOUS THROMBOEMBOLISM RISK AFTER SPINAL CORD INJURY: A SECONDARY ANALYSIS OF THE CLOTT STUDY

Presenter: Laura Godat, MD

Discussant: Jeremy Cannon, MD

Paper 24

3:10 PM - 3:30 PM

IMPACT OF WHOLE BLOOD LEUKOREDUCTION ON OUTCOMES IN TRAUMA PATIENTS, A MULTICENTER RETROSPECTIVE REVIEW

Presenter: Marissa Beiling, DO

Discussant: Jon Simmons, MD

Paper 25

3:30 PM - 3:50 PM

COMPUTED TOMOGRAPHY FIRST RESUSCITATION WITH HYBRID EMERGENCY ROOM FOR SEVERELY INJURED PATIENTS

Presenter: Satomi Senoo, MD

Discussant: Christine Gaarder, MD, PhD

Paper 26

3:50 PM - 4:10 PM

MULTICOMPARTMENTAL TRAUMA ALTERS BONE MARROW ERYTHROBLASTIC ISLANDS

Presenter: Lauren Kelly, MD

Discussant: Timothy Pritts, MD

Paper 27

PROSPECTIVE VALIDATION OF K/ICA RATIO AS A PREDICTOR FOR MORTALITY IN SEVERE HEMORRHAGE

Presenter: Brennan Gagen

4:10 PM - 4:30 PM

Discussant: Abhijit Pathak, MD

Paper 28

PLATELET AND CRYOPRECIPITATE TRANSFUSIONS FROM FEMALE DONORS HAVE IMPROVED HEMOSTATIC POTENTIAL

Presenter: Margot DeBot, MD

4:30 PM - 4:50 PM

Discussant: Carrie Sims, MD

Paper 29

MYOCARDIAL ALTERATIONS FOLLOWING TRAUMATIC HAEMORRHAGIC INJURY

Presenter: Rebecca Simpson, BSc (Hons)

4:50 PM - 5:10 PM

Discussant: Scott Brakenridge, MD

Paper 30

OUTCOMES OF FIVE YEARS OF PATIENTS WITH MILD TRAUMATIC SUBARACHNOID HEMORRHAGE

Presenter: Mark Broadwin, MD

5:10 PM - 5:30 PM

Discussant: Bellal Joseph, MD

5:30 PM - 5:45 PM

Break in Exhibit Hall

Room Location: Riverside East

5:45 PM - 6:15 PM

Session IV: Expert Surgeon Lecture

"A Life is Saved... Then What?"

Presenter: Ellen J. MacKenzie, PhD

Room Location: GR BR A-DNorth

6:15 PM - 7:15 PM

Session V: Poster Session I

Room Location: Riverside East

Group One: Abdominal Trauma (including GI)

Group Two: Critical Care (including infection and sepsis)

Group Three: Emergency General Surgery

Group Four: Geriatrics I (Trauma and EGS)/Palliative Care

Group Five: Geriatrics II (Trauma and EGS)/Palliative Care

Group Six: Health disparities/diversity, equity and inclusion

Group Seven: Injury Prevention and Pediatrics

7:15 PM - 8:15 PM

Welcome Reception

Room Location: Riverside East

THURSDAY, SEPTEMBER 22, 2022

6:15 AM - 7:15 AM

International Attendee Breakfast *(Pre-Registration Required)*

Room Location: Great Hall MN

6:15 AM - 7:15 AM

Committee Meetings II

Acute Care Surgery Committee

Room Location: Randolph 2

Diversity, Equity, and Inclusion Committee

Room Location Randolph 1AB

Disaster Committee

Room Location: Randolph 3

Palliative Care Committee

Room Location: Michigan 2

Geriatrics Committee

Room Location: Michigan 3

7:00 AM - 8:00 AM

Breakfast in Exhibit Hall

Room Location: Riverside East

7:00 AM - 1:00 PM	Exhibits <i>Room Location: Riverside East</i>
7:00 AM - 2:30 PM	Registration <i>Room Location: Grand Registration Desk</i>
7:00 AM - 3:00 PM	Donor Lounge <i>Room Location: Riverside East</i>
7:30 AM - 9:10 AM	Session VI: Papers 31-35 Moderator: Deborah Stein, MD, MPH; Recorder: Sharon Henry, MD <i>Room Location: Grand Ballroom</i>
Paper 31	7:30 AM - 7:50 AM
DETECTION OF PNEUMOTHORAX BY ULTRASOUND USING ARTIFICIAL INTELLIGENCE	
Presenter: Sean Montgomery, MD	Discussant: Jaswin Sawhney, MD
Paper 32	7:50 AM - 8:10 AM
DOES COVID-19 REALLY WORSEN SURGICAL OUTCOMES? A LARGE COVIDSURG PROPENSITY-MATCHED ANALYSIS	
Presenter: Dias Argandykov, MD	Discussant: Jeffrey Shupp, MD
Paper 33	8:10 AM - 8:30 AM
THE EVOLUTION OF NEUTROPHIL HETEROGENEITY AND EMERGENCE OF A DISTINCT POPULATION OF LOW-DENSITY NEUTROPHILS AFTER TRAUMA	
Presenter: Michael Yaffe, MD, PhD	Discussant: Mark Hoofnagle, MD
Paper 34	8:30 AM - 8:50 AM
PSEUDOANEURYSMS AFTER HIGH GRADE BLUNT SOLID ORGAN INJURY AND THE UTILITY OF DELAYED CT ANGIOGRAPHY	
Presenter: Morgan Schellenberg, MD, MPH	Discussant: Susan McLean, MD, MPH
Paper 35	8:50 AM - 9:10 AM
PREHOSPITAL SHOCK INDEX PREDICTS OUTCOMES AFTER PROLONGED RURAL TRANSPORT	
Presenter: James Bardes, MD	Discussant: Angela Earley, MD
9:10 AM - 10:10 AM	Session VII: Panel I, "Defining an Acute Care Surgery FTE" <i>Panelists: Marc deMoya, MD; Amy Goldberg, MD; Randi Smith, MD</i> <i>Moderator: Kristan Staudenmayer, MD, MSc</i> <i>Room Location: Grand Ballroom</i>
10:10 AM - 10:50 AM	Session VIII: Scholarship Presentations <i>Room Location: Grand Ballroom</i>
10:50 AM - 11:50 AM	Session IX: Fitts Lecture "Trauma. The Most Progressive Subspecialty of All" Presenter: David Feliciano, MD <i>Room Location: Grand Ballroom</i>
11:50 AM - 12:00 PM	Break in Exhibit Hall <i>Room Location: Riverside East</i>
12:00 PM - 1:00 PM	Session X: Poster Session II <i>Room Location: Riverside East</i>

Group Eight: Neurological Trauma

Group Nine: Organ-Based Trauma I

Group Ten: Organ-based Trauma II

Group Eleven: Shock/Transfusions I

Group Twelve: Shock/Transfusions II

Group Thirteen: Trauma Systems, Health Economics, and Epidemiology I

Group Fourteen: Trauma Systems, Health Economics, and Epidemiology II

1:10 PM - 2:10 PM

Lunch with Exhibitors (AAST Sponsored)

Room Location: Riverside East

1:10 PM - 2:25 PM

Lunch Sessions II

Implementation of the National Trauma Research Action Plan

Room Location: Grand Hall J

EGS Verification: The Why, The What, and the How

Room Location: Grand Hall GH

Highlights from the Pediatric Trauma Society Meeting

Room Location: Grand Hall MN

Quality Care is Equitable Care: A Call to Action to Link Quality to Achieving Health Equity within Trauma and Acute Care Surgery

Room Location: Grand Hall L

2:30 PM - 5:30 PM

JTACS Editorial Board Meeting (*Invite Only*)

Room Location: Grand Hall J

2:30 PM - 6:00 PM

Add-on Sessions

Complex Trauma Follow up and Discharge Management: Improving Lives and Preventing Reinjury

Room Location: Grand Hall J

Advanced Research Methods and Grant Writing for the Acute Care Surgeon Scientist

Room Location: Grand Hall GH

The AAST Neurocritical Care Update and Board Review Course

Room Location: Grand Hall MN

5:00 PM - 8:00 PM

SCCPDS Board of Directors Meeting (*Invite Only*)

5:00 PM - 6:00 PM

Virtual Job Fair Social Hour (*Open to all*)

Room Location: Michigan 2

6:00 PM - 7:30 PM

Associate Member Happy Hour (AAST Associate Members Only)

Room Location: Michigan 2

FRIDAY, SEPTEMBER 23, 2022

6:15 AM - 7:15 AM

Committee Meetings III

AAST Associate Member Council (optional)

Room Location: Randolph 2

Critical Care Committee

Room Location: Randolph 1AB

International Committee

Room Location: Randolph 3

Multi-Institutional Trials Committee

Room Location: Michigan 2

Military Committee

Room Location: Michigan 3

Patient Assessment Committee

Room Location: Michigan 1AB

6:15 AM - 7:15 AM

Board of Managers Meeting (Invite Only)

Room Location: Michigan 1C

7:00 AM - 8:00 AM

Breakfast in Exhibit Hall

Room Location: Riverside East

7:00 AM - 1:30 PM

Exhibits

Room Location: Riverside East

7:00 AM - 3:00 PM

Registration

Room Location: Grand Registration Desk

7:30 AM - 10:30 AM

Session XI: Papers 36-44

Moderator: Hayato Kurihara, MD; **Recorder,** Suresh Agarwal, MD

Room Location: Grand Ballroom

Paper 36

RECONCEPTUALIZING HIGH-QUALITY EGS CARE: TOP-TIER HOSPITALS REMAIN CONSISTENT ACROSS VARIABLE OUTCOMES, CONDITIONS, SEVERITIES, AND AGES
Presenter: Cheryl Zogg, PhD, MSPH, MHS

7:30 AM - 7:50 AM

Discussant: Amy Kwok, MD

Paper 37

WHO'S INFORMED OF TRAUMA INFORMED CARE? PATIENTS' PRIMARY LANGUAGE AND COMPREHENSIVENESS OF INITIAL TRAUMA ASSESSMENT
Presenter: Souma Kundu, MPH

7:50 AM - 8:10 AM

Discussant: Nicole Goulet, MD

Paper 38

THE IMPACT OF STATE TRAUMA FUNDING ON TRIAGE AND MORTALITY OF TRAUMA PATIENTS
Presenter: Meilynn Shi, BA

8:10 AM - 8:30 AM

Discussant: Rajan Gupta, MD, MS

Paper 39

DEALING WITH THE GROWING EPIDEMIC OF ELDER ABUSE: NATIONWIDE DISPARITIES IN INTERVENTIONS FOR ABUSE AMONG THE VULNERABLE ELDERLY
Presenter: Khaled El-Qawaqzeh, MD

8:30 AM - 8:50 AM

Discussant: Julie Goswami, MD

Paper 40

DOES ACQUISITION OF EMERGENCY MEDICAID AT THE TIME OF INJURY LEAD TO SUSTAINED INSURANCE? A STATEWIDE ANALYSIS
Presenter: Lisa Marie Knowlton, MD, MPH

8:50 AM - 9:10 AM

Discussant: Erica Lester, MD

Paper 41

FINANCIAL VULNERABILITY OF TRAUMA CENTERS: A NATIONAL ANALYSIS
Presenter: Alexander Marrotte, MD

9:10 AM - 9:30 AM

Discussant: Jason Smith, MD

Paper 42

GREATER SPATIAL ACCESS TO CARE IS ASSOCIATED WITH LOWER MORTALITY FOR EGS DISEASE

9:30 AM - 9:50 AM

Presenter: Marta McCrum, MD, MPH

Discussant: Vanessa Ho, MD, MPH

Paper 43

CATASTROPHIC HEALTH EXPENDITURE IN NON-NEUROLOGICAL INJURY DUE TO MOTOR VEHICLE CRASH
Presenter: Madhuri Nishtala, MD

9:50 AM - 10:10 AM

Discussant: David Zonies, MD, MPH, MBA

Paper 44

THE IMPACT OF A MULTIMODAL PAIN REGIMEN ON ANALGESIA PRESCRIBING AT AN ACADEMIC HOSPITAL

Presenter: Krista Stephenson, MD

10:10 AM - 10:30 AM

Discussant: Andrew Bernard, MD

10:30 AM - 11:00 AM

Break in Exhibit Hall

Room Location: Riverside East

11:00 AM - 12:00 PM

Session XII: Panel II, "When it is One of Us"

Panelists: Joseph Sakran, MD; R. Todd Maxson, MD; Rachael Callcut, MD

Moderator: David Livingston, MD

Room Location: Grand Ballroom

12:00 PM - 1:15 PM

Lunch Sessions III

Surgical futility in the elderly: First do no harm

Room Location: Grand Hall J

Allocation of scarce resources during times of need: Lessons learned from the COVID-19 pandemic

Room Location: Grand Hall GH

Hospital Based Violence Intervention Programs (HVIPs) – A step-by-step guide to establishing one and maintaining full-fledged status

Room Location: Grand Hall L

The Power of Mentorship: A No-Lecture, Round Table Discussion

Room Location: Grand Hall MN

New ACS Trauma Center Standards: What you need to know

Room Location: Grand Hall I

1:15 PM - 4:55 PM

Session XIII A: Papers 45-55

Moderator: Walt Biffel, MD; **Recorder:** Raminder Nirula, MD, MPH

Room Location: GR BR A-DNorth

Paper 45

MEDICAL MANAGEMENT IS THE TREATMENT OF CHOICE FOR LOW GRADE BLUNT THORACIC AORTIC INJURIES

Presenter: Simin Roward, MD

1:15 PM - 1:35 PM

Discussant: Charles Butts, MD

Paper 46

DOES THE USE OF REBOA IMPROVE SURVIVAL IN PATIENTS WITH PELVIC FRACTURES REQUIRING HEMORRHAGE CONTROL INTERVENTION?

Presenter: Daniel Ricaurte, MD

1:35 PM - 1:55 PM

Discussant: Susan Rowell, MD

Paper 47

DISPELLING DOGMA: AAST PROSPECTIVE, MULTICENTER TRIAL OF INITIAL VS. DELAYED FASCIOTOMY AFTER EXTREMITY TRAUMA

Presenter: Jane Keating, MD

1:55 PM - 2:15 PM

Discussant: Leah Tatebe, MD

Paper 48

ANTIBIOTIC ADMINISTRATION WITHIN ONE-HOUR FOR OPEN LOWER EXTREMITY FRACTURES: INFECTION PREVENTION OR JUST SURGICAL DOGMA?

Presenter: Areg Grigorian, MD

2:15 PM - 2:35 PM

Discussant: Addison May, MD, MBA

Paper 49

ADMISSION MA-R RATIO: ASSOCIATION BETWEEN THROMBOELASTOGRAPHY (TEG) VALUES PREDICTS POOR OUTCOME IN INJURED CHILDREN

Presenter: Elissa Abou Khalil, MD

2:35 PM - 2:55 PM

Discussant: Mary Edwards, MD

Paper 50 **2:55 PM - 3:15 PM**
NATIONWIDE TRENDS IN THE MANAGEMENT OF ISOLATED HIGH-GRADE
SPLENIC INJURIES: LESS SPLEENS ARE THROWN INTO A BUCKET
Presenter: Makoto Aoki, MD, PhD Discussant: Ben Zarzaur Jr., MD, MPH

Paper 51 **3:15 PM - 3:35 PM**
AAST MULTICENTER STUDY: DOES ANGIOEMBOLIZATION IMPROVE
SURVIVAL FOR SEVERE HEPATIC INJURIES?
Presenter: Amanda Radisic, MD Discussant: Mark Seamon, MD

Paper 52 **3:35 PM - 3:55 PM**
HERNIA RECURRENCE RISK FACTORS IN BLUNT TRAUMATIC ABDOMINAL
WALL HERNIAS: A SECONDARY ANALYSIS OF A WESTERN TRAUMA
ASSOCIATION MULTICENTER STUDY
Presenter: Kevin Harrell, MD Discussant: Benjamin Davis, MD

Paper 53 **3:55 PM - 4:15 PM**
TIME TO CRITICAL INTERVENTION: PUSHING ADVANCED RESUSCITATION
INTO THE PREHOSPITAL SETTING
Presenter: Andrew-Paul Deeb, MD Discussant: Adam Fox, DO

Paper 54 **4:15 PM - 4:35 PM**
MULTICOMPARTMENTAL TRAUMATIC INJURY AND THE MICROBIOME: SHIFT
TO A PATHOBIOME
Presenter: Jennifer Munley, MD Discussant: Stephanie Savage, MD

Paper 55 **4:35 PM - 4:55 PM**
EVALUATION OF LEAD AND OTHER HEAVY METAL LEVELS FROM RETAINED
BULLET FRAGMENTS: A PILOT STUDY
Presenter: Randi Smith, MD, MPH Discussant: Jessica Weaver, MD

1:15 PM - 4:55 PM

Session XIIB: Papers 56-66
Moderator: Jonathan Tilsed, MD; **Recorder:** Rosemary Kozar, MD, PhD
Room Location: Grand BR CSouth-G

Paper 56 **1:15 PM - 1:35 PM**
TIMING IS EVERYTHING: EARLY VERSUS LATE PALLIATIVE CARE CONSULTS IN TRAUMA
Presenter: Audrey Spencer, MD Discussant: Kathleen O'Connell, MD

Paper 57 **1:35 PM - 1:55 PM**
DETRIMENTAL IMPACT OF FRAILTY ON LONG-TERM PATIENT REPORTED
OUTCOMES IN EGS PATIENTS
Presenter: Ashley Meagher, MD, MPH Discussant: Amy Gore, MD

Paper 58 **1:55 PM - 2:15 PM**
INTERFACILITY TRANSFER IS ASSOCIATED WITH SURVIVAL BENEFIT IN
SEVERELY AND PROFOUNDLY INJURED PATIENTS
Presenter: Sami Kishawi, MD Discussant: Jordan Estroff, MD

Paper 59 **2:15 PM - 2:35 PM**
SURGICAL RESIDENT OPERATIVE AUTONOMY ON NIGHTS AND WEEKENDS:
WHAT HAPPENS TO SURGICAL EDUCATION DURING OFF-HOURS?
Presenter: Devashish Anjaria, MD Discussant: Amy Hildreth, MD

Paper 60 **2:35 PM - 2:55 PM**
A COMPREHENSIVE ANALYSIS OF 30-D READMISSIONS AFTER EGS
PROCEDURES. ARE RISK FACTORS MODIFIABLE?
Presenter: Raul Coimbra, MD, PhD Discussant: Kimberly Davis, MD, MBA

Paper 61 **2:55 PM - 3:15 PM**
SURGICAL STABILIZATION OF CRITICAL ABDOMINAL INJURIES PRIOR TO
TRANSFER HAS IMPROVED SINCE 2010
Presenter: Chandler Tinsman Discussant: Alison Wilson, MD

Paper 62 **3:15 PM - 3:35 PM**
LONGITUDINAL STUDY EVALUATING POST-ICU SYNDROME DIFFERENCES
BETWEEN ACUTE CARE SURGERY AND TRAUMA SICU SURVIVORS
Presenter: Nikolay Bugaev, MD Discussant: Jennifer Gurney, MD

Paper 63 **3:35 PM - 3:55 PM**
EXTERNAL VALIDATION OF THE TEMPT SCORE AS A PREDICTOR OF BLOOD TRANSFUSION
Presenter: Rafael Lozano, MD Discussant: Bryan Cotton, MD

Paper 64 **3:55 PM - 4:15 PM**
VIDEO-ASSISTED RETROPERITONEAL DEBRIDEMENT (VARD) FOR NECROTIZING
PANCREATITIS IS ASSOCIATED WITH SUPERIOR IN-HOSPITAL OUTCOMES
Presenter: Zachary Tran, MD Discussant: Nancy Parks, MD

Paper 65 **4:15 PM - 4:35 PM**
MULTIYEAR EXPERIENCE WITH MOBILE ONLINE PLATFORM FOR
DOCUMENTATION OF ACUTE CARE SURGERY FELLOWS SUPERVISION
Presenter: Oliver Gunter, MD, MPH Discussant: Jasmeet Paul, MD

Paper 66 **4:35 PM - 4:55 PM**
EARLY THROMBOPROPHYLAXIS IN NONOPERATIVE BLUNT ABDOMINAL
TRAUMA: A CLOTT RESEARCH STUDY
Presenter: Mary Bokenkamp, MD Discussant: Eric Ley, MD

5:00 PM - 6:30 PM

Business Meeting
Room Location: GR BR A-DNorth

7:00 PM - 7:30 PM

Reception
Room Location: Grand BR CSouth-G

7:30 PM - 11:00 PM

Auction and Banquet
Room Location: Grand BR CSouth-G

SATURDAY, SEPTEMBER 24, 2022

7:00 AM - 8:00 AM

New Member Breakfast
Room Location: Grand D

7:30 AM - 10:00 AM

Registration (if needed)
Room Location: Grand Reg Desk

7:30 AM - 8:30 AM

Breakfast
Room Location: Grand F Foyer

8:00 AM - 9:18 AM

Session XIV: Quickshot Session I 1-13

Moderator: Eileen Bulger, MD
Room Location: GR BR A-DNorth

Quickshot 1 **8:00 AM - 8:06 AM**
DETERMINANTS OF LONG-TERM PHYSICAL AND MENTAL HEALTH OUTCOMES
AFTER INTENSIVE CARE ADMISSION FOR TRAUMA SURVIVORS
Presenter: Juan Herrera-Escobar, MD, MPH Discussant: Libby Schroeder, MD,

Quickshot 2 **8:06 AM - 8:12 AM**
HISTORIC RACISM AND CONTEMPORARY GUN VIOLENCE INCIDENCE IN
ATLANTA, GA
Presenter: Jason Williams, MD Discussant: D'Andrea Joseph, MD

Quickshot 3 **8:12 AM - 8:18 AM**
FIREARM INJURY SURVIVAL IS ONLY THE BEGINNING: THE IMPACT OF SOCIAL
DETERMINANTS OF HEALTH ON UNPLANNED READMISSION AFTER INJURY
Presenter: Derek Lumbard, MD Discussant: Tanya Zakrison, MD, MPH

Quickshot 4 **8:18 AM - 8:24 AM**
EARLY VERSUS DELAYED THORACIC ENDOVASCULAR AORTIC REPAIR
FOR BLUNT THORACIC AORTIC INJURY: A PROPENSITY SCORE-MATCHED
ANALYSIS
Presenter: Anne-Sophie Romijn, MD Discussant: Stephanie Berry, MD

Quickshot 5 **8:24 AM - 8:30 AM**
OPIOID EXPOSURE IN TRAUMA PATIENTS WITH A POSITIVE URINE DRUG
SCREEN: A SUBGROUP ANALYSIS OF A RANDOMIZED CONTROLLED TRIAL
Presenter: James Klugh, MD Discussant: Bethany Strong, MD

Quickshot 6 **8:30 AM - 8:36 AM**
ACHIEVING THE DAMAGE CONTROL RESUSCITATION GOALS DECREASES
MORTALITY IN MASSIVELY TRANSFUSED TRAUMA PATIENTS
Presenter: Iver Andersgaski Discussant: Kazuhide Matsushima, MD

Quickshot 7 **8:36 AM - 8:42 AM**
DEVELOPING AN AI PREDICTION MODEL FOR TRAUMA INDUCED ACUTE
KIDNEY INJURY
Presenter: Rebecca Stoner, MBChB, MSc, MRCS Discussant: Brandon Bruns, MD

Quickshot 8 **8:42 AM - 8:48 AM**
SURGEON COMPASSION MAY MITIGATE QUALITY OF LIFE DISPARITIES
ASSOCIATED WITH HEALTH LITERACY
Presenter: Morgan Hopp, MD Discussant: Tasce Bongiovanni, MD

Quickshot 9 **8:48 AM - 8:54 AM**
MESOTHELIAL CELL RESPONSE TO ACUTE APPENDICITIS OR SMALL BOWEL
OBSTRUCTION REACTIVE ASCITES
Presenter: Melissa Hausburg, PhD Discussant: Todd Costantini, MD

Quickshot 10 **8:54 AM - 9:00 AM**
BIAS IN THE TRAUMA BAY: A MULTICENTER QUALITATIVE STUDY ON
TEAM COMMUNICATION
Presenter: Brittany Bankhead, MD Discussant: Michael Cripps, MD

Quickshot 11 **9:00 AM - 9:06 AM**
HYPOXICALLY STORED BLOOD IMPROVED RESUSCITATION FROM
HEMORRHAGIC SHOCK AFTER TRAUMATIC BRAIN INJURY COMPARED TO
CONVENTIONALLY STORED BLOOD
Presenter: Cynthia Muller, PhD Discussant: William Chiu, MD

Quickshot 12 **9:06 AM - 9:12 AM**
THE GENDER GRADIENT IN ACUTE CARE SURGERY: PEAKS AND PLATEAUS
Presenter: Sabrina Goddard, MD Discussant: Tanya Anand, MD

Quickshot 13 **9:12 AM - 9:18 AM**
REDEFINING TRAUMA DESERTS: NOVEL TECHNIQUE TO ACCURATELY MAP
PREHOSPITAL TRANSPORT TIME
Presenter: Leah Tatebe, MD Discussant: Bradley Dennis, MD

9:18 AM - 9:40 AM

Break
Room Location: Grand BR Foyer

9:40 AM - 10:58 AM

Session XV: Quickshot Session II 14-26
Moderator: Susan Evans, MD
Room Location: GR BR A-DNorth

Quickshot 14 **9:40 AM - 9:46 AM**
OUTCOMES OF SURGICAL VS NON-SURGICAL TREATMENT FOR MULTIPLE RIB
FRACTURES: A US HOSPITAL DATABASE ANALYSIS
Presenter: Adam Shiroff, MD Discussant: Nikolay Bugaev, MD

Quickshot 15 **9:46 AM - 9:52 AM**
IMAGING THE INFLAMED GALLBLADDER, ULTRASOUND, CT OR MRI, AN AAST
MULTICENTER STUDY
Presenter: Kevin Schuster, MD Discussant: David Blake, MD, MPH

Quickshot 16 **9:52 AM - 9:58 AM**
THE CHICKEN OR THE EGG: CORRELATION OF LOW PLATELETS & POST-
INJURY ACUTE RESPIRATORY DISTRESS SYNDROME
Presenter: Anamaria Robles, MD Discussant: Adrian Maung, MD

Quickshot 17 **9:58 AM - 10:04 AM**
COAGULOPATHY AND POSTINJURY MULTIPLE ORGAN FAILURE: IDENTIFYING
THE HIGHEST RISK PATIENTS THROUGH ADMISSION THROMBELASTOGRAPHY
Presenter: Lauren Dwyer Discussant: Kaushik Mukherjee, MD

Quickshot 18 **10:04 AM - 10:10 AM**
ENHANCING UTILITY OF INTERFACILITY TRAUMA TRIAGE GUIDELINES USING
MACHINE LEARNING: DEVELOPMENT OF THE GERIATRIC INTERFACILITY TRAUMA
TRIAGE SCORE (GITTS)
Presenter: Tabitha Garwe, PhD, MPH Discussant: Alison Smith, MD, PhD

Quickshot 19 **10:10 AM - 10:16 AM**
AN ASSESSMENT OF THE SAFETY, HEMOSTATIC EFFICACY, AND CLINICAL IMPACT
OF LOW-TITER GROUP O WHOLE BLOOD IN CHILDREN AND ADOLESCENTS
Presenter: Justin Gerard, MD Discussant: Romeo Ignacio, MD

Quickshot 20 **10:16 AM - 10:22 AM**
MORTALITY AFTER MASSIVE TRANSFUSION: TEACHING HOSPITAL STATUS, NOT
TRAUMA CENTER DESIGNATION, IS ASSOCIATED WITH IMPROVED SURVIVAL
Presenter: Walter Ramsey, MD Discussant: Mark Hemmila, MD

Quickshot 21 **10:22 AM - 10:28 AM**
SETTLING THE DEBATE REGARDING OPTIMAL TIMING OF FRACTURE
FIXATION FOR POLYTRAUMA TBI PATIENTS: A TQIP ANALYSIS
Presenter: Sarah Lombardo, MD, MSc Discussant: Haytham Kaafarani, MD

Quickshot 22 **10:28 AM - 10:34 AM**
A MAJORITY OF FAILURES-TO-RESCUE IN HOSPITALIZED TRAUMA PATIENTS
WOULD BE AVOIDED WITH FULL SUPPORTIVE CARE
Presenter: Charles Shahan, MD, MS Discussant: Anupamaa Seshadri, MD

Quickshot 23 **10:34 AM - 10:40 AM**
TAKING CARE OF THE BLOCK: ASSOCIATES BETWEEN AREA DEPRIVATION
INDEX AND OUTCOMES IN TRAUMA PATIENTS
Presenter: Seth Quinn, MD Discussant: Rochelle Dicker, MD

Quickshot 24 **10:40 AM - 10:46 AM**
THE COST OF LIVER DISEASE: THE CIRRHOSIS OUTCOMES SCORE IN TRAUMA STUDY
Presenter: Rachel Appelbaum, MD Discussant: Krista Kaups, MD

Quickshot 25 **10:46 AM - 10:52 AM**
EFFECT OF TRANEXAMIC ACID ON ENDOTHELIAL VON WILLEBRAND FACTOR/
ADAMTS-13 RESPONSE TO IN VITRO SHOCK CONDITIONS
Presenter: Lawrence Diebel, MD Discussant: Lucy Kornblith, MD

Quickshot 26 **10:52 AM - 10:58 AM**
TRANEXAMIC ACID REGULATES PYRUVATE KINASE M2
Presenter: Joseph Rappold, MD Discussant: Karim Brohi, MD

11:00 AM

Meeting Adjourned

Schedule subject to change. Please check conference app and online program book for most up-to-date schedule and room names.

AAST ABSTRACTS OF PAPERS

81ST ANNUAL MEETING OF AAST 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 21, 2022

8:00 AM - 8:30 AM

Location: Grand Ballroom

Presiding: David Livingston, MD

SESSION I:

PLENARY PAPERS #1- 8

Wednesday, September 21, 2022

8:30 AM - 11:10 AM

Location: Grand Ballroom

Moderator: David Livingston, MD

Recorder: Karen Brasel, MD, MPH

September 21-24, 2022



SESSION I: **PLENARY PAPERS 1-8**

Wednesday, September 21, 2022

8:30 AM - 11:10 AM

Location: Grand Ballroom

Moderator: David Livingston, MD

Recorder: Karen Brasel, MD, MPH

PROSPECTIVE VALIDATION AND APPLICATION OF THE TRAUMA SPECIFIC FRAILITY INDEX: RESULTS OF AN AAST MULTI-INSTITUTIONAL OBSERVATIONAL TRIAL

Bellal Joseph, MD, FACS; Laura Godat, MD, FACS; Toby Ennis, MD; Thomas Shoultz, MD; Tanya Egodage, MD; Sigrid Burruss, MD; Melissa Whitmill, MD; Julie Dunn, MD; Tasce Bongiovanni, MD; Kaveh Najafi, DO; Josh Hazelton, MD; Kristin Colling, MD; Erika Tay-Lasso, MD; Amanda Teichman, MD

American Association for the Surgery of Trauma

Invited Discussant: Richard Miller, MD

Background: The TSFI was created & validated at a single center to accurately identify frailty while remaining a practical risk-prediction tool. The aim of this study is to prospectively validate the TSFI in a multi-institutional cohort of geriatric trauma patients. We hypothesized that frailty predicts worse outcomes in geriatric trauma patients. **Methods:** This is a prospective, observational, multi-institutional trial across 17 ACS Level I & II trauma centers. All geriatric patients (≥65 yrs) presenting during a three-year period were included. Frailty status was measured within 24 hrs of admission using the 15-variable TSFI, & patients were stratified: non-frail (TSFI ≤0.12); pre-frail (0.13-0.25); frail (>0.25). Outcomes include--ed index admission mortality, complications, & unfavorable discharge (skilled nursing facility/rehabilitation center), & 3-month post-discharge readmissions, falls, complications, & mortality. **Results:** A total of 1,321 patients were identified (Non-frail: 33%; Pre-frail: 30%; Frail: 37%). Mean age 77±8 yrs, 49% were male, median ISS was 9 [5-13], most common mechanism of injury was fall (69%). Overall, 14% had a major complication, 42% had unfavorable discharge, & 5% died during index admission. Frail patients had higher rates of complications (21 vs 14 vs 10%, *p*<0.001) & mortality (7 vs 3 vs 4%, *p*=0.048) compared to pre-frail & non-frail patients. Of 1,116 patients discharged who had follow-up information, 16% were readmitted within 3 months, 7% had a second fall, 7% had a complication, & 2% died within 3 months. On both univariate & multivariate analyses, frailty was associated with worse outcomes both during the index admission & 3 months post-discharge (Table).

Conclusion: TSFI was able to be applied at 17 ACS Level I & II trauma centers. TSFI is an

Table	Univariate Analysis				Multivariate Analysis-Independent Effect of Frailty		
	Non-frail (N=435)	Pre-frail (N=392)	Frail (N=494)	<i>P</i> -value	aOR	95% CI	<i>P</i> -value
Index Admission							
Mortality	18 (4%)	13 (3%)	33 (7%)	0.048	1.93	1.12 – 3.32	0.018
Major Complications	35 (8%)	42 (11%)	102 (21%)	<0.001	3.55	2.26 – 5.57	<0.001
Unfavorable Disch. Disp.	131 (30%)	164 (42%)	259 (52%)	<0.001	1.98	1.44 – 2.72	<0.001
3-months Post-discharge							
Readmissions	39 (10%)	46 (14%)	96 (24%)	<0.001	2.70	1.69 – 4.31	<0.001
Fall Recurrence	10 (4%)	10 (4%)	40 (12%)	<0.001	5.77	1.94 – 17.15	0.002
Major Complications	17 (4%)	17 (4%)	42 (10%)	0.002	2.44	1.20 – 4.95	0.013
Mortality	1 (0.3%)	5 (2%)	16 (4%)	<0.001	6.89	2.17 – 21.85	0.001

aOR-adjusted odds ratio, CI-confidence interval, Disch. Disp=discharge disposition

independent predictor of worse outcomes, both in the short-term as well as long-term. TSFI is a practical & effective risk-stratification tool that clinicians should use in the management of geriatric trauma patients.

NOT SO FAST WITH ABC FOR NONCOMPRESSIBLE TORSO HEMORRHAGE: AN AD-HOC REVIEW OF AAST MIT

Juan Duchesne, MD, MPH; Sharven Taghavi, MD, MPH, MS; Olan Jackson-Weaver, PhD; Danielle Tatum, PhD
Tulane University School of Medicine
Invited Discussant: Ryan Dumas, MD

Background: The tenet of Airway, Breathing, Circulation (ABC) after traumatic injury is standard of care but has recently begun to be called into question in patients with hemorrhagic shock. We sought to determine the impact of Emergency Department (ED) intubation in hypotensive noncompressible torso hemorrhage (NCTH) patients on mortality.

Methods: This was an AAST-sponsored multicenter, prospective analysis of hypotensive [systolic blood pressure (SBP) \leq 90 mmHg] patients aged 15+ years who presented with NCTH from May 2018-December 2020. Primary outcome of interest was in-hospital mortality after ED intubation.

Results: There were 237 patients included of which 92 (38.8%) were intubated in the ED prior to operating room (OR) disposition. Intubated patients were older ($p=0.01$), had higher median New Injury Severity Score (34 vs 27, $p<0.001$), higher median ED shock index (1.5 vs 1.3, $p<0.001$), lower median initial SBP (78 vs 82, $p=0.001$), and lower median initial Glasgow Coma Scale (8 vs 15, $p<0.001$).

Those intubated were more likely to be blunt injured (63% vs 39%, $p<0.001$), have pelvic injury (31.5% vs 18%, $p=0.02$), and had higher mortality than those non-intubated (64.6% vs 32.3%, $p<0.001$). There was no difference between groups in regards of intra-operative cardiac arrest, damage control laparotomy or thoracotomy nor median time from ED to OR start. ED intubation in hypotensive NCTH patients was shown to be associated with significantly higher odds of mortality even after controlling for potential confounders. (Table) Analysis of the predictive ability of the model revealed an area under the curve of 0.814 ($p<0.001$).

Conclusion: ED intubation in hypotensive NCTH patients was associated with increased mortality even after controlling for injury type and severity and physiological derangement. This suggests a need to reorder the ABCs to address circulation first in this patient population. Future randomized trials are necessary.

Table. Multivariable logistic regression of factors associated with mortality

Parameter	Odds ratio	95 % CI	P
Age in years	1.06	1.03 – 1.09	< 0.001
Penetrating injury	3.71	1.19 – 11.64	0.02
Pre-hospital crystalloids given	1.11	0.45 – 2.79	0.82
New Injury Severity Score (NISS)	1.05	1.02 – 1.08	< 0.01

WHEN IS ENOUGH ENOUGH? ODDS OF SURVIVAL BY UNIT TRANSFUSED

Andrew M. Loudon, MD; Amy Rushing, MD; Matthew Moorman, MD

University Hospital Cleveland Medical Center

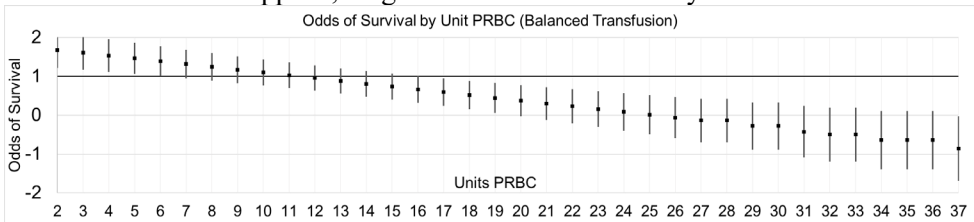
Invited Discussant: Michael Goodman, MD

Introduction: Balanced transfusion is lifesaving for hemorrhagic shock. Massive transfusion protocols (MTP) expedite delivery of blood in balanced ratios. The American Red Cross critical blood shortage in January 2022 threatened the immediate availability of blood products. To eliminate waste, we reviewed the utility of transfusions per unit (U) at an urban level 1 trauma center. The goal was to define expected mortality at various levels of balanced blood product resuscitation.

Methods: A retrospective study of 296 patients receiving MTP on presentation was performed from January 2018 to December 2021. U of packed red blood cells (PRBC), fresh frozen plasma (FFP), and platelets (PLT) received in the first 4 hours were recorded. Patients were excluded if they died in the Emergency Department (DIE), died on arrival (DOA), received <2U PRBC or FFP, or received PRBC: FFP >2:1. Primary outcomes were mortality and odds of survival to discharge. Subgroups were defined as transfused (T) if receiving 2-9U PRBC, massive transfusion (MT) for 10-19U PRBC, and ultramassive transfusion (UMT) for ≥ 20 U PRBC.

Results: 207 patients were included: median age 31 years, median Injury Severity Score 25, 67% with penetrating mechanism. Mortality was 18% (38/207) at 24 hours, 29% (61/207) at discharge. Odds of survival = odds of mortality at 11U PRBC (OR 1.02, 95% CI 0.70, 1.35). Beyond 17U PRBC, odds of mortality exceed survival (OR 0.59, 95% CI 0.24, 0.94). Odds of survival are negligible at 37U PRBC (OR -0.86, 95% CI -0.03,-1.70). No patient survived after 67U PRBC. Subgroup mortality rates increased with U transfused (16% T vs 36% MT, $z=-3.00$, $p=.0027$; 36% MT vs 67% UMT, $z=-2.76$, $p=.0058$).

Conclusion: Mortality increases with each U balanced transfusion. Surgeons should view efforts heroic beyond 17U PRBC/4 hours, near futile beyond 37U PRBC/4 hours, and ineffective beyond 67U PRBC/4 hours. With limited blood supplies, surgeons should assess futility at 17U PRBC.



INTO THE FUTURE: PRECISION AUTOMATED CRITICAL CARE MANAGEMENT (PACC-MAN) FOR CLOSED-LOOP CRITICAL CARE

Aravindh Ganapathy, MD; Nathan Patel, MD; Aidan Wiley, BA; Antonio Renaldo, BS; Magan Lane, BS; James Jordan, PhD; Jason Adams, MD, MS; Austin Johnson, MD, PhD; Lucas P. Neff, MD; Timothy Williams, MD

Wake Forest Baptist Health

Invited Discussant: Michael Vella, MD

BACKGROUND: Goal-directed blood pressure management can improve trauma outcomes but is labor-intensive. Automated critical care (ACC) systems can deliver scaled interventions and avoid excessive fluid or vasopressor administration. We compared a custom automated drug and fluid delivery platform to a novel algorithm, incorporating more physiologic inputs and therapeutics. We hypothesized that our improved algorithm would provide a more balanced resuscitation.

METHODS: Twelve swine underwent 30% hemorrhage, then 30min of zone-1 REBOA. Next, animals underwent shed blood transfusion, REBOA removal, and randomization into a standardized critical care (SCC) algorithm or enhanced version (SCC+) for 4.25hrs. SCC+ measured response to fluid bolus. Vasopressin was added as an adjunct to norepinephrine. Lactate and urine output were incorporated into the algorithm. Primary and secondary outcomes were decreased crystalloid administration and maintaining goal normotension, respectively.

RESULTS: Weight-based fluid bolus volume was lowered in SCC+ compared to SCC (26.9 ml/kg vs. 67.5 ml/kg $p=0.02$). There was no difference in cumulative norepinephrine dose required (SCC: 13.76 mcg/kg vs. SCC+: 26.9 mcg/kg, $p=0.24$). Three out of 6 animals (50%) in SCC+ triggered vasopressin. Mean arterial blood pressure proportional time spent between 60-70 mmHg and terminal creatinine / lactate were not different (SCC: 79%, 2.2 mg/dL, 3.8 mmol/dL and SCC+: 80%, 2.4 mg/dL, 4.6 mmol/dL, $p=0.09$, $p=0.26$, $p=0.30$, respectively).

CONCLUSION: Refinement of the SCC algorithm showed significant decrease in crystalloid administration without sacrificing time in normotension, significant increase in vasopressor support, or increase in terminal lactate and creatinine levels. This approach demonstrates feasibility of ACC to achieve target hemodynamics in a distributive-shock model.

ESTRADIOL PROVOKES HYPERCOAGULABILITY AND AFFECTS FIBRIN BIOLOGY: A MECHANISTIC EXPLORATION OF SEX DIMORPHISMS IN COAGULATION

Julia R. Coleman MD, MPH; Ernest E. Moore, MD; Lauren Schmitt, BS; Kirk Hansen, PhD; Nathan Dow, BS; Kalev Freeman, MD; Mitchell J. Cohen, MD; Christopher C. Silliman, MD, PhD

University of Colorado

Invited Discussant: Matthew Kutcher, MD, MS

Background: Sex dimorphisms in coagulation are well-established and persist after injury, with female-specific hypercoagulability conferring a survival benefit in the setting of trauma-induced coagulopathy (TIC). While circulating sex hormones versus intrinsic differences in cellular biology have been proposed as the mediating forces, the molecular mechanism for this hypercoagulability and survival benefit is unknown. The objective of this study was to examine the effect of estradiol on clot viscoelastic, thrombin formation, and fibrin biology. We hypothesize that estradiol provokes a hypercoagulable profile in vitro and alters FXIII cross-linking of the fibrin matrix.

Methods: To examine the effect of estradiol on clot viscoelasticity and thrombin formation, whole blood was collected from healthy adult volunteers, specifically 15 premenopausal females and 15 age-matched males. Citrated native thrombelastography (TEG), functional fibrinogen TEG, platelet mapping TEG, and whole blood thrombin generation (TG) were performed after pre-treatment of the blood with physiologic concentrations of beta-estradiol. To examine the effect of estradiol on clot formation, we performed analysis in both plasma and whole blood clots. First, clots were formed from pooled platelet poor donor plasma stock with a titration of beta-estradiol and then imaged with confocal microscopy with fluorescently labelled fibrinogen to examine clot architecture. We then formed whole blood clots in vitro from healthy volunteers, washed to isolate the insoluble fibrin matrix, chemically and enzymatically digested, and then fractionated with high pH reversed phase (HPRP) chromatography and analyzed via LC-MS/MS to identify cross-linked peptides.

Results: Estradiol provoked a hypercoagulable phenotype in TEG in males and females, specifically a shorter time to clot formation (8.6 min vs 10.7 min, $p=0.01$), greater rate of clot propagation (61.8 vs 55.0, $p=0.04$), higher clot strength (66.5 mm vs 59.5 mm, $p=0.004$), and diminished clot lysis (LY30 0.7% vs 2.3%, $p=0.0004$). This hypercoagulability was also characterized by increased functional fibrinogen (FLEV 529.2 vs 392.3, $p=0.007$) and platelet hyperactivity (ADP inhibition of 99.6% vs 54.9% and AA inhibition of 99.6% vs 67.0%, $p < 0.0001$). TG was significantly more robust after addition of estradiol, with a greater peak thrombin of 94.6 nM versus 84.2 nM ($p=0.03$) in females. On plasma clot formation analysis, the fiber resolvability (a metric of the density of clot architecture) significantly increased with estradiol concentration, signifying more highly structured and distinct fibrin fibers (Figure). On proteomic analysis of whole blood clot composition, estradiol was associated with robust increases in several procoagulant and antifibrinolytic proteins, specifically alpha-1 antitrypsin, fibrinogen alpha chain, myosin-0, complement components, apolipoprotein A-1, coagulation factor IX, and multiple platelet glycoproteins. Additionally, cross-linking mass spectrometry analysis showed addition of estradiol increased the abundance of several FXIII cross-links within the FIBA alpha chain.

Conclusion: Estradiol provokes a hypercoagulable phenotype, affecting time to clot formation, clot propagation, clot strength, and clot fibrinolysis. The induced fibrinolytic shutdown is likely due to its transformation of normal fibrin biology to increase FXIII cross-linking and alter clot proteomics. In sum, these data highlight the role of estradiol in driving female-specific hypercoagulability and pose the question of its role as a therapeutic adjunct in resuscitation of TIC.

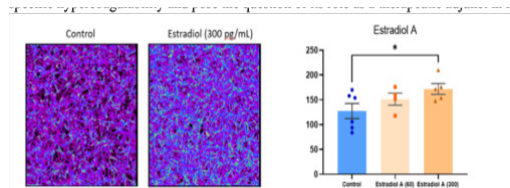


Figure. Representative images of the fiber resolvability index as a function of the average STDEV of every pixel through the depth of the optical section from clots formed in control conditions and with the addition of estradiol. Summary data shows that clots formed with estradiol have higher signal distinction (i.e., high contrast against the background), relative to control.

**TRENDS IN TRAUMA CARE ACCESS AND SOCIO-
DEMOGRAPHIC PREDICTORS OF INJURY MORTALITY IN
THE UNITED STATES, 2005 - 2020**

Jamie Benson, BA, AEMT; Stas Amato, MD, MSc; Barclay Stewart, MD, PhD; Turner Osler, MD; David Hosmer, PhD; Gary An, MD; Alan Cook, MD, MSc; Robert John Winchell, MD, FACS; Ajai Malhotra, MD
University of Vermont

Invited Discussant: Stefan Leichtle, MD, MBA

Background: Timely access to high level (I/II) trauma centers (HLTC) is essential to minimize mortality after injury. Over the last 15-years there has been a proliferation of HLTC nationally. The current study evaluates the impact of these additional HLTC on population access and injury mortality. We hypothesize that additional HLTC have not improved population level access or injury mortality.

Methods: A geocoded list of HLTC, with year designated, was obtained from American Trauma Society and 60-minute travel time polygons were created around HLTC using OpenStreetMap data. Census tract population centroids, summarized at county level, and American Communities Survey demography were integrated. Age-adjusted injury mortality was obtained from CDC, Wide-ranging Online Data for Epidemiologic Research (WONDER). Geographically weighted Poisson regression models were created to predict access to HLTC, and injury mortality, adjusting for demography, income, health status, racial composition, and rurality.

Results: Over the 15-year (2005–2020) study period HLTC coverage increased by 30.11% (445 to 579). Population access to HLTC increased by 4.21% (79.05% to 83.26%) – Figs I&II. Increased coverage was higher for white populations (4.7% vs 3.4%). Population level age-adjusted injury mortality decreased by 3.6/100,000 (45.9 vs 42.3) – Fig III. Counties with limited access (< 50% population) were primarily rural (78.2% vs 40.9%), whiter (78.2% vs 74.8%), with lower median household income (\$48,000 vs \$59,600) and suffered higher age-adjusted injury mortality (47.2 vs 36.6/100,000) – $p < 0.001$ for all. Despite greater access to HLTC, after controlling for other factors, counties with higher proportion of non-whites had higher injury mortality (IRR 1.29, 95%CI 1.28-1.31).

Conclusions: Over the past 15-years, HLTC have increased 30% while population access to HLTC has increased only 4%. HLTC designation is likely driven by factors other than population need.

**TACKLING THE BEDSIDE ARTIFICIAL INTELLIGENCE
BARRIER: NATURAL LANGUAGE PROCESSING TO EXTRACT
INJURY ICD10 DIAGNOSIS CODES REAL-TIME FROM
ELECTRONIC MEDICAL RECORDS**

Jeff Choi MD, MSc; Yifu Chen, BS; Alexander Sivura, BS; Jenny Wang,
BS; David A. Spain, MD

Stanford University

Invited Discussant: Rachael Callcut, MD

Introduction: Despite surging interest, artificial intelligence (AI) prediction tools are rarely used at the bedside. Many prediction tools require ICD10 diagnosis codes as inputs, yet these are time-consuming to extract manually. To tackle this prevalent bedside AI adoption barrier, we aimed to build a natural language processing (NLP) algorithm that outputs injury ICD10 diagnosis codes real-time using unstructured free text from the electronic medical record.

Methods: Our dataset comprised deidentified trauma tertiary survey notes from 3,400 consecutive patients admitted to our level I trauma center between 2016 and 2020. The dataset was split into train, validation, and test sets. We trained and fine-tuned a deep learning Bidirectional Encoder Representations from Transformers algorithm to automatically extract injury ICD10 diagnosis codes from unstructured free text. We compared algorithm-extracted ICD10 diagnosis codes with manual, trauma registrar-extracted codes (ground truths). We measured validation set performance using micro-area under the curve (AUC) and compared our algorithm's performance against that of an industry benchmark (Amazon Comprehend Medical).

Results: Our NLP algorithm was trained using 1986 tertiary survey notes with 7914 injury ICD10 diagnosis codes (3957 ground truths, 3957 randomly generated negative samples). The model automatically produced injury ICD10 diagnosis codes after users input free text describing injuries (e.g. injury list, radiology report). Compared with Amazon Comprehend Medical's micro-AUC of 0.76, our algorithm achieved validation set micro-AUC of 0.84.

Conclusion: We built a NLP algorithm that automatically extracts injury ICD10 diagnosis codes real-time from unstructured free text. Interim performance exceeded that of a leading industry benchmark. Reliable, automated ICD10 diagnosis code extraction could connect the critical missing link for many AI prediction tools to reach the patient bedside.

EARLY PNEUMONIA DIAGNOSIS DECREASES VENTILATOR-ASSOCIATED PNEUMONIA RATES IN TRAUMA POPULATION

Robert Maxwell, MD; Kevin Harrell, MD; William Lee, MD; Hunter Rooks, MD; W Eric Briscoe, MD

University of Tennessee College of Medicine Chattanooga

Invited Discussant: Samuel Carmichael, MD

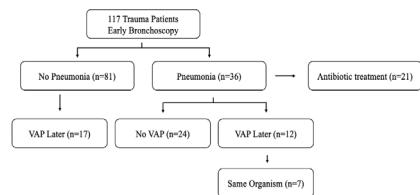
Introduction: Ventilator-associated pneumonia (VAP) is a source of morbidity and mortality for trauma patients. Aspiration events are also common in trauma patients due to traumatic brain injury, altered mental status, or facial trauma. In patients requiring mechanical ventilation, early pneumonias, often due to aspiration, may be erroneously classified as ventilator-associated leading to the reporting of artificially inflated VAP rates.

Methods: A prospective early bronchoscopy protocol was implemented from January 2020 through January 2022 at a single ACS-verified level 1 trauma center. Trauma patients intubated prior to arrival or within 48 hours of admission underwent bronchoalveolar lavage (BAL) within 24 hours of intubation. Patients with more than 100,000 colony forming units (CFU) on BAL were considered to have early pneumonia. Patients with clinical signs of infection were treated with antibiotics. Patients with early pneumonia were compared to patients without early pneumonia.

Results: A total of 117 patients met inclusion criteria and underwent early BAL. Ninety-three (79.5%) had any growth on BAL with 36 (30.8%) of these patients having greater than 100,000 CFU, meeting criteria for early pneumonia. For the total study population, 29 (24.8%) patients later developed a VAP on secondary BAL, 12 of which had previously been diagnosed with early pneumonia. Out of patients who were diagnosed with early pneumonia (n=36), 21 (58.3%) were treated with antibiotics based on clinical signs of infection. In patients with early pneumonia who had a subsequent VAP (n=12), seven (58.3%) grew the same organism from their initial BAL. Patients with early pneumonia had a higher rate of smoking history (41.7% vs. 19.8%, p<0.001) compared to patients without early pneumonia. There was no difference in median hospital length of stay (LOS), ICU LOS, ventilator days, or mortality between the two groups. Without the investigation of early pneumonia, the total patient population would have had a reported VAP rate of 45.3% (n=53), but this was reduced to 24.8% (n=29) by excluding the early pneumonias.

Conclusion: Early pneumonia appears to be common in trauma patients intubated within the first 48 hours of admission. Identification of this process allows for prompt treatment of early respiratory infection, possibly due to aspiration events. Accounting for these patients that have a nidus of infection at admission significantly reduces reported VAP rates.

Figure: Diagnosis of Early Pneumonia in a Trauma Population



SESSION II: PRESIDENTIAL ADDRESS



“SURVIVORSHIP”

Wednesday, September 21, 2022

11:35 AM - 12:35 PM

Location: Grand Ballroom

Presenter: David Livingston, MD

AAST President

Wesley J. Howe Professor and Chief of
Trauma and Surgical Critical Care
Rutgers-New Jersey Medical School



SESSION IIIA: PAPERS 9-19

Wednesday, September 21, 2022

1:50 PM - 5:30 PM

Location: Grand Ballroom

Moderator: Roxie Albrecht, MD

Record: Ajai Malhotra, MD

EXTERNAL VALIDATION OF CRASH PROGNOSTIC MODEL IN AN URBAN TERTIARY CARE PUBLIC HOSPITAL

Devi Bavishi, MD; Asif Mulla, MBBS, MS; Monty Khajanchi, MBBS, DNB Surgery, FIAGES; Martin Gerdin Wärnberg, MD, PhD
Seth. G. S. Medical College & K.E.M. Hospital Mumbai, India
Invited Discussant: Joseph Forrester, MD

Introduction: Road traffic injury is the 7th most common cause of mortality in low income countries. Amongst road traffic injuries traumatic brain injuries (TBI) are the major cause of mortality and morbidity. The multicentre randomized control trial CRASH published a prediction model for traumatic brain injury patients to estimate prognosis. This prediction model was derived based on data from High Income and Low and Middle-Income Countries. The external validity of this prediction model was not assessed in Low and Middle-Income Countries. To fill this gap we aim to external validate the CRASH prediction model in TBI patients in India, a lower-middle income country.

Methods: It is a prospective observation study was done at General Surgery Department of an urban tertiary care public university hospital. Calibration and discrimination of CRASH model were evaluated in traumatic brain injuries (TBI) patients referred to the emergency department. Variables required for calculating CRASH predicted outcomes and observed 14 day mortality and 6 month unfavourable outcomes were gathered. The correlation of CRASH predicted and the observed outcome of the patients was evaluated. The data were analyzed using STATA version 14.0.

Results: In this study, 417 patients with the median age of 40 and range of 18-95 years were evaluated (83.7% male). Calibration of the basic and CT models in prediction of 14 day mortality and 6 month unfavourable outcome were in the desirable range ($P < 0.05$). The area under the ROC curve in basic and CT models in prediction of 14 day mortality were 0.885 (95% CI: 0.849-0.921) and 0.885 (95% CI: 0.849-0.921), respectively. In addition, Area under the ROC curve in basic and CT models in prediction of 6 month unfavourable outcome were 0.901 (95% CI: 0.871-0.938) and 0.896 (95% CI: 0.860-0.931), respectively. There was no significant difference between the discriminations of the models in prediction of 14 day mortality (basic $p = 0.082$, CT $p = 0.067$) and 6 month unfavourable outcome (basic $p = 0.688$, CT $p = 0.204$).

Conclusion: The results of this study showed that the CRASH basic and CT model both accurately predict 14 day mortality and 6 month unfavourable outcomes of TBI patients in an urban tertiary care public university hospitals of India.

ASSESSING TRAUMA READINESS COSTS IN LEVEL III AND LEVEL IV TRAUMA CENTERS

Dennis W. Ashley, MD; Regina S. Medeiros, RN; Kelli A. Vaughn, RN;
Gregory K. Patterson, MD; Alicia R. Register, MD Mercer University
School of Medicine

Invited Discussant: R. Shayn Martin, MD, MBA

Background: Readiness costs are real expenses incurred by trauma centers to maintain essential infrastructure providing emergent services on a 24/7 basis. Although the components for readiness are well described in the American College of Surgeon's *Resources for Optimal Care of the Injured Patient*, the cost associated with each component is not well defined. Previous studies have described readiness costs for level I and level II trauma centers based on these criteria. The purpose of this study was to quantify the cost of level III and level IV trauma center readiness.

Methods: The state trauma commission in conjunction with trauma medical directors, program managers, and financial staff of each trauma center standardized definitions for each component of trauma center readiness cost and developed a survey tool for reporting. Readiness costs were grouped into four categories: Administrative/Program Support Staff, Clinical Medical Staff, In-House Operating Room, and Education/Outreach. To verify consistent cost reporting, a financial auditor analyzed all data. Trauma center outliers were further evaluated to validate variances. All Level III/Level IV trauma centers (n=14) completed the survey on 2019 data.

Results: Average annual readiness cost is \$1,715,025 for a Level III trauma center and \$81,620 for Level IV centers. Among the costliest components were clinical medical staff for level III's and administrative costs for level IV's representing 54% and 97% of costs respectively. Although education/outreach is mandated, levels III and IV trauma centers only spend approximately \$8,000 annually on this category (0.8%–3%), demonstrating a lack of resources.

Conclusion: This study defines the cost associated with each component of readiness as defined in the *Resources for Optimal Care of the Injured Patient* manual. Average readiness cost for a level III trauma center is \$1,715,025 and \$81,620 for a level IV. The significant cost of trauma center readiness highlights the need for additional trauma center funding to meet the requirements set forth by the American College of Surgeons.

**ROUTINE POST-OPERATIVE LABS AND HEALTHCARE
SYSTEM BURDEN IN ACUTE APPENDICITIS**

Joshua A. Sznol, MD, MSPH; Kevin M. Schuster MD, MPH
Yale New Haven Hospital
Invited Discussant: Angela Ingraham, MD

Introduction: Data from the National Health Expenditure Accounts have shown a steady increase in healthcare cost paralleled by availability of laboratory tests and by the adoption of electronic medical records (EMR). Multiple societies have made attention to resource utilization, including reducing laboratory testing, a top priority for reducing health care costs and improving value. We hypothesized that there would be significant variation in perioperative resource utilization resulting in significant costs and healthcare system burden, in acute appendicitis (AA) management.

Methods: Patients presenting with uncomplicated AA from the years 2016-2020 admitted through the emergency department were identified by operative codes and ICD-10 codes across a large health system consisting of large academic and small community hospitals. Clinical variables, patient demographics, medication usage, and admission data were abstracted from the EMR. Electrolyte repletions and post-operative lab usage was determined. Abnormal and critical lab results were pre-defined by the hospital system. Correlations were determined with ANOVA with Bonferroni adjustment and negative binomial regression.

Results: 3724 patients with uncomplicated AA were identified. The average LOS for acute appendicitis was 41.9 hours with an average post-operative LOS of 9.6 hours. Half of patients (1840, 49.4%) had post-operative labs and 173 (9.4%) received non-critical electrolyte repletion. Total costs of labs (99.7%) and repletions (0.3%) were \$369,000. Post-operative time was associated with comorbidity, age, blood pressure, OR time, gender, blood pressure but not post-operative labs (Table 1). Patients with critically abnormal labs had on average four comorbidities compared to one in the remainder of the cohort.

Conclusions: In our patient population, post-operative labs resulted in significant costs but no significant change in outcomes as obtaining labs did not lead to findings that increased length of stay. Routine post-operative laboratory testing should be avoided in patients with minimal or no comorbidity as this likely increases cost without adding value.

RACIAL AND ETHNIC DISPARITIES IN INTERHOSPITAL TRANSFER FOR COMPLEX EMERGENCY GENERAL SURGERY

Stephanie E. Iantorno, MD; Joshua J. Horns, PhD; Brian T. Bucher, MD; Marta L. McCrum, MD

University of Utah School of Medicine
Invited Discussant: Adel Elkbuli, MD, MPH, MBA

Introduction: Interhospital transfer (IHT) for Emergency General Surgery (EGS) conditions is often required for patients with complex disease to access specialized resources. We evaluated if racial and ethnic disparities exist in the decision to transfer patients with complex EGS conditions.

Methods: A cross-sectional analysis of the 2019 Nationwide Emergency Department Sample was performed, identifying adults with 13 EGS conditions and complex disease using previously published ICD-10 codes for AAST severity scales. Multivariable logistic regressions were used to determine the association between race/ethnicity and IHT. We controlled for age, sex, Charlson Comorbidity Index, region, rurality, hospital ownership, and hospital teaching status (Model 1). As we hypothesized that income and primary insurance might mediate the relationship between race/ethnicity and IHT, we then added these variables (Model 2).

Results: Of 387,610 weighted ED visits to 989 hospitals, 59,395 (15.3%) patients were transferred. In Model 1, when compared to White patients, the adjusted odds of IHT was lower for Hispanic/Latino (aOR 0.79, 95% CI: 0.71-0.87) and Asian/Pacific Islander (aOR 0.74, 95% CI: 0.62-0.88) patients, with no differences noted for Non-Hispanic Black and Other race patients. In Model 2, these trends were preserved for all groups (Table). These findings were preserved in sub-analysis of rural/community hospitals most likely to transfer patients for higher level care.

Conclusion: In a nationally representative sample, patients of minority race/ethnicity presenting with complex EGS disease were less likely to be transferred than White patients, an association not explained by income or insurance status. Further work is needed to understand mechanisms of transfer disparities and how such inequities contribute to patient outcomes.

Table: Interhospital Transfer for Complex EGS by Race/Ethnicity

Race/Ethnicity	Rates of IHT	Model 1 aOR (95% CI), p-value	Model 2 aOR (95% CI), p-value
White	17.0%	Ref	Ref
Non-Hispanic Black	14.7%	1.03 (0.95-1.11), p=0.5	0.76 (0.88-1.04), p=0.30
Hispanic/Latino	9.0%	0.79 (0.71-0.87), p<0.001	0.75 (0.68-0.83), p<.001

**THE DICHOTOMY OF DEFINING VALUE IN HEALTHCARE:
COST ELIMINATION OF A MULTIPROFESSIONAL (mPATH)
TEAM LED TO INCREASED LOS**

Michael J. Avery, DO; Sariana Mendez Rodriguez, BS; Samuel W. Ross, MD, MPH; Kelly E. Sing, MPH; Ashley B. Christmas, MD, MBA; Kyle W. Cunningham, MD, MPH; Ronanld F. Sing, DO; Bradley W. Thomas, MD
Carolinas medical center

Invited Discussant: Weidun Alan Guo, MD, PhD

Intro: A multi-professional, acute trauma health care team (mPATH) was developed as a quality initiative to address resource intensive patients with severe traumatic brain injury (TBI) and spinal cord injuries (SCI) requiring tracheostomy. Despite demonstrating decreased length of stay (LOS) and perceived healthcare costs, the hospital administration withdrew support after 31 months and the dedicated team was dissolved. We sought to determine the impact of this decision on the outcomes of the TBI/SCI population since the dissolution of the mPATH team.

Methods: A retrospective cohort study was performed comparing patients pre mPATH team (2014), during mPATH team (2016), and for a two-year period following the dissolution of the mPATH team (2018-2019). Demographics were collected for all groups and specifically looking at patients with TBI/SCI requiring tracheostomy. The primary endpoint was hospital LOS; secondary endpoints included ICU LOS, step-down LOS, and inpatient mortality.

Results: There were 70 pre, 80 during, and 65 post mPATH patients. There were 14 (6.5%) deaths: 5.7 vs 3.8 vs 10.8%, $p=0.118$. Hospital LOS decreased with mPATH and then increased after funding was cut [Median (IQR): 27(21-31) vs 19 (15-26) vs 30 (23-51) days; $p<0.001$]. ICU LOS also increased [14 (10-18) vs 11 (8-16) vs 14 (11-20); $p<0.001$], Step-down LOS was increased [8(5-12) vs 7 (4-11) vs 13 (8-30) days $p=0.008$] and time to tracheostomy was increased (9 vs 7 vs 8 days).

Conclusion: The administrative withdraw of financial support for a multi-professional health care team dedicated to the resource intensive patients with severe TBI and SCI requiring tracheostomy led to significant increases in ICU-LOS, hospital LOS, and increased time to tracheostomy. Administrative and clinical alignment of value for our patients is vital to their improved outcomes.

EVALUATION OF AN EVIDENCE-BASED, COMPREHENSIVE CLINICAL DECISION SUPPORT SYSTEM IMPLEMENTED AT 9 U.S. TRAUMA CENTERS FOR PATIENTS WITH TRAUMATIC RIB FRACTURES

Emma K. Jones, Matthew Bahr, Ivana Ninkovic, Sarah Dodge, Michael Doering, David Martin, Julie Ottosen, Greg Beilman, Tadashi Allen, Genevieve B Melton, Christopher J Tignanelli
University of Minnesota
Invited Discussant: Daniel Margulies, MD

Introduction: Traumatic rib fractures are associated with high morbidity and mortality. Clinical decision support systems (CDSS) have been shown to improve adherence to evidence based (EB) practice, reduce health disparities, and improve clinical outcomes. The objective of this study was to investigate if a rib fracture CDSS care map implemented across 9 U.S. trauma centers reduced hospital length of stay (LOS). A secondary objective was to investigate the independent association of EB practices on clinical outcomes.

Method: The CDSS was scaled across 9 U.S. trauma centers. The CDSS included the following modules: risk stratification, NEXUS Chest CT tool, surgical rib stabilization tool, admission order bundle, RibScore documentation support, PIC early warning system (EWS), nursing Brain, and a post-discharge monitoring application. Implementation began 11/2020 and the CDSS was scaled across all trauma centers by 7/2021. All emergency department (ED) and transfer patients ≥ 18 years old with rib fractures from 7/2015-1/2022 were included. Multivariable logistic and negative binomial regression models were risk-adjusted for the trauma mortality prediction model (TMPM), age, sex, admitting hospital, elixhauser comorbidity index, and the following ED results: pain level, incentive spirometry (IS) level, respiratory rate, heart rate, oxygen saturation, systolic blood pressure, temperature, respiratory support, carbon dioxide level, creatinine, hemoglobin, and sodium.

Results: 1640 patients met inclusion criteria (1453 PRE, 187 POST). On risk-adjusted analysis, LOS significantly decreased following the intervention (IRR 0.79, 95% CI 0.66-0.93, $p=0.01$) representing a 1 day reduction in the predicted probability of median hospital LOS (PRE: 4.1 days, POST: 3.2 days). There was not a significant reduction in mortality (PRE: 2.6%, POST: 1.2%, OR 0.45, 95% CI 0.02-11.5, $p=0.6$) or ICU admission (PRE: 12.7% POST: 5.8%, OR 0.32, 95% CI 0.09-1.17, $p=0.08$). Provider utilization of the admission order bundle was 52% (peak 75%). Rates of the following EB practices increased following implementation: rib fixation for patients with flail chest (13.0% to 25.0%), neuraxial blockade for patients stratified as severe risk (4.5% to 7.0%), IS utilization and documentation (41.4% to 63.6%), and adherence with the NEXUS Chest CT criteria (64.0% to 84.0%). The EWS fired on 58.9% of patients, proper adherence to the recommendation made by the EWS (provider notified) was 48.2%. The integration of the EWS was associated with a significant reduction in median hospital LOS (2.88 to 3.17 days, $p=0.03$). EWS triggers in response to tachycardia (IRR 3.44, $p=0.02$), cough (IRR 5.15, $p=0.04$), and IS volume (IRR 1.63, $p=0.05$) were most associated with increased hospital LOS.

A novel, user-centered, comprehensive CDSS improves adherence to the following EB practices: rib fixation for flail chest, neuraxial blockade, IS use, and NEXUS Chest CT and is associated with a significant reduction in hospital LOS.

CASE VOLUME AND RATE ARE ASSOCIATED WITH OUTCOMES IN GERIATRIC TRAUMA: A CASE FOR GERIATRIC TRAUMA CENTERS?

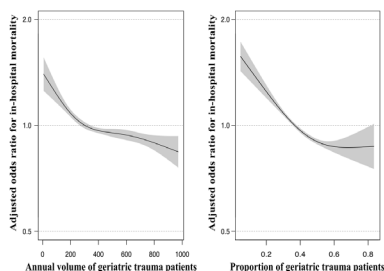
Mitsuaki Kojima, MD; Akira Endo MD, PhD; Bishoy Zakhary, MPH;
Tomohisa Shoko, MD, PhD; Matthew Firek BS; Raul Coimbra, MD, PhD
Tokyo Women's Medical University Adachi Medical Center
Invited Discussant: Jody DiGiacomo, MD

Introduction: Increased morbidity and mortality in geriatric trauma patients are usually due to decreased physiologic reserve and increased comorbidities. It is unclear whether geriatric trauma case volume and rates, compared to non-geriatric patients, are correlated to a survival benefit. We hypothesized that geriatric patients would have increased survival when treated in high case volume and rate trauma centers.

Methods: A retrospective cohort study using the TQIP database (2015 – 2019) was conducted. Geriatric trauma patients (65 years and older) with severe injury ($ISS \geq 16$) were included. Geriatric case volume (GCV) was defined as the mean annual number of treated geriatric trauma patients, whereas geriatric case rate (GCR) was the number of elderly trauma patients divided by all trauma patients in each center. Trauma centers were classified into low-, medium-, and high volume and rate facilities based on GCV and GCR. The association of GCV and GCR with in-hospital mortality was assessed using Generalized Additive Model (GAM) and Multivariate Generalized Linear Mixed Model (GLMM) adjusted for patient characteristics (age, sex, ISS, Revised Trauma Score, and modified Frailty Index) and hospital-level factors (random effect variable).

Results: A total of 170,429 geriatric trauma patients from 810 trauma centers were included. The GAM plots showed that the adjusted odds of in-hospital mortality decreased according to the increase in GCV and the GCR (Figures). The GLMM model revealed that both high-GCV and high-GCR centers had lower observed mortality rates compared to low GCV and GCR centers (AOR [95% CI] of high-GCV and high-GCR centers = 0.82 [0.72–0.92] and 0.81 [0.73-0.90], respectively).

Conclusion: High geriatric trauma center volume and rates were associated with decreased mortality of geriatric trauma patients. Consolidation of care for elderly patients with severe injury in specialized high-volume centers may be considered.



WHEN MINUTES MATTER: PREHOSPITAL TRANSFUSION REDUCES MORTALITY IN PEDIATRIC TRAUMA

Katrina M. Morgan, MD; Elissa Abou-Khalil, MD; Stephen Strotmeyer,
PhD; Ward M. Richardson, MD; Barbara A. Gaines, MD; Christine M.
Leeper, MD, MSc

Children's Hospital of Pittsburgh of UPMC

Invited Discussant: Jeffrey Upperman, MD

Background: Optimal hemostatic resuscitation in pediatric trauma is not well-defined. The study objective was to assess the impact of prehospital (PH) transfusion in injured children.

Methods: The Pennsylvania Trauma Outcomes Study database was queried for children 0-18 years who received a PH blood transfusion from 2009-2019. Interfacility transfers were excluded. The primary outcome was 24-hour mortality. Propensity Score Matching was performed accounting for age, sex, race, insurance status, injury mechanism and severity score, shock index, and Glasgow Coma Score. Secondary outcomes included in-hospital mortality and complications.

Results: Of 31,343 children who were transported to a Pennsylvania trauma center directly from the scene, n=3,140 (10%) were in shock and n=100 (0.3%) received PH blood transfusions. At baseline, the PH transfusion group had higher ISS (17(6-29) vs 6(4-11)), older age (15(10-17) vs 11(4-16) years), more commonly sustained penetrating trauma (21% vs 11%) and were in shock (41% vs 10%). Unadjusted 24-hour mortality was greater in the transfusion group (16% vs 2%), however, after propensity-matching to adjust for the confounders listed above, PH transfusion was associated with a statistically and clinically significant reduction in 24-hour mortality (12.8% vs 16.3%; p=0.044). The number needed to treat to save one child's life is 28. On adjusted analysis, the PH transfusion group had significantly decreased in-hospital mortality (18.6% vs 19.8%; p=0.05).

Conclusion: Prehospital transfusion is rare in injured children but is independently associated with increased survival, suggesting that bleeding pediatric patients benefit from early hemostatic resuscitation. Though the logistics of PH blood product programs are complex, strategies to shift hemostatic resuscitation toward the immediate post-injury period should be pursued.

ARE WE WAITING FOR THE SKY TO FALL? PREDICTORS OF WITHDRAWAL OF LIFE-SUSTAINING SUPPORT IN GERIATRIC TRAUMA PATIENTS

Avanti Badrinathan, MD; Vanessa Ho, MD; Glen Tinkoff, MD; Olivia Houck, MPH; Daniel Vazquez, MD; Monica Gerrick, PhD; Ann Kessler, MD; Amy Rushing, MD

University Hospital Cleveland Medical Center

Invited Discussant: Miriam Bullard, MD

Introduction: Scarce data exist regarding the impact of advanced care planning on trauma management for injured geriatric patients. We hypothesized that patients with advance directives limiting care (ADLC) compared to those without ADLC are more likely to undergo withdrawal of life-sustaining support (WLSS).

Methods: This is a retrospective study of ACS TQIP patients ≥ 65 years entered from 2017-2018, excluding those who died within 24 hours. Patients with ADLC on admission were compared to those without ADLC. The primary outcome was WLSS and days prior to WLSS. Additional factors examined included hospital LOS, unplanned operations, unplanned ICU admissions, and in-hospital cardiac arrests. Patients with and without ADLC were compared, using Student's t-test for continuous and χ^2 for binary variables. A logistic regression model assessed factors associated with WLSS.

Results: 597,840 patients were included: 44,001 patients with an ADLC (7.4%) compared to 553,839 with no ADLC (92.6%). Clinical characteristics were comparable between groups, with median GCS of 15 and median ISS 9 ($p > 0.05$). Patients with an ADLC underwent WLSS more often than those with no ADLC (8.6% vs 2.9%, $p < 0.001$) and were hospitalized fewer days until WLSS (5.3 vs. 6.6, $p < 0.001$). Patients with ADLC were more likely to undergo WLSS (OR 3.14, 95% CI 3.02-3.26), although stronger predictors of WLSS included unplanned operations (OR 5.69, 95% CI 4.93-6.56), unplanned ICU admissions (OR 5.27, 95% CI 4.99-5.57), and in-hospital cardiac arrests (OR 12.60, 95% CI 11.71-13.53).

Conclusion: A small proportion of the geriatric trauma population had ADLC on admission. While ADLC was predictive of WLSS, adverse events were more strongly associated with WLSS. To ensure patient-centered care, surgeons should delineate goals of care early regardless of ADLC. Consequently, this may lead to a decrease in interventions that are of no benefit to the patient.

PREDICTORS OF CARE DISCONTINUITY IN GERIATRIC TRAUMA

Manuel Castillo Angeles, MD, MPH; Cheryl K. Zogg, PhD, MSPH, MHS;
Molly P. Jarman, PhD, MPH; Reza Askari, MD; Stephanie Nitzschke, MD;
Zara Cooper, MD; Ali Salim, MD; Joaquim Havens, MD

Brigham & Women's Hospital
Invited Discussant: Jay Yelon, DO

Objectives: Readmission to a non-index hospital, or care discontinuity, has been shown to have worse outcomes among surgical patients. Little is known about its effect on geriatric trauma patients. Our goal was to determine predictors of care discontinuity and to evaluate its effect on mortality in this geriatric population.

Methods: This was a retrospective analysis of Medicare inpatient claims (2014-2015) of geriatric trauma patients. Care discontinuity was defined as readmission within 30 days to a non-index hospital. Demographic and clinical characteristics (including readmission diagnosis category) were collected. Multivariate logistic regression analysis was performed to identify predictors of care discontinuity and to assess its association with mortality.

Results: We included 754,313 geriatric trauma patients. Mean age was 82.13 (SD 0.50), 68% were male and 91% were white. 21,615 (2.87%) were readmitted within 30 days of discharge. Of these, 34% were readmitted to a non-index hospital. Overall, 30 day-mortality after readmission was 25%. In unadjusted analysis, readmission to index hospitals was more likely to be due to surgical infection, GI complaints, or cardiac/vascular complaints. After adjusted analysis, predictors of care discontinuity are shown in the table. Care discontinuity was not

associated with mortality (OR 0.93, 95% Confidence Interval 0.86–1.01).

Conclusions: More than a third of geriatric trauma patients are readmitted to a non-index hospital, which is driven by readmission diagnosis, travel time and hospital characteristics. However, unlike other surgical settings, this care discontinuity is not associated with increased mortality. Further work is needed to understand the reasons for this and to determine which standardized processes of care can benefit this population.

Odds of Care Discontinuity		
Variables	Adjusted OR	95% CI
Age	0.98	0.97 – 0.99
Injury Severity Score	1.02	1.01 – 1.03
Charlson Comorbidity Index	0.95	0.94 – 0.98
Hospital size (>=200 beds)	0.75	0.69 – 0.82
Region (ref. Northeast)		
Midwest	1.16	1.05 – 1.28
South	1.51	1.38 – 1.64
West	1.21	1.08 – 1.36
Travel time (mins)	0.99	0.98 – 0.99
Readmission Diagnosis (ref. Others)		
Surgical Infection	0.38	0.33 – 0.43
GI Complication	0.59	0.53 – 0.67
Cardiac Complication	0.75	0.68 – 0.82
Admitting Hospital (Ref. Level 1)		
Level 2 Trauma Center	0.65	0.59 – 0.73
Level 3 Trauma Center	0.59	0.52 – 0.67
Non-Trauma Center	0.59	0.53 – 0.66

EARLY SURGICAL STABILIZATION OF RIB FRACTURES FOR FLAIL CHEST IS ASSOCIATED WITH IMPROVED PATIENT OUTCOMES

Alexander Simmonds, MD; Kyle Alexander, MS; Alex Simmonds, MD; Julia Smolen, MS; Mathew Ciurash, MS; Yahya Alwatari, MD; James Whelan, MD; Jonathan Bennett, MD; Stefan Leichtle, MD, FACS; Michel Aboutanos, MD, MPH, FACS; Edgar Rodas, MD, FACS
Virginia Commonwealth University Medical Center
Invited Discussant: Babak Sarani, MD

Introduction: Rib fractures are a common injury associated with thoracic trauma. Increasingly, patients with flail segments are being treated with surgical stabilization of rib fractures (SSRF). We sought to review the Trauma Quality Improvement Program (TQIP) database to determine if a difference in outcomes exists in patients undergoing early SSRF (< 3 days) vs late SSRF (> 3 days).

Method: TQIP data from 2017-2019 was examined. Patients with flail chest were identified by CPT code, assessing those who underwent SSRF. We excluded those under age 18 and AIS head severity scores greater than 3. Patients were grouped based on SSRF before and after hospital day 3. These patients were case matched based on initial GCS, ISS score, and AIS chest score. All data was examined using χ^2 , Student t-test* and Fisher's Exact Test within SPSS version 28.0.

Results: Over 3 years, 20,324 patients were noted to have flail chest, and 3,345 (16.46%) of these patients underwent SSRF. After case matching, 319 patients were found in each group. No significant difference existed between any major comorbidities reported. Patients with early SSRF had less unplanned intubations (8.2% Vs. 14.1%, p=0.017), less total ventilator days (9.16 days \pm 8.70 Vs. 11.75 \pm 9.12 p=0.006), ICU length of stay (9.59 days \pm 8.58 Vs. 13.28 days \pm 9.58 p<0.001) and hospital length of stay (14.55 \pm 9.28 vs 20.64 \pm 11.87, p<0.001). Cases with early plating had statistically significant lower rate of DVT, Ventilator Acquired Pneumonia, and sepsis. No difference existed in mortality (3.4% vs 1.6%, p=0.129).

Conclusion: In trauma accredited centers patients with flail chest who undergo early SSRF (< 3 days) had improved outcomes including less unplanned intubation, decreased ventilator days, decreased ICU LOS and HLOS, decreased PNA, DVT, and sepsis.



SESSION IIIB: PAPERS 20-30

Wednesday, September 21, 2022

1:50 PM - 5:30 PM

Location: Grand Ballroom

Moderator: Christopher Michetti, MD

Recorder: Lisa Kodadek, MD

TRIAL OF ANTIBIOTIC RESTRAINT IN PRESUMED PNEUMONIA

Christopher A. Guidry, MD; Robel T. Beyene, MD; Christopher M. Watson, MD; Robert G. Sawyer, MD; Lynn Chollet-Hinton, PhD; Steven Q. Simpson, MD; Leanne Atchison, PharmD; Michael Derickson, MD; Lindsey C. Cooper, PharmD; George P. Pennington, II, MD; Sheri Vandenberg, RN; Bachar N. Halimeh, MBBS; Jacob C. O'Dell, MD
University of Kansas Medical Center
Invited Discussant: John Agapian, MD

Background: Pneumonia is the most common hospital-acquired infection in the trauma and emergency general surgery population. Despite guidelines urging aggressive antibiotic use, data supporting aggressive antibiotic initiation in cases of suspected infection is limited. Our hypothesis was that a protocol of ‘conservative’ antibiotic initiation would have similar compliance and outcomes to an ‘aggressive’ strategy.

Methods: To test our hypothesis, we devised a pragmatic cluster-randomized crossover trial. Four Surgical Intensive Care Units were randomized to either an ‘aggressive’ or ‘conservative’ antibiotic initiation protocol for intubated patients in whom a bronchial culture was obtained. In the ‘aggressive’ arm antibiotics were started immediately after the culture regardless of patient status. In the ‘conservative’ arm antibiotics were delayed until objective gram stain or culture results suggested infection. If the patient was in septic shock antibiotics were started immediately. Each arm of the study ran for 4 months followed by a washout period and 4-month cross-over to the opposite arm. Outcomes were protocol compliance, all-cause 30-day mortality, and ventilator-free alive days at 30 days. Standard statistical techniques were applied.

Results: 186 patients had 244 total cultures of which only the first was analyzed. 93 patients (50%) were enrolled in each arm. 97.8% were Trauma or EGS patients. There were no differences in demographics, comorbidities, SOFA, APACHE II or Injury Severity Scores. Antibiotics were started significantly later in the ‘conservative’ arm (0 vs 9.3 hours; $p < 0.0001$) with 19 (20.4%) patients avoiding antibiotics completely for that episode. There was no difference in the rate of protocol adherence (74.2% vs 82.8%; $p = 0.15$). There were no differences in 30-day mortality (18.3% vs 18.3%) or ventilator-free alive days at 30-days (7 vs 8 days; $p = 0.6$).

Conclusion: In this cluster-randomized crossover trial, we found similar compliance rates between ‘aggressive’ and ‘conservative’ antibiotic initiation strategies. Delayed or ‘conservative’ antibiotic initiation in patients with a suspected hospital-acquired pneumonia did not result in worse clinical outcomes compared to ‘aggressive’ initiation.

ELEVATED PLASMA SERPINB1 IS A MARKER OF IMMUNE DYSREGULATION PREDICTIVE OF POST-INJURY OUTCOMES

Terry Schaid, MD; Margot DeBot, MD; Ernest E. Moore, MD, FACS; Angela Sauaia, MD, PhD; Alexis Cralley, MD; Christopher Erickson, PhD; Ian Lacroix, MD; Christopher Silliman, MD, PhD; Angelo D'Alessandro, PhD; Kirk Hansen, PhD; Mitchell J. Cohen, MD, FACS

University of Colorado at Denver
Invited Discussant: Lawrence Diebel, MD

Introduction: Serine protease inhibitors (serpins) regulate multiple proteolytic cascades. SerpinB1, an intracellular serpin, is vital to neutrophil function. We hypothesized that aberrations in plasma serpinB1 levels, reflective of disrupted neutrophil homeostasis, are associated with injury severity and clinical outcomes.

Methods: Blood was collected from injured patients at a Level I Trauma Center as part of the COMBAT study. Plasma proteomics were performed using liquid chromatography coupled with mass spectrometry. Mann-Whitney tests, Kruskal-Wallis tests, and multiple linear regression were used to analyze association between injury, serpinB1 levels, and clinical outcomes.

Results: Patients with NISS>25 and base deficit (BD) >10mEq/L had elevated serpinB1 levels on emergency department (ED) arrival (Figure 1A). ED SerpinB1 was elevated in non-survivors, patients with ≤ 25 ventilator-free days (VFD), and patients with ≤ 23 ICU-free days (IFD; $P < 0.0001$, Figure 1B-D). Independently of NISS and BD in multiple regression, elevated ED serpinB1 was associated with fewer VFD and IFD ($P < 0.05$). SerpinB1 levels at 24 hours returned to those of healthy controls ($P < 0.01$).

Conclusions: SerpinB1 plasma levels are elevated early after severe injury and are independently associated with adverse outcomes. SerpinB1 is an early marker of immune dysregulation that may stratify trauma patients at risk for inflammatory complications. Mechanisms of elevated serpinB1 are unclear but may involve neutrophil lysis and extracellular trap release, which occurs following severe injury. Comprehensive proteomics with animal models will clarify the role of serpinB1 in the global immunological signature related to adverse outcomes post-injury.

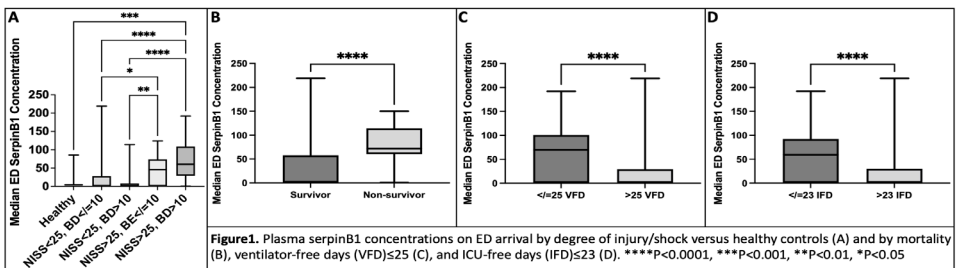


Figure 1. Plasma serpinB1 concentrations on ED arrival by degree of injury/shock versus healthy controls (A) and by mortality (B), ventilator-free days (VFD) ≤ 25 (C), and ICU-free days (IFD) ≤ 23 (D). **** $P < 0.0001$, *** $P < 0.001$, ** $P < 0.01$, * $P < 0.05$

EARLY TRACHEOSTOMY IN POLYTRAUMA PATIENTS IS ASSOCIATED WITH IMPROVED OUTCOMES

Edgar Rodas, MD; Alexander Simmonds, MD; Christopher Liu, MS; Yahya Alwatari, MD; Luke Wolfe, MS; Hiba Ezzeddine, MD; Stefan Leichtle, MD, FACS; Michel Aboutanos, MD, MPH, FACS
Virginia Commonwealth University Medical Center
Invited Discussant: Bryce Robinson, MD, MSc

Introduction: Early tracheostomy is beneficial in certain patient populations, but insufficient evidence exists to inform the timing of tracheostomy for the general trauma population. We sought to use the Trauma Quality Improvement Program (TQIP) database to examine if patients undergoing early tracheostomy had improved outcomes. **Methods:** TQIP data from 2017-2019 was examined. Patients undergoing tracheostomy were identified using ICD procedure codes. Those with AIS head severity scores more than 3 or that died within 48 hours of admission were excluded. Cases were identified as undergoing early tracheostomy (3-7 days) or late tracheostomy (8-21 days). Propensity score matching was then used to control for NSQIP frailty index comorbidities as well as AIS head injury scores, ISS scores, and anticoagulation usage. Data was examined using χ^2 , Student t-test* and Fisher's Exact Test within SAS version 9.4. **Results:** 15,807 patients were identified undergoing tracheostomy in the 3 years examined. After matching, 4,295 patients remained in each group. Age (46.0 years vs 47.0 p=0.0041), BMI (27.2 vs 27.4, p=0.03), and ISS (18.0 vs 17.0, p=0.0005) were similar between groups. No significant difference existed in major comorbidities or injury mechanism. Early tracheostomy was associated with significantly shorter ICU length of stay (14.1 days \pm 12 vs 24.2 \pm 12, p<0.001), total length of stay (20.5 days \pm 16 vs 31.4 \pm 18, p<0.001), and ventilator days (11.4 days \pm 10 vs 19.9 \pm 12, p<0.001) Early tracheostomy was also associated with significantly lower rates of unplanned intubation (7.7% vs 20%, p<0.0001) and higher rates of discharge to home (34.2% vs 18.4%, p<0.001). There was no significant difference in mortality (4.8% vs 4.6%, p=0.68). **Conclusion:** Early tracheostomy in severely injured patients without head trauma is associated with shorter length of ICU and total hospital stay, reduced ventilator days, and increased rates of home discharge.

VENOUS THROMBOEMBOLISM RISK AFTER SPINAL CORD INJURY: A SECONDARY ANALYSIS OF THE CLOTT STUDY

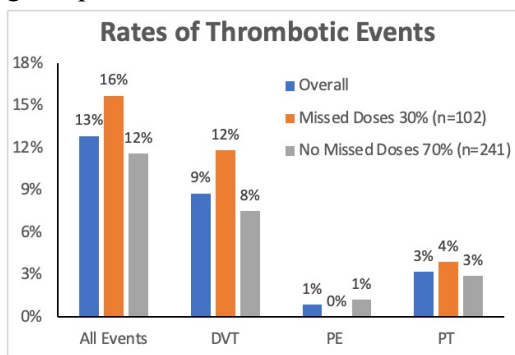
Laura Godat, MD, FACS; Elliott Haut, MD PhD; Ernest E. Moore, MD, FACS; M. Margaret Knudson, MD; Todd W. Costantini, MD
UCSD

Invited Discussant: Jeremy Cannon, MD

Introduction: Patients with spinal cord injury (SCI) are at high risk of venous thromboembolism (VTE). Pharmacologic VTE prophylaxis (VTE ppx) is frequently delayed in patients with SCI due to concerns for bleeding risk. Here, we hypothesized that delaying VTE prophylaxis until ≥ 48 hours would be associated with increased risk of thrombotic events.

Methods: This is a secondary analysis of the prospective, observational, cohort CLOTT study of patients age 18-40 from 2018-2020 at 17 US Level 1 trauma centers. Patients admitted for > 48 hours with a diagnosis of SCI were evaluated. Timing of initiation of VTE ppx, rates of thrombotic events (Deep vein thrombosis (DVT), pulmonary embolism (PE) or de novo pulmonary thrombosis (PT)) and missed VTE ppx doses were analyzed. The primary outcome was VTE (DVT and PE). Secondary outcomes included de novo PT and bleeding complications.

Results: There were 343 patients identified with SCI. The mean age was 29.0 ± 6.6 years, 77.3% were male and 78.7% blunt mechanism. There were 44 patients (12.8%) with thrombotic events: 30 (8.7%) DVT's, 3 (0.9%) PE's and 11 (3.2%) PT's. Only 21.3% of patients



started VTE ppx at ≤ 24 hours, this increased to 48.7% at ≤ 48 hours. The VTE rate was high overall at 9.6%; however, the VTE rate was lower in patients starting VTE ppx within 48 hours (6.6% vs 12.5%, $p=0.063$). There was no difference in the number of patients with an abdominal AIS >3 that started VTE ppx ± 48 hours suggesting that associated solid organ injury did not limit timely initiation of VTE ppx. Missed doses of VTE ppx were common (30%) and associated with higher rates of thrombotic events (graph). **Conclusion:** Rates of thrombotic events in patients with SCI are high. Prompt initiation of VTE ppx and avoiding missed doses is critical to limit thrombotic events in high-risk patients with SCI.

**IMPACT OF WHOLE BLOOD LEUKOREDUCTION ON
OUTCOMES IN TRAUMA PATIENTS, A MULTICENTER
RETROSPECTIVE REVIEW**

Marissa Beiling, DO; Bradley Rittenhouse, MD; Alicia J. Johnson, MPH; S.
James El Haddi, MD, MS; Alexandra Adams, MD, MPH; Jason S.
Radowsky, MD; Jennifer Gurney, MD; Martin A. Schreiber, MD
Oregon Health & Science University
Invited Discussant: Jon Simmons, MD

Background: Whole blood transfusion has been widely adopted for the management of traumatic hemorrhage in both military and civilian settings. In prehospital or resource limited settings, the logistical ease of transfusion makes cold-stored low titer Group O whole blood (LTOWB) a pragmatic option for balanced resuscitation. However, LTOWB is frequently leukoreduced for use in civilian hospitals, which is known to decrease both platelet number and function. In this study, we compared outcomes in non-leukoreduced LTOWB use at a military Level I trauma center in the US (MIL) to leukoreduced LTOWB use at a civilian Level I trauma center (CIV.)

Methods: All trauma patients who received an emergent transfusion of LTOWB between 7/1/2016 and 10/15/2019 at MIL and CIV were retrospectively analyzed for outcomes and blood product utilization. Patients who expired or received CPR within 30 minutes of arrival were excluded. A logistic regression model was used to compare 30-day mortality between institutions. Hospital and ICU free days, and number of transfusions were compared using Wilcoxon rank sum tests. Mortality and complication rates were compared using chi-square tests or Fisher's exact tests as appropriate.

Results: 447 patients were included in the analysis. There was no significant difference seen in mortality by institution (19.0% CIV, 22.9% MIL, $p = 0.703$), when controlling for age, sex, mechanism, and prehospital transfusion. There was also no difference observed between institutions in ICU FD ($p = 0.42$), or HFD ($p = 0.28$). Significantly fewer MIL patients (3.2%) developed AKI compared to CIV patients (11.7%), $p < 0.001$. Whole blood, platelet, RBC, plasma, and cryo transfusions were all significantly less in MIL patients (all p -values < 0.001 .)

Conclusion: Our model demonstrated a higher rate of AKI at CIV and increased blood transfusion requirements, but otherwise did not reveal statistically significant associations in outcomes for patients receiving non-leukoreduced vs leukoreduced LTOWB.

COMPUTED TOMOGRAPHY FIRST RESUSCITATION WITH HYBRID EMERGENCY ROOM FOR SEVERELY INJURED PATIENTS

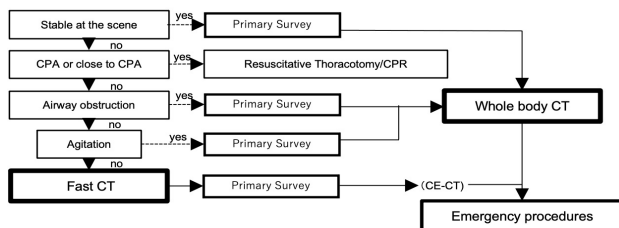
Satomi Senoo, MD; Shokei Matsumoto, MD; Masayuki Shimizu, MD;
Tomohiro Funabiki, PhD
Saiseikai Yokohamashi Tobu Hospital
Invited Discussant: Christine Gaarder, MD, PhD

Introduction: The introduction of hybrid emergency room with high-speed computed tomography (CT) scan has dramatically changed the management for severely injured patients in some centers in Japan. We developed CT first resuscitation (CTFR) strategy in hybrid ER with the goal of minimizing the time to identification of critical injuries and the definitive treatment (Fig 1). The purpose of this study was to provide a current descriptive outline of our experience with CTFR over two years.

Methods: All patients who met CTFR criteria during the first two years of starting the strategy (2019 to 2021) at a Japanese trauma center were compared with those during the previous two years (2017 to 2018). CTFR criteria included presumptive hemorrhage shock on pre-hospital vital signs. Demographics, injury patterns, interventions, time from arrival to CT and intervention, adverse event related to CTFR, and outcome were analyzed.

Results: Ninety-five patients who met the inclusion criteria were identified: 49 in the CTFR group and 46 in the non-CTFR group. There were no differences in the patient's characteristics between the two groups. Median door to CT initiation time was significantly shorter in the CTFR group than those in the non-CTFR group (1.5 [0.6-4.0] minutes vs 15.0 [8.8-23.0] minutes; $P < 0.001$). Median scan time using the setting for CTFR (Fast CT) was 56 [15.0-284] seconds. During CT scans, no patient was aggravated in hemodynamic status in both groups. However, there was no statistical difference in the mortality (14.0% vs 4.3%; $P=0.098$), the time of hemostatic intervention (55.5[24.8-92.5] minutes vs 69.0 [48.0-94.0] minutes; $P = 0.487$), the amount of red blood transfusion (0 [0-4] units vs 0 [0-8] units; $P = 0.562$) between the two groups.

Conclusion: CTFR facilitated timely trauma management without adverse events. This novel strategy was not associated with increased mortality. A further prospective study including optimal patient selection is warranted.



MULTICOMPARTMENTAL TRAUMA ALTERS BONE MARROW ERYTHROBLASTIC ISLANDS

Lauren S. Kelly, MD; Jennifer A. Munley, MD; Kolenkode B. Kannan, PhD; Erick E. Pons, BS; Philip A. Efron, MD, FACS, FCCM; Alicia M. Mohr, MD, FACS, FCCM

University of Florida College of Medicine

Invited Discussant: Timothy Pritts, MD

Introduction: Trauma is associated with widespread inflammation, neuroendocrine activation, and an inadequate bone marrow response to anemia. During late-stage erythropoiesis, erythroid progenitors/erythroblasts form clusters on the surface of specialized bone marrow (BM) macrophages where they are supported through terminal differentiation and enucleation. We hypothesized that these erythroblastic islands (EBIs) are adversely impacted by multicompartmental polytrauma (PT).

Methods: Groups (n=3-7/group) included male Sprague-Dawley rats subjected to either polytrauma (PT) (lung contusion, hemorrhagic shock, cecectomy, bifemoral pseudofracture, and 50% shed blood resuscitation), PT plus 2 hours daily chronic stress in a restraint cylinder (PT+CS), or naïve controls. Rats were sacrificed on either day 2 or 7. Nuclear-stained, enriched BM EBIs were fixed and stained for CD71, VCAM-1, and CD163, and confocal images were obtained at 20x magnification. Numbers of erythroid cells/EBI and ratio of reticulocytes/EBI were counted by a blinded observer. Differences were compared using ANOVA, with significance defined as * $p < 0.05$. Data presented as mean \pm SD.

Results: PT and PT+CS had significantly reduced numbers of erythroid cells per EBI on day 2 when compared to naïve (PT: $5.9\pm 1.0^*$, PT+CS: $6.8\pm 0.8^*$ vs. naïve: 8.5 ± 0.8 cells). On day 7, the number of erythroid cells/EBI increased following PT (8.3 ± 0.4 cells), but remained reduced following PT+CS ($5.9\pm 0.5^*$ cells). This corresponded to an increased proportion of reticulocytes/EBI on day 7 following PT alone, which was not present following PT+CS (PT: $54\%^*$ vs. PT+CS: 28%).

Conclusion: Late-stage erythropoiesis was altered following multicompartmental polytrauma early after injury and these alterations persist with the addition of daily chronic stress. Alterations in EBI structure and function after severe trauma and critical illness may serve as a promising new area of study to improve mechanistic understanding of persistent anemia after trauma.

PROSPECTIVE VALIDATION OF K/iCA RATIO AS A PREDICTOR FOR MORTALITY IN SEVERE HEMORRHAGE

Brennan Gagen, BS; Michael Ghio, MD; Abby Duplechain, BS; Danielle Krakosky, BS; John T. Simpson, MD; Danielle Tatum, PhD; Juan

Duchesne, MD, MPH

Tulane School of Medicine

Invited Discussant: Abhijit Pathak, MD

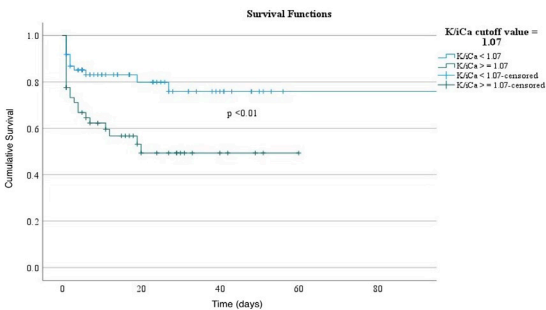
Background: Patients receiving massive transfusion protocol (MTP) are at risk for post-transfusion hypocalcemia and hyperkalemia due to citrate-containing blood. This prospective study sought to validate previous retrospective analysis indicating the value of the potassium/ionized calcium (K/iCa) ratio as a predictor for mortality in patients receiving MTP.

Methods: This is a prospective analysis of adult trauma patients from 2019-2021 who received MTP at a Level 1 trauma center. K and iCa lab values were collected after the start of MTP. A receiver operating characteristic (ROC) curve was used to establish a K/iCa ratio cut-off. Kaplan-Meier (KM) survival analysis and Cox regression model determined the prognostic capability of the K/iCa ratio on survival.

Results: A total of 110 MTP patients were included in the study. Deceased patients had a significantly higher median K/iCa ratio compared to those who survived ($p < 0.01$). As seen in Figure 1, The KM survival curve demonstrated a strong prognostic indicator of mortality for the K/iCa ratio ($p < 0.01$). Cox regression showed a significant association between K/iCa and mortality (HR 2.15, 95% CI 1.28-3.61, $p = 0.004$). Median emergency department (ED) Glasgow Coma Score (GCS) was significantly lower in deceased patients ($p < 0.01$), but there was no significant difference in ED systolic blood pressure (SBP), heart rate (HR), or shock index.

Conclusion: This evidence further highlights the importance of the K/iCa ratio in predicting mortality for patients receiving MTP and post-transfusion K levels along with iCa should be carefully monitored in the MTP setting.

Figure 1: KM Survival Analysis of the K/iCa ratio



PLATELET AND CRYOPRECIPITATE TRANSFUSIONS FROM FEMALE DONORS HAVE IMPROVED HEMOSTATIC POTENTIAL

Margot DeBot, MD; Marguerite Kelher, MD; Terry Schaid, MD; Ernest E. Moore, MD, FACS; Alexis Cralley, MD; Ian Lacroix, MD; Christopher Erickson, PhD; Angelo D'Alessandro, PhD; Kirk Hansen, PhD; Mitchell J. Cohen, MD, FACS; Christopher Silliman, MD, PhD; Julia Coleman, MD
University of Colorado

Invited Discussant: Carrie Sims, MD

Introduction: Females are relatively hypercoagulable compared to males, but the impact of transfusing female blood products remains unclear. We hypothesize that transfusion of female (F) blood products optimizes hemostatic capacity compared to male (M) blood products.

Methods: Sex dimorphisms in coagulation assays and total fibrinogen (Fbg) measured via mass spectroscopy were compared in healthy volunteers. The effect of transfusions from F versus M donors was evaluated using an *in vitro* coagulopathy model. F or M platelets (plt) or single-donor cryoprecipitate (cryo) was added to “recipient” whole blood after dilution of recipient blood with citrated saline to provoke a coagulopathic profile. Citrated native thrombelastography was then performed.

Results: Healthy F had relatively increased plt count, functional Fbg (FLEV), active Fbg (Von Claus), angle, maximum amplitude (MA), and shorter R time (Table 1). When we compared functional and total Fbg in F versus M, F active Fbg ($r^2=0.63$, $p<0.0001$ vs. $r^2=0.21$, $p=0.008$) and FLEV Fbg ($r^2=0.33$, $p<0.0001$ vs $r^2=0.04$, $p=0.15$) had stronger correlations with total Fbg indicating an increased proportion of functional Fbg in F donors. F plt induced greater decrease in R time (-8% vs 0%, $p=0.02$) than M plt in M recipients. F cryo induced greater decrease in R time (-9% vs -5%, $p<0.05$) than M cryo in M recipients and greater increase in angle in M (23% vs. 14%, $p=0.04$) and F recipients (28% vs 20%, $p=0.04$).

Conclusions: Healthy females have increased plt and functional Fbg, and transfusion of F blood products improves clot formation more than M blood products. This highlights the potential role for sex-specific transfusion strategies to improve hemostasis in the critically injured patient.

Table 1. Sex Dimorphisms in Coagulation

	Platelets ($10^9/L$)	Active Fbg (mg/dL)	FLEV (mg/dL)	Total Fbg (LSM)	R time (min)	Angle (degrees)	MA (mm)
Female (n=47)	283 (247-335)	293 (254-330)	402 (374-447)	61000 (53000-6800)	13.7 (12.7-15.2)	47.3 (42.2-54.3)	59.0 (54.4-62.1)
Male (n=52)	250 (213-278)	249 (235-277)	329 (299-438)	59000 (56000-64000)	15.6 (13.4-17.8)	39.0 (35.5-62.8)	53.3 (50.0-62.5)
<i>p</i> value	0.0007	0.0002	<0.0001	0.68	0.0013	<0.0001	<0.0001

Data expressed as median (IQR). P value calculated using Mann-Whitney test.

MYOCARDIAL ALTERATIONS FOLLOWING TRAUMATIC HAEMORRHAGIC INJURY

Rebecca Simpson, MBBS, BSc; Banjerd Praditsuktavorn, MD; Johanna Wall, MD, PhD; Christoph Thiemermann, MD, PhD; Jordi Lopez-Tremoleda, DVM, PhD, MRCVS; Karim Brohi, MD

Centre for Trauma Sciences, Blizard Institute, Queen Mary University of London

Invited Discussant: Scott Brakenridge, MD

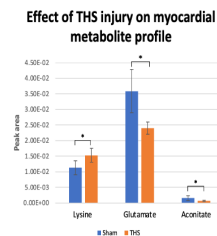
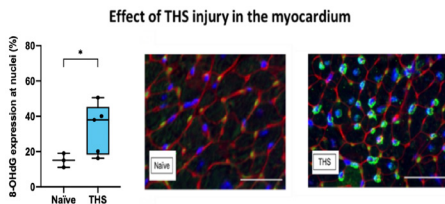
Introduction: Cardiac Dysfunction (CD) has emerged as a key contributor to delayed organ failure and late mortality in patients surviving the initial traumatic haemorrhagic response. Inflammatory processes are implicated in the initial stages of this CD, however downstream pathways leading to a characteristic rapid fall in SV and CO are not yet fully defined. Currently, no cardioprotective treatments are available. We investigated the role of myocardial oxidative stress in the pathogenesis of CD associated to traumatic haemorrhagic injury, and its related metabolomic profile.

Methods: Ex vivo tissue from a 3-hour murine model of pressure-controlled trauma haemorrhagic shock (THS) was analyzed. Animals were randomized to echocardiography-guided crystalloid fluid resuscitation or a control group (sham: cannulation and anaesthesia only, or naïve: no intervention). THS and naïve samples were assessed by immunohistochemistry for nuclear 8-OHdG expression as a marker of oxidative stress. Metabolomic analysis of THS and sham group tissue was performed by LC-MS.

Results: 8-OHdG expression across the myocardium was significantly higher following THS injury compared to naïve group ($33.01 \pm 14.40\%$ vs. $15.08 \pm 3.96\%$, $p < 0.05$). THS injury significantly increased lysine ($p = 0.022$), and decreased aconitate ($p = 0.016$) and glutamate ($p = 0.047$) in the myocardium, indicating activation of a catabolic metabolism and

oxidative stress response.

Conclusion: We confirm the acute development of oxidative



stress lesions and altered cardiac energy metabolism following traumatic haemorrhage injury, providing insight into the relationship between inflammatory damage and impaired cardiac contractility. These findings may provide targets for development of novel cardioprotective therapeutics aiming to decrease late mortality from trauma.

OUTCOMES OF FIVE YEARS OF PATIENTS WITH MILD TRAUMATIC SUBARACHNOID HEMORRHAGE

Mark Broadwin, MD; Pujja Patel, DO; Tara Stansbury, MD; Jeffrey Brown, BS; Anh Hoang, DO; Kamalesh Shah, MD, FACS; Mark Cipolle, MD, PhD

Lehigh Valley Health Network

Invited Discussant: Bellal Joseph, MD

Introduction: It is standard practice for patients with isolated mild traumatic subarachnoid hemorrhages (tSAH), defined as GCS of > 13 , to be transferred to trauma centers with neurosurgical services for evaluation. There is low morbidity and mortality associated with tSAH, however, it has become common practice to perform repeat imaging, consult neurosurgical services, or transfer patients to a center with neurosurgery despite the fact that it is uncommon for these patients to require neurosurgical intervention. Current literature suggests that it may be safe to observe patients with tSAH without neurosurgical consultation, but the need for transfer to tertiary center has not been fully explored. The purpose of this study was to investigate if patients suffering from mild tSAH require transfer for neurosurgical evaluation or if they can be safely managed at their presenting institution.

Methods: A retrospective chart review of a trauma database of patients admitted or transferred to a level one trauma center between October 1st, 2015, to September 30th, 2019, with GCS 13-15 and evidence of isolated SAH initial head CT was performed. Descriptive statistics were used to summarize the findings. Bivariate analyses, including the Mann-Whitney U Test and chi-square test of independence/Fisher's exact test, were conducted to determine if certain factors were associated with a worsening repeat CT.

Results: 350 patients presented with isolated tSAH. The majority were blunt injuries (99.1%). There were more females (57.4%) than males (42.6%) and the median age was 73 (IQR: 58-84). The median ISS was 5 (IQR: 5-6). Slightly more than half (56.6%) of the patients were transfers from another facility. While 342 (97.7%) had a neurosurgical consult, only 1 (0.3%) of them required neurosurgical intervention. In-hospital mortality occurred in 4 patients (1.1%). Out of the remaining 346 who did not die in-hospital, 14 (4.1%) were readmitted within 60 days, and 10 (2.9%) died within 60 days (6 patients were missing data for 60-day mortality). 311 (88.9%) patients had at least one repeat CT scan and of those only 16 (5.1%) had the second scan come back worse. The only factor found to be significantly associated with a worse scan change was AIS head ($p=0.0180$).

Conclusion: Neurosurgical intervention was only required in 0.3% of patients presenting with mild tSAH. While 88.9% of them had a repeat CT scan, only 5.1% of them showed worsening results. Our data suggest that it is safe to manage mild tSAH without transfer to a tertiary care center or neurosurgical consultation and that repeat imaging may be of little clinical utility.

SESSION IV:
EXPERT SURGEON LECTURE



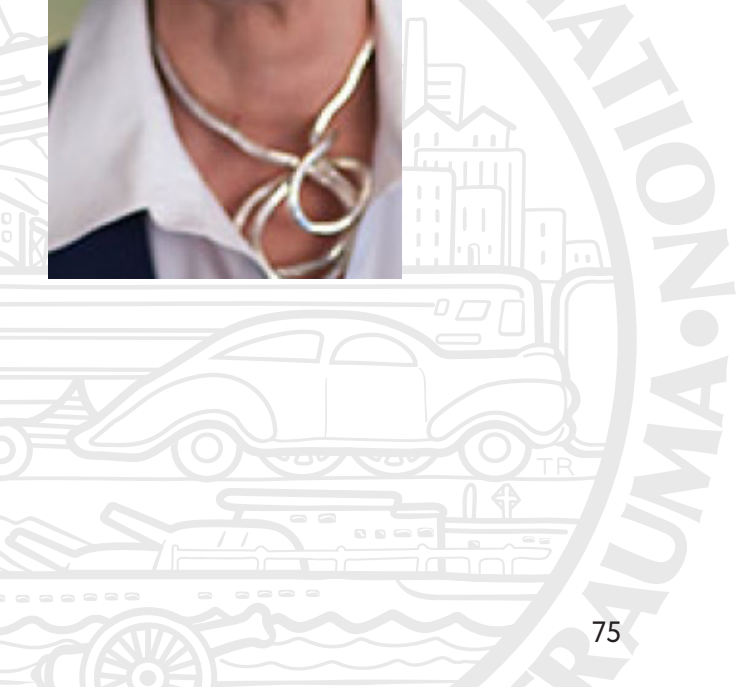
**“A LIFE IS SAVED...
THEN WHAT?”**

Wednesday, September 21, 2022

5:45 PM - 6:15 PM

Location: GR BR A-DNorth

Presenter: Ellen MacKenzie, PhD





SESSION VI: PAPERS 31-35

Thursday, September 22, 2022

7:30 AM - 9:10 AM

Location: Grand Ballroom

Moderator: Deborah Stein, MD, MPH

Recorder: Sharon Henry, MD

DETECTION OF PNEUMOTHORAX ON ULTRASOUND USING ARTIFICIAL INTELLIGENCE

Sean Montgomery, MD; Forrest Li, BS; Christopher Funk, PhD; Erica Peethumangsin, MD; Michael Morris, MD; Jess T. Anderson, MD; Andrew M. Hersh, MD; Stephen Aylward, PhD

Duke University Medical Center

Invited Discussant: Jaswin Sawhney, MD

Background: Ultrasound (US) for the detection of pneumothorax shows excellent sensitivity in the hands of skilled providers. Artificial intelligence (AI) may facilitate the movement of US for pneumothorax into the prehospital setting. The large amount of training data required for conventional neural network methodologies has limited their use in US so far.

Methods: A limited training database was supplied by DARPA of 30 three-second video US, showing 15 cases with sliding lung and 15 cases without. Images were annotated for ribs and pleural interface. The software performed anatomic reconstruction to identify the region of interest bounding the pleura. Three neural networks were created to analyze images on a pixel by pixel fashion with direct voting determining the outcome. Independent verification and validation was performed on a dataset gathered by the DOD. The test images were categorized as sliding and not sliding by subject matter experts (SMEs) from the DOD and our institution.

Results: Anatomic reconstruction with the identification of ribs and pleura was accomplished on all images. On independent verification and validation against the DOD testing data, ARGUS concurred with the SME 80% of the time and achieved a 90% sensitivity (18/20) for pneumothorax and a 71% specificity for the absence of pneumothorax (15/21). Of the 8 mistakes by our AI; 1 was unexplained, 1 had movement of the chest wall, 1 had lung hepatization, and 5 were equivocal cases in which the SMEs did not agree on sliding.

Discussion: Using learning with limited labeling techniques, we were able to identify pneumothorax on US with an accuracy of 80%. Several points of failure were noted that can be improved, to include controlling for chest wall motion, establishing Hierarchical Mixture of Experts ensemble, and the addition of M-mode data to allow accurate classification of equivocal images.

DOES COVID-19 REALLY WORSEN SURGICAL OUTCOMES? A LARGE COVIDSURG PROPENSITY-MATCHED ANALYSIS

Dias Argandykov, MD; Mohamad El Moheb, MD;

Ander Dorken Gallastegi, MD; Mary Bokenkamp, MD; Anthony Gebran, MD; Dmitri Nepogodiev, MBChB; Aneel Bhangu, MBChB, PhD; Haytham Kaafarani, MD, MPH

Massachusetts General Hospital

Invited Discussant: Jeffrey Shupp, MD

Introduction: Patients undergoing surgery with perioperative COVID-19 are suggested to have worse outcome, but whether this is COVID-related or due to selection bias remains unclear. We aimed to compare the postoperative outcomes of patients with and without COVID-19.

Methods: Patients with perioperative COVID-19 from 68 US hospitals in COVIDSURG, an international multicenter database, were 1:1 propensity score-matched to patients without COVID-19 undergoing similar procedures in the ACS-NSQIP database. The matching criteria included demographics, comorbidities, and operation characteristics (e.g., type, urgency, complexity). The primary outcome was 30-day hospital mortality. Secondary outcomes included hospital length of stay (LOS) and 13 postoperative complications.

Results: A total of 97,936 patients were included, 1,054 with and 96,882 without COVID-19. Pre-matching, COVID-19 patients more often underwent emergency surgery (76.1% vs 10.3%, $p < 0.001$). A total of 843 COVID-19 and 843 non-COVID-19 patients were successfully matched. Figure 1 compares the outcomes of patients with and without COVID-19. Specifically, COVID-19 patients had a higher mortality (12.0% vs 8.1%, $p = 0.007$), longer LOS (6 [2-15] vs 5 [1-12]) days, and higher rates of acute renal failure (19.3% vs 3.0%, $p < 0.001$), sepsis (13.5% vs 9.0%, $p = 0.003$), and septic shock (11.8% vs 6.0%, $p < 0.001$). They also had higher rates of thromboembolic complications such as deep vein thrombosis (4.4% vs 1.5%, $p < 0.001$), pulmonary embolism (2.5% vs 0.4%, $p < 0.001$), but lower rates of bleeding (11.6% vs 26.1%, $p < 0.001$).

Conclusion: Patients undergoing surgery with perioperative COVID-19 have higher rates of 30-day mortality and postoperative complications, especially thromboembolic, compared to similar patients without COVID-19 undergoing similar surgeries. Such information is crucial for the complex surgical decision-making and counseling of these patients.

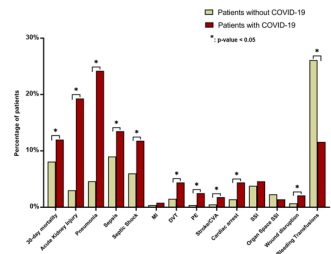


Figure 1. 30-day mortality and postoperative complications of propensity

THE EVOLUTION OF NEUTROPHIL HETEROGENEITY AND EMERGENCE OF A DISTINCT POPULATION OF LOW-DENSITY NEUTROPHILS AFTER TRAUMA

Michael B. Yaffe, MD, PhD; Ingrid Goretti-Rica, PhD; Brian A. Joughin, PhD; Alec Griffith, BS; Laura A. Cahill, BS; Simon C. Robson, MD, PhD; Leo E. Otterbein, PhD; Carl J. Hauser, MD; James A. Lederer, PhD
Beth Israel Deaconess Medical Center
Invited Discussant: Mark Hoofnagle, MD

Introduction: Multiple large clinical trauma trials document an increased susceptibility to infection after injury. Although neutrophils (PMN) were historically considered a homogeneous cell type, we hypothesized that injury could alter neutrophil heterogeneity and predispose to dysfunction. To explore whether trauma generates PMN heterogeneity, we performed mass-spectrometry based cytometry (CyTOF) on total leukocytes (TL) as well as low density PMN found in the monocyte fraction (MF) of leukocytes from healthy controls and trauma patients.

Methods: A total of 74 matched samples from 12 trauma patients, each sampled at 1 or more time points, and controls were fractionated and profiled by CyTOF using a panel of 49 distinct markers. After deconvolution and conservative gating on neutrophils, data were analyzed using Seurat, followed by clustering of principal components.

Results: 11 distinct neutrophil populations were resolved in control and trauma neutrophils based on differential protein surface marker expression. Trauma markedly altered the basal heterogeneity of neutrophil subgroups seen in the control samples, with loss of a dominant population of resting neutrophils marked by high expression of C3AR and low levels of CD63, CD64 and CD177 (Cluster 1), and causing expansion of 2 alternative neutrophil populations distinguished respectively by high expression of CD63, CD54, CD95-Fas with suppression of CD16 and CD64 (Cluster 2), or by high expression of CD177 with suppression of CD10, CD16, C3AR, CD63, CD64, and of the active forms of CD11b and CD18 (Cluster 6). Remarkably, following trauma a substantially larger percentage of neutrophils sediment in the monocyte fraction. These low-density neutrophils (LDNs) bear markers of functional exhaustion and form a unique trauma-induced population (Cluster 9) with markedly upregulated expression of active surface adhesion molecules (activated CD11b, CD18, and CD66b), with suppression of nearly all other surface markers, including receptors for formyl peptides, leukotrienes, chemokines, and complement.

Conclusions: Circulating neutrophils demonstrate considerable evidence of functional heterogeneity that is markedly altered by trauma. Trauma induces evolution of a novel, exhausted low-density neutrophil population with immunosuppressive features

PSEUDOANEURYSMS AFTER HIGH GRADE BLUNT SOLID ORGAN INJURY AND THE UTILITY OF DELAYED CT ANGIOGRAPHY

Morgan Schellenberg, MD; Natthida Owattanapanich, MD; Brent Emigh, Chance Nichols, MD; Joshua Dilday, DO; Chaiss Ugarte, Atsushi Onogawa, Kazuhide Matsushima, Matthew J. Martin, Kenji Inaba
LAC + USC Medical Center

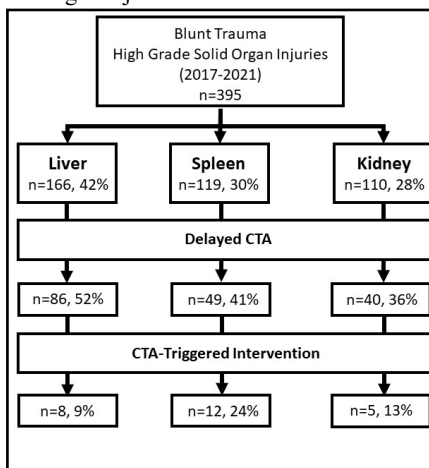
Invited Discussant: Susan McLean, MD, MPH

Introduction: Pseudoaneurysms (PSA) can occur following high grade blunt solid organ injury. The natural history of PSAs is unclear but risk for spontaneous rupture and exsanguination exist. The yield of delayed CT Angiography (dCTA) for PSA diagnosis is not well delineated and optimal timing is undefined. Study objective was definition of dCTA utility in diagnosing and triggering intervention for PSA after high grade blunt solid organ injury.

Methods: All blunt trauma patients arriving to our ACS-verified Level 1 trauma center with AAST grade ≥ 3 abdominal solid organ injury (liver, spleen, and/or kidney) were included in this retrospective study (01/2017-10/2021). Exclusions were age < 18 y, transfers in, death < 48 h, and immediate nephrectomy/splenectomy. dCTA performance was not protocolized and was pursued at attending surgeon discretion. Demographics, clinical/injury data, and outcomes were collected. Primary outcome was intervention triggered by dCTA. Statistical testing with ANOVA and Chi squared compared outcomes by type of solid organ injured.

Results: 349 blunt trauma patients with 395 high grade solid organ injuries were identified (Figure 1). Median age was 34 [26-50] years and 70% were male. Median ISS was 24 [18-33]. Median AAST grade of solid organ injury for each was 3 [3-4]. Initial management strategy was typically nonoperative (Liver 59%; Spleen 45%; Kidney 65%) or angioembolization (AE) (Liver 24%; Spleen 50%; Kidney 24%), with fewer patients undergoing operative management (OM) (Liver 12%; Spleen 4%; Kidney 9%) or combined OM/AE (Liver 5%; Spleen $< 1\%$; Kidney 2%). dCTA to screen for PSA was typically done on hospital day 4 [3-7]. dCTA identified vascular lesions in 16 Splenic, 10 Liver, and 6 Kidney injuries. The proportion of patients undergoing dCTA and the frequency with which this investigation triggered intervention are given in Figure 1. dCTA triggered intervention in 24% of Splenic, 13% of Kidney, and 9% of Liver injuries, for an overall yield of 14%. Intervention was typically AE ($n=23$, 92%), although two splenic injuries required splenectomy for PSA treatment.

Conclusion: Delayed CTA screening for PSA after high grade blunt solid organ injury was performed in approximately half of eligible patients at our center. Delayed CT imaging identified a significant number of vascular lesions requiring endovascular or surgical intervention, with highest yield for splenic injuries. We recommend further examination of this subject and consideration of universal screening of high grade blunt solid organ injuries with delayed abdominal CTA to avoid missing PSAs.



PREHOSPITAL SHOCK INDEX PREDICTS OUTCOMES AFTER PROLONGED RURAL TRANSPORT

James Bardes, MD, FACS; Bradley Price, PhD; Hannah Bailey, MS; Alexander Quinn, BS; Zachary Warriner, MD; Andrew Bernard, MD; Aimee LaRiccica, DO, Chance Spalding, MD; Scott Armen, MD; Melissa Linskey Dougherty, MD; Alison Wilson, MD
 West Virginia University
 Invited Discussant: Angela Earley, MD

Introduction: Shock index (SI) predicts outcomes after trauma. Prior single center work demonstrated that emergency medical services (EMS) initial SI was the most accurate predictor of hospital outcomes in a rural environment. This study aimed to evaluate the predictive ability of SI in multiple rural trauma systems with prolonged transport times to a definitive care facility.

Methods: This retrospective review was performed at four ACS-verified level 1 trauma centers with rural catchment basins. Adult trauma patients who were transferred and arrived >60 minutes from scene during 2018 were included. Patients who sustained blunt chest or abdominal trauma were analyzed. Subjects with missing data or severe head trauma (AIS>2) were excluded. A zero inflated Poisson model and binomial logistic regression were utilized to study the effect of SI and delta SI (Δ SI) on outcomes.

Results: After applying criteria 935 patients were considered for analysis, 575 scene patients and 360 transfers. Mean ISS was 8 (IQR 6) for scene and 8.9 (IQR 5) for transfers.

Initial EMS SI was the most significant predictor of the need for blood transfusion and ICU care in both scene and transferred patients (Table 1, $p < 0.0001$), outperforming Δ SI between scene and transferring facility and Δ SI between definitive care and scene. However, any increase in Δ SI was also associated with the need for transfusion and the number of units transfused ($p < 0.05$). Mortality was predicted by initial EMS SI for scene patients ($p < 0.005$). SI was not predictive for operative intervention until measured at the definitive care facility.

Conclusion: Providers must maintain a high level of clinical suspicion for patients who had an initially elevated SI. EMS SI was the greatest predictor for use of blood and ICU care, as well as mortality for scene patients. This highlights the importance of SI and Δ SI in rural trauma care.

Table 1 Variable/ Response	Scene		Transfer	
	Use of Blood (Binomial Logistic)	Number of Units of Blood (Poisson)	Use of Blood (Binomial Logistic)	Number of Units of Blood (Poisson)
EMS SI	4.016 ***	1.157 ***	1.994	1.626 **
Δ SI EMS to Definitive	2.443 ***	1.294 ***	0.301	1.411 **
Δ SI EMS to Transfer Fac			0.0151 *	0.895 *
p-values: <0.10 (.), <0.05 (*), <0.01 (**), <0.001 (***)				



SESSION VII: PANEL I

Thursday, September 22, 2022

9:10 AM - 10:10 AM

Location: Grand Ballroom

Panelists:



Marc deMoya, MD



Amy J. Goldberg, MD



Randi Smith, MD

Moderator:



Kristan Staudenmayer, MD, MSc



SESSION VIII: SCHOLARSHIP PRESENTATIONS

Thursday, September 22, 2022

10:10 AM - 10:50 AM

Location: Grand Ballroom

Presenters:

Lisa Marie Knowlton, MD, MPH

Evaluating Enrollment of Uninsured Trauma Patients in Medicaid at the Time of Hospitalization Due to Injury

Samuel Carmichael, MD

Anti-Fibrotic Therapies for Prevention of Abdominal Adhesions

Mehreen Kijat, MD

Improving diagnosis of post-traumatic sepsis using sequencing of microbial DNA in blood

Christine Leeper, MD, MS

Characterizing Endotheliopathy in a Pediatric Trauma Cohort

Caroline Park, MD

Associate Member Mentoring Scholarship sponsored by Dr. David and Jill Spain

SESSION IX:
FITTS LECTURE



**“TRAUMA. THE MOST
PROGRESSIVE
SUBSPECIALTY
OF ALL”**

Thursday, September 22, 2022

10:50 AM - 11:50 AM

Location: Grand Ballroom

Presenter: David Feliciano, MD



SESSION XI: PAPERS 36-44

Friday, September 23, 2022

7:30 AM - 10:30 AM

Location: Grand Ballroom

Moderator: Hayato Kurihara, MD

Recorder: Suresh Agarwal, MD

RECONCEPTUALIZING HIGH-QUALITY EGS CARE: TOP-TIER HOSPITALS REMAIN CONSISTENT ACROSS VARIABLE OUTCOMES, CONDITIONS, SEVERITIES, AND AGES

Cheryl K. Zogg, PhD, MSPH, MHS; Kristan L. Staudenmayer, MD, MSc;

Lisa M. Kodadek, MD; Kimberly Davis, MD, MBA

Yale School of Medicine

Invited Discussant: Amy Kwok, MD

Introduction: For years, trauma centers have improved care through the establishment of formal quality-improvement programs. There is now a push to develop comparable programs for emergency general surgery (EGS). Successful implementation will require clear definitions for what constitutes high-quality EGS care. However, given the heterogeneous nature of EGS conditions, variability in disease severity, and frequent low in-hospital mortality risk for common conditions like acute appendicitis/cholecystitis, the best approach remains unclear. We developed a novel set of six non-mortality-based quality-metrics that could be used to expand assessment of EGS performance. In this study, we sought to apply them with the goal of determining whether (1) a group of best-performing EGS hospitals can be defined and (2) good performance for one EGS condition in one patient group is associated with similar outcomes for other conditions/patients at an institution.

Methods: Patients hospitalized with 1-of-16 AAST-defined EGS conditions were identified in the 2019 Nationwide Readmissions Database. They were stratified by age and AAST severity (simple-vs-complex) into four cohorts: simple older adults, complex older adults, simple adults, and complex adults. Within each cohort, Bayesian mixed-effects regression models were used to calculate condition-specific risk-standardized quality-metrics. The six quality-metrics included: major morbidity, index hospital length of stay, ability to be discharged home, need for readmission within 30 days, need for reoperation within 90 days, and a patient's average number of hospitalized days within 6 months of index admission. K-means cluster analysis identified hospitals with similar performance. Multinomial regression identified predictors of resultant 'best' EGS care.

Results: $N=1,130,496$ patients from 2,355 hospitals were included (39.5% simple older adult, 6.4% complex older adult, 40.6% simple adult, and 13.5% complex adult). Within each cohort, K-means cluster analysis identified three distinct clusters (best, average, and worst). Best-performing hospitals demonstrated consistently better outcomes for each included EGS condition and quality-metric. They remained concordant across cohorts. When examined for associations with hospital-level factors, best-performing hospitals were those with larger EGS volumes, urban teaching status, and a larger proportion of EGS patients with higher average Hospital Frailty Risk Scores and more pre-existing medical conditions (two-sided p -value <0.05 for each).

Conclusions: Top-tier EGS hospitals remained consistent across variations in outcomes, EGS conditions, disease severity, and ages of patients. They tended to be larger teaching hospitals located in urban areas managing the most sick and frail patients. Such findings suggest that EGS centers-of-excellence could exist and that use of non-mortality-based quality-metrics could offer a needed, promising means of evaluating high-quality EGS care.

WHO'S INFORMED OF TRAUMA INFORMED CARE? PATIENTS' PRIMARY LANGUAGE AND COMPREHENSIVENESS OF INITIAL TRAUMA ASSESSMENT

Souma Kundu, MPH; Todd W. Costantini, MD; Jay J. Doucet, MD;
Allison E. Berndtson, MD

UC San Diego Health System
Invited Discussant: Nicole Goulet, MD

Introduction: Trauma informed care may improve outcomes by addressing disparities in at-risk patients. For patients with limited English proficiency (LEP), language poses a unique challenge in patient-provider communication. Using certified medical interpretation (CMI) can be difficult in time and resource limited settings including trauma. We hypothesized that there would be limited use of CMI during major trauma resuscitations, less comprehensive assessments, and less empathetic communication for Spanish-speaking patients with LEP (SSP) compared to English-speaking patients (ESP).

Methods: We analyzed video-recorded encounters of trauma initial assessments at a Level 1 trauma center. Each encounter was evaluated from patient arrival until completion of the secondary survey per Advanced Trauma Life Support protocol. A standard checklist of provider actions was utilized to assess comprehensiveness of the primary and secondary surveys and communication events such as provider introduction, reassurances, and communicating next steps to patients. We compared the SSP and ESP cohorts for significant differences in completion of checklist items.

Results: Fifty patients with Glasgow Coma Scale score 14-15 were included (25 ESP, 25 SSP). Mean age was 45 years; 72% SSP were male vs. 60% ESP. SSP received less comprehensive exams and communication (table). No patients were asked their primary language. Two (8%) SSP encounters used CMI; most (80%) utilized ad-hoc interpretation, 12% used English.

Checklist Component	SSP (n=25)	ESP (n=25)	p-value
Complete Motor Exam	48%	96%	<0.001
Complete Sensory Exam	4%	68%	<0.001
History of Present Illness	24%	68%	0.002
Provider explains next steps	32%	96%	<0.001
Provider reassures patient at least once	44%	88%	0.001

Conclusion: We found significant differences in the initial care provided to trauma patients based on primary language. Inclusion of an interpreter as part of the trauma team may improve the quality of care provided to trauma patients with limited English proficiency.

**THE IMPACT OF STATE TRAUMA FUNDING
ON TRIAGE AND MORTALITY OF TRAUMA PATIENTS**

Meilynn Shi, BA; Susheel Reddy, MPH; Jane L. Holl, MD, MPH; Renee Y. Hsia, MD, MSc; Robert C. Mackersie, MD; Anne M. Stey, MD, MSc
Northwestern University

Invited Discussant: Rajan Gupta, MD, MS

Objective: Less than half of states dedicate funding specifically towards trauma care and systems. This study examines the association between state trauma funding and mortality among critically injured patients.

Methods: Patient encounters with an injury diagnosis and Injury Severity Score (ISS) >15 were extracted from 2016 and 2017 Healthcare Cost and Utilization Project (HCUP) State Emergency Department Databases (SEDD) and State Inpatient Databases (SID) from five states (FL, MA, MD, NY, WI). These states capture a broad range of geographic and demographic variability and allow for patient linkage across encounters. These data were merged with the American Hospital Association (AHA) Survey and publicly available state trauma funding data obtained from each state's Department of Public Health. Patients were linked across emergency and inpatient encounters to determine triage status, defined as appropriate triage (admitted to a Level I or II trauma center (TC)), under-triage (admitted to a Level III, IV, or non-TC), or re-triage (emergently transferred from an emergency department to a Level I or II TC). We tested the association between state trauma funding and mortality using a hierarchical logistic regression, controlling for triage status with a trauma funding by triage status interaction term and adjusting for age, sex, race, primary payer, Elixhauser comorbidity score, and ISS.

Results: A total of 242,299 patients with ISS >15 met inclusion criteria. Median age was 52 years (IQR=28-73). Median ISS was 17 (IQR=16-25). Two states (MA, NY) allocated \$0.00 per capita trauma funding, and three states (WI, FL, MD) allocated between \$0.09-\$1.80 per capita trauma funding. Compared to patients in states with no trauma funding, patients in states with trauma funding experienced decreased adjusted odds of mortality (OR=0.75 [0.60-0.93]). Funding was associated with decreased adjusted odds of mortality among all triage statuses, with the lowest adjusted odds of mortality among re-triaged patients (OR=0.63 [0.46-0.87]).

Conclusion: State trauma funding is associated with lower adjusted mortality among severely injured patients. Increasing state trauma funding may lower adjusted mortality in states without trauma funding.

DEALING WITH THE GROWING EPIDEMIC OF ELDER ABUSE:
NATIONWIDE DISPARITIES IN INTERVENTIONS FOR ABUSE
AMONG THE VULNERABLE ELDERLY

Khaled El-Qawaqzeh, MD; Lourdes Castanon, MD, FACS; Raul Reina, MD; Colin Stewart, MD; Hamidreza Hosseinpour, MD; Tanya Anand, MD, MPH; Michael Ditillo, DO, FACS; Omar Obaid, MD; Adam Nelson, MD; Bellal Joseph, MD, FACS
The University of Arizona
Invited Discussant: Julie Goswami, MD

Background: Elder abuse is a growing epidemic associated with high morbidity & mortality. Healthcare professionals represent a key component in the management of elder abuse, as they may be the only point of contact for these vulnerable patients capable of recognizing, reporting, & intervening against abuse. The aim of our study was to identify the factors associated with initiation of abuse investigations & change of caregiver at discharge following reported elder abuse on a nationwide scale.

Methods: Analysis of the 2017-2018 ACS-TQIP. All geriatric trauma patients (≥ 60 yrs) presenting with suspected or confirmed elder abuse & an abuse report filed were included. Patients with missing information regarding abuse interventions were excluded. Outcomes were rates of abuse investigations initiated among those with an abuse report filed, & change of caregiver at discharge among survivors with an abuse investigation initiated.

Results: 1,405 patients with suspected or confirmed elder abuse & an abuse report filed were identified. Mean age was 72 ± 9 years, 43% were male, 72% were White, 15% were Black, 10% were Hispanic, & 76% had government insurance. Mechanisms of injury were: blunt (76%); penetrating (12%); burns (1%) & median ISS was 9 [4-16]. Forms of abuse were: physical (82%); neglect (13%); sexual (5%); psychological (1%). Most common perpetrator of abuse was a member of the extended or stepfamily (53%), followed by a member of the immediate family (38%), or care provider (9%). 1,060 (75%) abuse investigations were initiated following an abuse report. Of those, 23% resulted in a change of caregiver at discharge among the survivors. On multivariate analysis, male gender (aOR 0.69; $p < 0.01$), Hispanic ethnicity (aOR 0.59; $p = 0.04$), private insurance status (aOR 0.69; $p = 0.03$), positive drug screen at admission (aOR 1.90; $p = 0.02$), & management at non-level I trauma centers (aOR 0.52; $p = 0.01$) were independently associated with initiation of abuse investigation following an abuse report filed. Among those who had an abuse investigation initiated, male gender (aOR 0.72; $p = 0.03$), functional disability (aOR 1.50; $p = 0.03$), & dementia (aOR 1.74; $p < 0.01$) were independently associated with change of caregiver at discharge.

Conclusion: Significant gender, ethnic, & socioeconomic disparities in the nationwide management of elder abuse victims exist. Further studies are strongly warranted to expand on the contributing factors underlying these disparities & possible strategies to address them.

DOES ACQUISITION OF EMERGENCY MEDICAID AT THE TIME OF INJURY LEAD TO SUSTAINED INSURANCE? A STATEWIDE ANALYSIS

Lisa Marie Knowlton, MD, MPH; Linda Tran, PhD; Katherine Arnow, MS; Amber Trickey, PhD; David Spain, MD; Todd Wagner, PhD; Arden Morris, MD, MPH

Stanford School of Medicine

Invited Discussant: Erica Lester, MD

Introduction: Hospital Presumptive Eligibility (HPE) is a temporary Medicaid insurance available to patients at hospitalization. HPE insurance can offset costs of care, increase access to post-discharge resources, and provide patients with a path to sustain long-term coverage by applying for Medicaid. As HPE only lasts up to sixty days, it is unclear whether HPE-approved trauma patients are sustaining insurance. We aimed to determine Medicaid insurance status six months after injury and identify factors associated with successful sustainment.

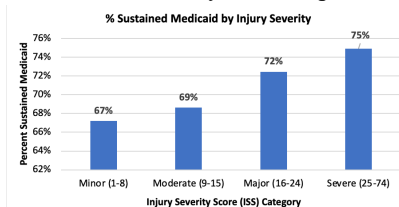
Methods: With the California Department of Health Care Services (DHCS), we developed a customized longitudinal claims dataset for HPE-approved patients. We analyzed adults admitted with a primary trauma diagnosis (ICD-10) who were HPE approved in 2016 and 2017. Our primary outcome was Medicaid sustainment at six months following HPE approval. Univariate and multivariate analyses were performed.

Results: A total of 9,749 trauma patients with HPE were analyzed; 6,795 (69.7%) sustained Medicaid at six months.

Compared to patients who did not sustain, those who sustained had higher injury severity score (ISS>15: 73.5% vs. 68.7%, $p<0.001$), more often underwent surgical

intervention (74.8% vs. 64.5%, $p<0.001$) and were more likely to be discharged to post-acute services (23.9% vs. 10.4%, $p<0.001$). Medicaid sustainment stratified by ISS is described in Figure 1. Medicaid sustainment was high among patients who identified as White (86.7%), Hispanic (86.7%), Black (84.3%) and Asian (83.7%), particularly if their preferred language was English (73.9%). Medicaid sustainment was low among the 2,505 patients (25.7%) who declined to report their race, ethnicity, or preferred language (14.8% sustainment). In adjusted analyses, major injuries (ISS>16) (vs. ISS≤15: aOR 1.51, $p=0.02$) and surgery (aOR 1.85, $p<0.001$) were associated with increased likelihood of Medicaid sustainment. Declining to disclose race, ethnicity, or language (aOR 0.05, $p<0.001$) decreased the likelihood of Medicaid sustainment.

Conclusion: HPE programs are a promising pathway for securing long-term insurance coverage for trauma patients, particularly among the severely injured who likely require ongoing access to healthcare services. Opportunities include educational interventions for patients with less severe injuries, as well as patient and provider interviews to better understand barriers in trust and policy for patients who do not disclose race or ethnicity.



FINANCIAL VULNERABILITY OF TRAUMA CENTERS: A NATIONAL ANALYSIS

Alexander Marrotte, MD; Richard Calvo, PhD; Derek Benham, MD; Benedict Capacio, MD; Christopher Goljan, MD; Alexandra Rooney, MPH; Alyssa Carroll, BS; Andrea Krzyzaniak, MA; Vishal Bansal, MD; Michael Sise, MD; Matthew Martin, MD

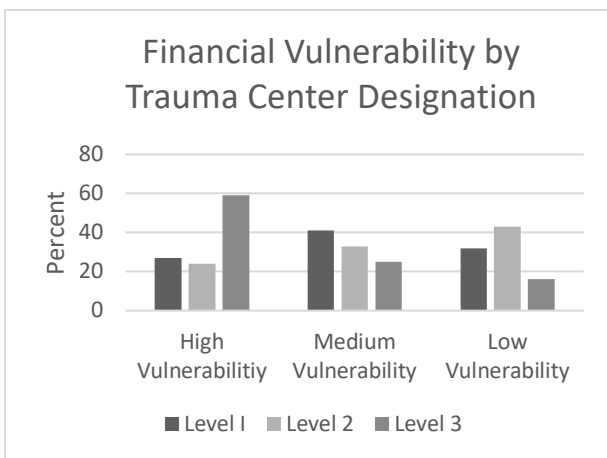
Scripps Mercy Hospital
Invited Discussant: Jason Smith, MD

Objective: Trauma centers function as an essential safeguard in the United States healthcare system. However, there has been minimal study of their financial health or vulnerability. We sought to perform a nationwide analysis of trauma centers using detailed financial data and a recently developed Financial Vulnerability Score (FVS) metric.

Methods: The RAND Hospital Financial Database was used to evaluate all ACS-verified trauma centers nationwide. The composite FVS was calculated for each center using six metrics. FVS tertiles were used to classify centers as High, Medium, or Low vulnerability and hospital characteristics were analyzed and compared. Hospitals were also compared by US Census region and teaching versus non-teaching hospitals.

Results: There were 617 centers identified: 194 Level I, 278 Level II, and 145 Level III. The largest share of the high FVS tier was comprised of Level III centers (59%), with the majority of Level I (40%) and Level II (43%) in the middle and low FVS tier, respectively (Figure). The most vulnerable centers had fewer beds, negative operating margins, and significantly less cash on hand. Lower FVS centers had greater asset:liability ratios, lower outpatient shares, and three times less uncompensated care. New England and East North Central regions had the largest proportion of high FVS centers. Non-teaching centers were statistically significantly more likely to have high vulnerability compared to teaching centers (46% vs. 29%).

Conclusion: With approximately 25% of Level I and II trauma centers at high risk for financial vulnerability, disparities in characteristics, including payer mix and outpatient status, should be targeted to reduce vulnerabilities and bolster the healthcare safety net.



GREATER SPATIAL ACCESS TO CARE IS ASSOCIATED WITH LOWER MORTALITY FOR EGS DISEASE

Marta L. McCrum, MD; Chelsea Allen, PhD; Angela Presson, PhD; Neng Wan, PhD

University of Utah

Invited Discussant: Vanessa Ho, MD, MPH

Introduction: Emergency General Surgery (EGS) diseases are time-sensitive conditions that require urgent surgical evaluation, yet the effect of geospatial access to care on outcomes remains unclear. We examined the association of spatial access with outcomes for common EGS conditions.

Methods: Retrospective analysis of twelve 2014 State Inpatient Databases, identifying adults admitted with one of eight common EGS conditions. Complex disease was defined by previously published ICD-9 codes for AAST severity scales. We assessed geospatial access to surgical care using the Spatial Access Ratio (SPAR)— an advanced spatial model that accounts for travel distance, hospital capacity, and population demand, normalized against the national mean (i.e. SPAR <1 indicates lower than average access.) Sequential multivariable logistic regression models adjusting for patient and hospital factors were used to evaluate the association between SPAR with a) in-hospital mortality and b) major morbidity.

Results: Of 1,161,424 admissions, 134,729 (11.6%) patients had low-access (SPAR<0.5) to surgical care and 767,580 (66.1%) high-access (SPAR≥1). Low-access patients were more likely to be white, male and treated in small, non-teaching hospitals. Low-access patients also had higher incidence of complex EGS disease when compared to high-access patients (16% vs 10%, $p<0.001$) and greater in-hospital mortality (3.3% vs 2.5%, $p<0.05$).

Adjusting for confounding factors, including presence of advanced hospital resources, high-access was protective against in-hospital mortality (aOR 0.96, 95% CI 0.94 -0.97, $p<0.001$), and remained so when complex disease – a potential mediator of the relationship between geospatial access and mortality - was included in the model. Spatial access had a minor association with major morbidity (aOR 0.99, 0.99-1.00 $p<0.001$). **Conclusions:** This is the first study to demonstrate that restricted geospatial access to surgical care is associated with higher incidence of complex EGS disease, and that greater spatial access is independently associated with lower in-hospital mortality. These results suggest that organized systems for EGS care are warranted to address the impact of spatial access to surgical care for these high-burden and time-sensitive diseases.

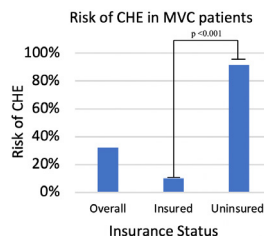
CATASTROPHIC HEALTH EXPENDITURE IN NON-NEUROLOGICAL INJURY DUE TO MOTOR VEHICLE CRASH

Madhuri Nishtala, MD; Madeline Reed, BS; Michael Collins, PhD, MPP; Manasa Venkatesh, BS; Bret Hanlon, PhD; Jessica Schumacher, PhD; Ben Zarzaur, MD

University of Wisconsin School of Medicine and Public Health
Invited Discussant: David Zonies, MD, MPH, MBA

Background: Hospitalization due to injury is costly. Single center studies demonstrate that 80% of injured patients suffer from financial hardship in the year after injury. Financial hardship after injury is associated with worse Health-Related Quality of Life. Motor Vehicle Crashes (MVC) are a leading cause of traumatic injury in the United States. There are little national data describing patients at risk for financial hardship for this common cause of injury. The purpose of this study is to describe financial hardship in terms of Catastrophic Health Expenditure (CHE) in a cohort of MVC patients.

Methods: The study cohort, derived from the National Inpatient Sample, consisted of adult patients ages 26-64 who suffered non-neurologic injury after MVC between 2014-2017. Post-subsistence spending was calculated using average cost of food for each income quartile (Bureau of Labor Statistics). Average yearly maximum out-of-pocket costs were calculated for all private insurance plans. CHE was defined as hospital costs $\geq 40\%$ of post-subsistence spending after accounting for insurance status. Patient/hospital characteristics were compared based on insurance status. **Results:** Amongst the 189,080 patients in the cohort, 149,705 were privately insured and 39,375 were uninsured. Most patients were male (65.6%), white (63.7%), treated at a large (65.1%) urban facility (83.2%), and survived to discharge (99%). 91.4% of uninsured patients and 10.1% of privately insured patients were at risk for catastrophic health expenditure. The risk of CHE was similar among most subpopulations, but some subpopulations had significant differences in risk of CHE. Among uninsured patients, patients in the lowest community income quartile (93.3%) had higher CHE risk than those in the highest (81.4%) ($p < 0.001$). Patients treated at urban facilities had higher CHE risk (91.6%) than rural (86.5%) ($p < 0.001$). **Conclusions:** MVC is one of the most common causes of injury in the United States. Over 90% of uninsured patients who suffer from non-neurologic injury due to MVC are at risk for CHE. While insurance is protective against CHE, 10% of insured patients are still at risk for CHE, suggesting that insurance alone is inadequate in eliminating financial hardship for all patients.



THE IMPACT OF A MULTIMODAL PAIN REGIMEN ON ANALGESIA PRESCRIBING AT AN ACADEMIC HOSPITAL

Krista Stephenson, MD; Allison Wells, MS; Allison Jenkins, Pharm D; Ronald Robertson, MD; Mary Kimbrough, MD; Avinash Bhavaraju, MD; Nolan Bruce, MD; Benjamin Davis, MD; Melissa Kost, MD; Joseph Margolick, MD; Anna Privratsky, MD; Matthew Roberts, MD; Kyle Kalkwarf, MD

University of Arkansas for Medical Sciences
Invited Discussant: Andrew Bernard, MD

Introduction: Opioid-sparing, multimodal pain therapy (MMP) was initiated at our institution in Aug 2016 when a new faculty member joined the Division of Trauma & Acute Care Surgery (TACS). Over the next two years, the practice was codified into a protocol as new members joined the division. This study aims to evaluate the dissemination and impact of MMP.

Methods: We conducted a single-center retrospective cohort study of all patients admitted to a surgical service from May 2015-July 2020 to evaluate opioid and non-opioid prescribing for analgesia. The analysis consisted of three populations: patients admitted to the TACS service, general surgery subspecialty (GSS) services with general surgery resident coverage, and other surgical department (OSD) services. Patients with a length of stay <24 hours, ICU admissions, and those prescribed an epidural/PCA were excluded.

Results: 12,010 patients met inclusion criteria. The mean age was 57.3 years. 1,979 (16.5%) were admitted to the TACS service, 1,106 (9.2%) to GSS services, and 8,925 (74.3%) to OSD services. Opioid morphine milligram equivalents (MME) varied widely, with an overall average of 38.6 ± 33.3 daily, but decreased in all groups over the study period. Non-opioid adjunctive medications were used in 5,932 (49.4%) and increased in all groups after implementation of the protocol (all $p < 0.001$). After MMP introduction, non-opioid analgesic use increased most rapidly in TACS and slowest in OSD. Conversely, after protocol application the average daily MME decreased most rapidly in TACS (24.4%, $p < 0.001$), while GSS and OSD services saw a subsequent decrease in opioid use ($p = 0.004$ and $p < 0.001$, respectively) as MMP increased.

Conclusion: Implementation of a multimodal pain protocol by a single division can facilitate the rapid spread of non-opioid adjunctive pain medication use and decrease opioid utilization throughout surgical specialties in a hospital.

	Start	1-Aug-2015	1-Aug-2016	1-Aug-2017	1-Aug-2018	1-Aug-2019
	End	31-Jul-2016	31-Jul-2017	31-Jul-2018	31-Jul-2019	31-Jul-2020
Trauma & ACS	MME/day	18.0+/-23.6	16.4+/-20.2	13.0+/-17.8	13.5+/-17.9	14.3+/-19.8
	Non-opioid %	34.6%	57.1%	73.9%	76.2%	81.6%
General Surgery Subspecialties	MME/day	44.5+/-35.4	33.7+/-26.0	30.2+/-25.8	22.6+/-18.2	41.4+/-60.6
	Non-opioid %	36.3%	31.0%	34.3%	58.3%	68.6%
Other Surgical Departments	MME/day	50.1+/-33.6	49.7+/-34.2	40.5+/-29.1	40.5+/-28.9	39.3+/-33.9
	Non-opioid %	37.9%	39.3%	45.6%	52.8%	54.6%



SESSION XII: PANEL II

Friday, September 23, 2022

11:00 AM - 12:00 PM

“WHEN IT IS ONE OF US”

Location: Grand Ballroom

Panelists:



Joseph Sakran, MD



R. Todd Maxson, MD



Rachael Callcut, MD

Moderator:



David Livingston, MD



SESSION XIII A: **PAPERS 45-55**

Friday, September 23, 2022

1:15 PM - 4:55 PM

Location: Grand Ballroom

Moderator: Walt Biffl, MD

Recorder: Raminder Nirula, MD, MPH

MEDICAL MANAGEMENT IS THE TREATMENT OF CHOICE FOR LOW GRADE BLUNT THORACIC AORTIC INJURIES

Simin Roward, MD; Joseph Dubose, MD; Jessica Efird, MD; Pedro Teixeira, MD; Tatiana Cardenas, MD; Marc Trust, MD; Jayson Aydelotte, MD; Carlos Brown, MD

Dell Seton Medical Center at the University of Texas

Invited Discussant: Charles Butts, MD

Objective: Thoracic endovascular aortic repair (TEVAR) has become standard of care for the treatment of blunt thoracic aortic injuries (BTAI) requiring intervention. There is data showing that low grade BTAI (Grade 1 or Grade 2) will resolve spontaneously if treated with medical management (MM) alone. To date there has been no comparison between the use of MM vs. TEVAR for low grade BTAI. We hypothesize that low grade BTAI injuries can be safely managed with MM alone.

Methods: Retrospective analysis of all patients with a low grade BTAI in the Aortic Trauma Foundation Registry from 2016 to 2021 was performed. The study population was divided into two groups according to BTAI management strategy: MM vs. TEVAR. The primary outcome was mortality. Secondary outcomes included complications, hospital and ICU length of stay, and ventilatory days.

Results: 880 patients with BTAI were enrolled, of these, 274 (31%) sustained low grade BTAI. Five patients (2%) progressed to higher grade injuries, underwent uncomplicated TEVAR, and were excluded from further analysis. Of the 269 patients with low grade BTAI, 218 (81%) were treated with MM alone (81% Grade I, 19% Grade II), while 51 (19%) underwent a TEVAR (20% Grade I, 80% Grade II). Comparing low grade BTAI patients who underwent MM vs. TEVAR, there was no difference in demographics or mechanism of injury. Admission systolic blood pressure was lower in patients undergoing TEVAR (Mean (mm Hg): 114 vs 124, $p=0.035$). Rates of thoracotomy, craniectomy, and sternotomy were equal between the two groups, however TEVAR patients were more likely to undergo laparotomy (31% vs 15%, $p=0.007$). There was a significant difference in mortality between MM alone and TEVAR (8% vs. 18%, $p=0.009$). Aortic-related mortality was 0.5% in the MM group and 4% in the TEVAR group ($p=0.06$). TEVAR patients also had an increased incidence of DVT (12% vs. 1%, $p=0.002$) and ARDS, (10% vs. 3%, $p=0.038$). Hospital and ICU length of stay, and ventilator days were not different between the two groups.

Conclusions: MM alone is safe and appropriate management for low grade BTAs, with significantly lower mortality and decreased rates of complications when compared to routine initial TEVAR.

DOES THE USE OF REBOA IMPROVE SURVIVAL IN PATIENTS WITH PELVIC FRACTURES REQUIRING HEMORRHAGE CONTROL INTERVENTION?

Daniel Ricaurte, MD; Herbert Downton-Ramos, MD; Jonathan Gates, MD; Ya-Huei Li, PhD; Ste-phen Thompson, BS; Matthew Lissauer, MD
Hartford Hospital

Invited Discussant: Susan Rowell, MD

Introduction: Resuscitative endovascular balloon occlusion of the aorta (RE-BOA) can be utilized for hemorrhage control for bleeding below the dia-phragm. The aim of this study is to assess whether use of zone 3 REBOA decreases mortality in patients with pelvic fractures requiring control procedures.

Methods: Retrospective study of the ACS TQP Participant Use File from 2016-2019 included hypotensive patients ≥ 18 years, with blunt pelvic fractures requiring a hemorrhage control procedure, comparing those who underwent Zone 3 REBOA deployment (RB) versus those that did not (NR). Primary outcomes included in-hospital and 24hr mortality. Secondary outcomes included blood utilization at 4hrs and 24hrs, hospital and ICU LOS, SSI, lower limb amputation and AKI.

Results: 4,453 records were analyzed, with 139 patients in the RB group and 4,314 in the NR group. Patient demographics were not significant between groups. Median systolic BP and GCS were lower in the RB group, while ISS was higher. Propensity score matching for demographics, ISS, systolic blood pressure, and GCS matched 121 patients to each group. In-hospital (50.5% vs 25%, $p < 0.001$) and 24hr mortality (31% vs 14.3%, $p = 0.002$) were higher in the RB group. Median PRBC transfusions in the first 4hrs (4,000mL vs 1,750mL, $p < 0.001$) and 24hrs (5,600mL vs 2,800mL, $p < 0.001$) were also higher in the RB group. Of those that survived, there were no differences in ICU and hospital LOS. AKI was higher in the RB group (15.7% vs 6.6%, $p = 0.025$), while the rate of lower extremity amputations was similar between groups.

Conclusion: Zone 3 REBOA use in patients with pelvic fractures that require a hemorrhage control procedure appear to have worse outcomes. Further prospective studies are warranted.

DISPELLING DOGMA: AAST PROSPECTIVE, MULTICENTER TRIAL OF INITIAL VS. DELAYED FASCIOTOMY AFTER EXTREMITY TRAUMA

University of Connecticut

Jane Keating, MD; Joanelle A. Bailey, MD; Nathan Klingensmith, MD; Alexis Moren, MD; Fabio Saccomanno, BS; David Skarupa, MD; Anthony Loria, MD; Zoe Maher, MD; Sarah A. Moore, MD; Michael C. Smith, MD, FACS; Robert Jean, MD; Amanda Leung, BA; Kevin M. Schuster, MD, MPH; Mark J. Seamon, MD

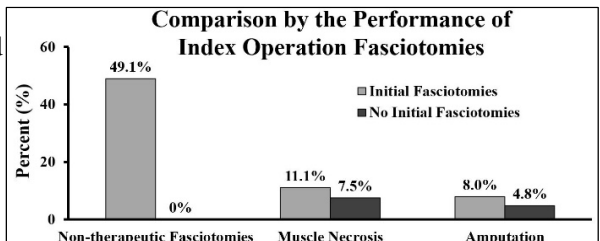
Invited Discussant: Leah Tatebe, MD

Background: Surgical dogma suggests “if you think about doing a fasciotomy, then do it,” yet the outcome benefit to this approach remains unclear. We hypothesized that early fasciotomy during index operative procedures for extremity vascular injury would improve outcomes.

Methods: This prospective, observational multicenter (18LI, 2LII) analysis included patients ≥ 15 yrs with extremity vascular injuries requiring operative management. Clinical variables and outcomes were analyzed with respect to fasciotomy timing for correlation with our primary study endpoint, muscle necrosis development or limb amputation. Associated variables ($p < 0.05$) were input into multivariable logistic regression (MVL) models. **Results:**

Of 442 study patients, most were males (86%) with penetrating (56%) lower extremity (77%) arterial (72%) vein (40%) and bony (51%) injuries with prolonged hospital LOS (med, 11 days). Patients who had index fasciotomies (66%) were compared to those who did not (34%). No differences were appreciated with respect to “hard” signs of vascular injury, SBP, MTP activation, extremity AIS, ISS, concomitant vein injury, initial OR >6 hrs after arrival, shunt use, or exam after repair. Of 289 patients who underwent index fasciotomies (Figure), 49% were non-therapeutic, 11% developed muscle necrosis, 4% required repeat fasciotomies and 8% required amputation while only 28 of 147 (19%) required delayed fasciotomies in those without index fasciotomies. Importantly, no additional muscle necrosis or amputation risk was noted in the delayed fasciotomy group ($p > 0.05$). After controlling for confounders, index fasciotomies were not associated with either muscle necrosis or amputation risk in MVL.

Conclusion: Routine, index operation fasciotomies failed to demonstrate an outcome benefit in this prospective, multicenter analysis. Our results suggest that a careful observation and fasciotomy when needed approach in select patients with extremity vascular injuries may limit unnecessary surgery and morbidity.



**ANTIBIOTIC ADMINISTRATION WITHIN ONE-HOUR FOR
OPEN LOWER EXTREMITY FRACTURES: INFECTION
PREVENTION OR JUST SURGICAL DOGMA?**

Areg Grigorian, MD; Morgan Schellenberg, MD; Kenji Inaba, MD;
Matthew Martin, MD; Kazuhide Matsushima, MD; Michael Lekawa, MD;

Jeffrey Nahmias, MD, MHPE

University of Southern California

Invited Discussant: Addison May, MD, MBA

Introduction: Open fractures have a high risk of infection with limited data correlating timing of prophylactic antibiotics administration and rate of subsequent infections. The Trauma Quality Improvement Project (TQIP) has established a standard guideline of antibiotic administration within one-hour of arrival, but there is a lack of adequately powered studies validating this metric. We hypothesize that open femur or tibia fracture patients undergoing orthopedic surgery have a decreased risk of deep or superficial surgical site infection if antibiotics are administered within one-hour of presentation compared to delayed administration after one-hour.

Methods: The 2019 TQIP was queried for adults with isolated (AIS<1 head/face/spine/chest/abdomen/upper-extremity) open femur or tibia fractures undergoing orthopedic surgery. Transfer patients were excluded. Patients receiving early antibiotics (EA) within one-hour were compared to patients receiving delayed antibiotics (DA) greater than one-hour from arrival.

Results: A total of 3,367 patients were identified, of which 2,400 (70.4%) received EA. Patients receiving EA had a higher rate of infections compared to DA (0.9% vs. 0.2%, $p=0.033$). After adjusting for age, comorbidities, injury severity, washout of the femur/tibia ≤ 6 -hours, blood transfusion and vitals on admission, patients in the EA group had a similar associated risk of infection compared to the DA cohort ($p=0.13$). These results remained in subset analyses of patients with only femur fractures, only tibia fractures or combined fractures (all $p>0.05$).

Conclusion: In this large national analysis, 70% of isolated open femur or tibia fracture patients undergoing surgery received antibiotics within one-hour. After adjusting for known risk factors of infection including abbreviated-injury-scale grade of the lower extremity, there was no association between infection and timing of antibiotic administration. Reconsideration of the surgical dogma that antibiotics must be initiated within one-hour for open fractures appears warranted.

ADMISSION MA-R RATIO: ASSOCIATION BETWEEN THROMBOELASTOGRAPHY (TEG) VALUES PREDICTS POOR OUTCOME IN INJURED CHILDREN

Elissa Abou Khalil, MD; Katrina Morgan, MD; Ward Richardson, MD;
Barbara A. Gaines, MD; Christine M. Leeper, MD, MSc
UPMC

Invited Discussant: Mary Edwards, MD

Background: TEG-MA/R, a derived ratio that accounts for both hypo- and hypercoagulable changes in coagulation, is associated with poor outcomes in adults. The relationship between these TEG values and its association with outcome has not been studied in children.

Methods: A level I pediatric trauma center database was queried for children age <18 who had a TEG assay on admission between 2016-2020. Demographics, injury characteristics, and admission TEG values were recorded. The MA/R ratio was calculated and divided into quartiles. Main outcomes included mortality, transfusion within 24 hours of admission, and thromboembolism. A logistic regression model was generated adjusting for age, injury severity score, injury mechanism, admission shock and Glasgow Coma Score.

Results: In total, 657 children were included. The median(IQR) age = 11(4-14) years, 70% male, median (IQR) ISS =10(5-22), 75% had blunt mechanism. In-hospital mortality = 7% (n=45) and 17% (n=112) required transfusion. Most R and MA values were within normal limits. On unadjusted analysis, the lowest MA-R ratio quartile was associated with increased mortality (15% vs 4%, 5%, and 4%, respectively; $p < 0.001$) and increased transfusion need (26% vs 12%, 16%, 13%, respectively; $p = 0.002$) compared to higher quartiles. In the logistic regression models, low MA/R ratio was independently associated with increased in-hospital mortality (Odds Ratio (95% CI) = 4.4 (1.9-10.2) and increased need for transfusion within 24 hours of admission (OR (95% CI) = 2.0 (1.2-3.4) compared to higher MA/R ratio. There was no association between MA/R ratio and thromboembolism (DVT rate by quartile = 4%, 2%, 1%, 3%).

Conclusion: Although individual admission TEG values are not commonly substantially deranged in injured children, the MA/R ratio is an independent predictor of poor outcome. MA/R ratio may be a useful prognostic tool in pediatric trauma; validation is necessary.

NATIONWIDE TRENDS IN THE MANAGEMENT OF ISOLATED HIGH-GRADE SPLENIC INJURIES: LESS SPLEENS ARE THROWN INTO A BUCKET

Makoto Aoki, MD, PhD; Kazuhide Matsushima, MD; Atsushi Onogawa, MD; Shohei Matsumoto, MD

Japan Red Cross Maebashi Hospital

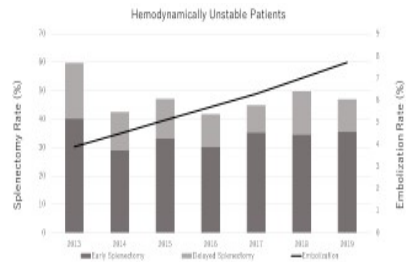
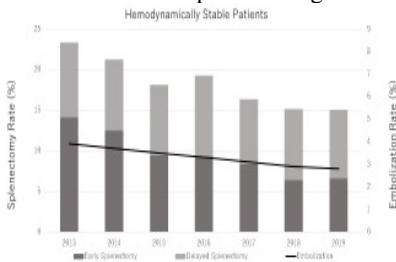
Invited Discussant: Ben Zarzaur Jr., MD, MPH

Introduction: The management of blunt splenic injury (BSI) has significantly changed since the introduction of non-operative management (NOM) in the late 1990s. A recent study reported that overall splenectomy rates for high-grade BSI remained unchanged between 2008 and 2014 despite an increased use of angioembolization. The purpose of this study was to report the recent trends in the management of isolated high-grade BSI, particularly the early splenectomy rate.

Methods: The American College of Surgeons Trauma Quality Improvement Program (ACS TQIP) database was searched to identify patients (aged ≥ 16 years) with isolated high-grade BSI (Abbreviated Injury Scale ≥ 3) between 2013 and 2019. The patients were divided into two groups based on their hemodynamic status (hemodynamically stable [HS] and hemodynamically unstable [HU] groups). Hemodynamic instability was defined as admission systolic blood pressure (SBP) < 90 mmHg, heart rate > 120 bpm, or lowest SBP < 90 mmHg within an hour after admission. The primary outcome was splenectomy rate each year and the secondary outcome was the use of angioembolization. Early splenectomy was defined as that performed within 6 hours, whereas delayed splenectomy between 6–72 hours after admission. Multiple regression models were constructed to estimate the annual trends in splenectomy rates.

Results: A total of 5,929 patients with isolated high-grade BSI were included in the analysis: 4,525 (76.3%) and 1,404 (23.7%) in the HS and HU groups, respectively. Multiple regression models showed significant decrease in the rate of splenectomy in the HS group (from 24.0% in 2013 to 14.9% in 2019, OR = 0.881, CI = 0.836–0.929, $p < 0.001$; Figure), while it remained stable in the HU group (from 60.6% in 2013 to 46.5% in 2019, OR = 0.969, CI = 0.897–1.050, $p = 0.424$). The rate of splenic angioembolization did not significantly change in the HS group (OR = 0.967, CI = 0.864–1.080, $p = 0.554$), but increased in the HU group (OR = 1.240, CI = 1.110–1.390, $p < 0.001$). In the HS group, early splenectomy rate decreased significantly (from 16.6% in 2013 to 8.8% in 2019, OR = 0.841, CI = 0.790–0.896, $p < 0.001$).

Conclusions: For isolated high-grade BSI, the splenic salvage rate showed increasing trends, particularly in HS patients. Because the rate of splenectomy has not significantly changed in HU patients, regardless of increased splenic embolization, further research is needed to identify the optimal group of patients who can benefit from splenic angioembolization to further increase the rate of splenic salvage.



AAST MULTICENTER STUDY: DOES ANGIOEMBOLIZATION IMPROVE SURVIVAL FOR SEVERE HEPATIC INJURIES? ;

Amanda Radisic, MD; Joseph Sakran, MD, MPA, MPH; Mariuxi Manukyan, MD; Bin You, BS; Fang Hu, BS; Meghan Wooster, DO; Kathy Noll, MSN, TCRN; David V. Feliciano, MD; Elliott Haut, MD, PhD; Grace F. Rozycki, MD, MBA
 Johns Hopkins Hospitals
 Invited Discussant: Mark Seamon, MD

Introduction: The hypothesis is that angioembolization (angio) improves survival in patients with severe hepatic injuries.

Methods: Data from 29 trauma centers were collected and analyzed on adult (≥ 18 yrs.) patients with Grades III, IV, and V hepatic injuries. Demographics, mechanism of injury, shock index (SI), transfusions (≥ 6 PRBCs), length of stay (LOS), ISS, use/timing of angio, and outcomes were recorded. Data were analyzed by mechanism and management: nonoperative with/without angio, operative with pre or post angio, and operation alone. Logistic regression was used to identify associations with mortality, $p < 0.05$.

Results: From 2013-2018, 2,430 patients (1,697 blunt, median ISS = 29; 733 penetrating, median ISS = 25) sustained severe hepatic injuries.

The strongest associations of mortality for blunt and penetrating patients were ISS ≥ 25 ($p < 0.0001$) and

PREDICTORS OF MORTALITY: LIVER INJURY GRADES III, IV, V				
	BLUNT		PENETRATING	
	OR (CI 95%)	P Value	OR (CI 95%)	P Value
SI > 1.0	0.965 (0.0703-1.325)	0.8253	0.722 (0.657-2.974)	0.181
ISS ≥ 25	3.793 (2.411-5.966)	<0.0001	7.576 (3.899-14.718)	<0.0001
≥ 6 U PRBCs in 24h	4.587 (3.168-6.642)	<0.0001	6.828 (3.965-11.760)	<0.0001
Timing of Angio relative to index operation: pre/post	0.39 (0.132-1.155)	0.0892	<i>Grp size too small; no statistical significance</i>	
Angio alone versus nonoperative management	1.619 (0.987-2.655)	0.0562	9.923 (2.028-48.563)	0.0046

≥ 6 u PRBC in the first 24 hours ($p < 0.0001$). SI was found to be associated with a higher mortality but only in a subgroup analysis of blunt Grade V liver injuries.

For patients undergoing operative management, the use of preop or postop angio had no impact on survival, but angio showed a decrease in mortality in penetrating injured patients when compared to nonoperative management alone, ($p = 0.0046$)

Conclusion: Angio does not improve survival in most cases of severe hepatic injuries but does offer a survival benefit in nonoperative high grade penetrating hepatic injuries.

HERNIA RECURRENCE RISK FACTORS IN BLUNT TRAUMATIC ABDOMINAL WALL HERNIAS: A SECONDARY ANALYSIS OF A WESTERN TRAUMA ASSOCIATION MULTICENTER STUDY

Kevin Harrell, MD; Arthur Grimes, MD; Harkanwar Gill, MD; Jessica Reynolds, MD; Jason Sciarretta, MD; Samuel Todd, MD; Marc Trust, MD; Marielle Ngoue, BS; Bradley W. Thomas, MD; Sullivan Ayuso, MD; Walter Biffl, MD; Jeffry Nahmias, MD; Robert Maxwell, MD
 University of Tennessee College of Medicine Chattanooga
 Invited Discussant: Benjamin Davis, MD

Introduction: While recent studies have supported the feasibility of early repair of blunt traumatic abdominal wall hernias (TAWH) during emergent laparotomy (EL) or initial hospitalization, concerns remain regarding the potential for increased recurrence. Little data exists, however, on the incidence of recurrence and risk factors that may predispose to hernia recurrence.

Methods: Patients who underwent repair of a TAWH from January 2012 to December 2018 were identified from 20 trauma centers recruited through the Western Trauma Association Multicenter Trials Committee. Patients were stratified into recurrence and non-recurrence groups. Logistic regression models were used to investigate risk factors for hernia recurrence.

Results: TAWH were repaired in 175 patients with 21 (12.0%) known recurrences. The recurrence group had a higher injury severity score (ISS) (26.0 ± 16.5 vs. 15.1 ± 16.0 , $p=0.011$) and were more commonly female (66.7% vs. 37.7%, $p=0.022$). No difference was found in hernia location, hernia defect size, primary fascial repair, or median time to repair between the recurrence and non-recurrence groups. Patients with hernia recurrence more commonly underwent EL on presentation (90.5% vs. 63.0%, $p=0.013$) and had a bowel resection (81.0% vs. 38.8%, $p<0.001$) compared to the non-recurrence group. Recurrence patients also had a higher rate of surgical site infection (42.9% vs. 11.1%, $p<0.001$). Mesh use was similar between the cohorts (33.3% vs. 38.3%, $p=0.840$), and not protective of recurrence. Female sex, ISS, EL, and bowel resection were associated with hernia recurrence using logistic regression. Bowel resection remained significant when these variables were placed into a multivariable model.

Conclusion: There is increased incidence of hernia recurrence after repair of TAWH in female patients, patients with higher ISS, and after EL or bowel resection. However, only, bowel resection remained significant in a multivariable logistic regression model as an associated risk factor for recurrence. Mesh use was not associated with lower recurrence rates. Surgeons should be aware of these factors when repairing these complex injuries and consider repair after initial resuscitation if laparotomy is not indicated for some other reason, such as for bowel injury.

Table Logistic regression for risk factors influencing TAWH recurrence

Variable	Univariable			Multivariable		
	OR	95% CI	p-value	OR	95% CI	p-value
Female sex	3.31	1.26-8.68	0.015	2.13	0.75-6.02	0.153
ISS	1.04	1.01-1.08	0.014	1.03	0.99-1.06	0.178
EL	5.58	1.2-24.8	0.024	2.49	0.51-12.07	0.257
Bowel resection	6.71	2.15-20.95	0.001	3.90	1.15-13.23	0.029
Mesh use	0.81	0.31-2.11	0.659	0.78	0.28-2.20	0.636

TIME TO CRITICAL INTERVENTION: PUSHING ADVANCED RESUSCITATION INTO THE PREHOSPITAL SETTING

Andrew-Paul Deeb, MD, MSc; Francis Guyette, MD, MPH; Brian Daley, MD; Rick Miller, MD; Brian Harbrecht, MD; Jeff Claridge, MD, MS; Herb Phelan, MD, MSc; Brian Eastridge, MD; Raminder Nirula, MD, MPH; Bellal Joseph, MD, FACS; Gary Vercruyse, MD; Jason Sperry, MD, MPH; Joshua Brown, MD, MSc

University of Pittsburgh Medical Center

Invited Discussant: Adam Fox, DO

Introduction: Hemorrhage is the leading cause of preventable death after injury. Damage control resuscitation can reduce this but is usually only available at a trauma center. Recent data suggest advanced prehospital resuscitation (aPHR) improves survival in longer prehospital (PH) time. Our objective was to evaluate if time to resuscitation initiation impacts mortality.

Methods: We combined data from two randomized PH trials; the PAMPer trial in which patients received PH plasma or standard care and the STAAMP trial in which patients received PH tranexamic acid (TXA) or placebo. We included scene patients with SBP<70 or SBP 70-89 plus HR>108. PRBC, plasma, or TXA administration were considered aPHR. We calculated the time to critical intervention (TCI) as the minutes from EMS arrival to receiving aPHR or arrival at the trauma center for those not receiving aPHR. Mixed-effects logistic regression assessed the association of 24h and 30d mortality with TCI, controlling for demographics, injury severity, vital signs, resuscitation, and procedures accounting for clustering by EMS agency and site. We tested the interaction of TCI and PH time.

Results: 1,187 patients met inclusion criteria (407 PAMPer; 780 STAAMP). 667 patients received aPHR (351 TXA; 148 plasma; 109 PRBC; 59 multiple). Every 1-min delay in TCI was associated with a 4% increase in odds of 24h mortality (OR 1.04; 95%CI 1.01-1.07, p=0.02) and 2% increase in odds of 30d mortality (OR 1.02; 95%CI 1.01-1.03, p=0.03). The interaction of TCI and PH time was not significant for 24h (p=0.07) or 30d (p=0.14) mortality. PH time was associated with increased 24h (OR 1.07; 95%CI 1.01-1.13, p=0.02) but not 30d mortality, while TCI remained associated with 24h (p=0.04) and 30d mortality (p=0.02). A delay in TCI for each aPHR component was associated with higher 30d mortality (p<0.05).

Conclusions: TCI is associated with early and late mortality in patients with hemorrhagic shock after injury. TCI may be more important than simple PH time for long term outcomes. This suggests bleeding patients need advanced resuscitation early, whether at the trauma center in systems with short PH times or in the field when PH time is prolonged. EMS professionals should consider initiating available aPHR interventions when arrival at the trauma center may be delayed in patients with hemorrhagic shock.

MULTICOMPARTMENTAL TRAUMATIC INJURY AND THE MICROBIOME: SHIFT TO A PATHOBIOME

Jennifer A. Munley, MD; Lauren S. Kelly, MD; Erick E. Pons, BS;
Kolenkode B. Kannan, PhD; Philip A. Efron, MD, FACS, FCCM; Ravinder
Nagpal, PhD; Alicia M. Mohr, MD, FACS, FCCM
University of Florida College of Medicine
Invited Discussant: Stephanie Savage, MD

Introduction: Previous animal models have demonstrated altered gut microbiome after mild traumatic injury; however, the impact of injury severity and critical illness is unknown. We hypothesized that a rodent model of severe multicompartmental injuries and chronic stress would demonstrate microbiome alterations toward a “pathobiome” characterized by an overabundance of pathogenic organisms which would persist one week after injury.

Methods: Male Sprague-Dawley rats (n=8/group) were subjected to either polytrauma (PT) (lung contusion, hemorrhagic shock, cecectomy, and bifemoral pseudofractures), PT plus 2-hours daily chronic restraint stress (PTCS), or naïve controls. Fecal microbiome was measured on days 0, 3, and 7 using high-throughput 16S rRNA sequencing and QIIME2 bioinformatics analysis. Microbial alpha-diversity was assessed using Chao1 (number of different unique species) and Shannon (species richness and evenness) indices. Beta-diversity was assessed using principle coordinate analysis. Pairwise analyses were performed in R software package, with significance defined as $p < 0.05$.

Results: There were no differences in diversity or microbiome composition between groups at baseline. PT demonstrated significant alterations in beta-diversity at days 3 ($p=0.01$) and 7 ($p=0.04$) compared to naïve. PTCS demonstrated significant differences in beta-diversity at day 3 ($p=0.01$) which persisted at day 7 ($p=0.01$) versus naïve. PTCS also significantly depleted bacterial diversity (Chao1) at day 3 ($p=0.01$) which persisted up to day 7 ($p=0.03$) versus naïve. Bacteroides dominated both PT and PTCS cohorts while Enterococcus was prevalent in PT.

Conclusion: Polytrauma with and without chronic stress induced significant alterations in microbiome diversity and composition within three days after injury; these changes were more prominent and persisted for one-week post-injury with chronic stress. This rapid and persistent transition to a “pathobiome” phenotype represents a critical phenomenon that may influence outcomes after severe trauma and critical illness.

EVALUATION OF LEAD AND OTHER HEAVY METAL LEVELS FROM RETAINED BULLET FRAGMENTS: A PILOT STUDY

Randi N. Smith, MD; Lauren Amidon, BA; Ashleigh hawk, BS; Hyunshik Kim, BA; Kyle Suen, MD; Wandave Tizhe, MPH; Alexis Thompson, MPH; Christine Castater, MD, MBA; Courtney Meyer, MD; Ziad Kazzi, MD
Emory University

Invited Discussant: Jessica Weaver, MD

Introduction: Worldwide, lead toxicity is a major public health problem, with serum levels ≥ 5 $\mu\text{g}/\text{dL}$ associated with symptoms. In the US, retained bullet fragments (RBFs), made of lead and other heavy metals, are a common, yet rarely studied etiology of lead toxicity after firearm injury. The objective of this study was to correlate RBFs, lead and other heavy metal levels, and symptoms of toxicity.

Methods: Adult patients who sustained gunshot wounds at an urban Level 1 trauma center between July 2020 and November 2021 were evaluated. Participants were sorted into two groups: exposed (≥ 1 RBF) and control (0 RBF). Vital signs, blood and urine samples were collected at the time of index hospitalization and at 2 to 4 weeks following injury. The samples were tested for lead and other heavy metals. Demographics, injury patterns, and clinical outcomes were analyzed. Surveys were used to assess prior exposure to lead and cognitive impairment post-injury.

Results: There were 103 patients enrolled and 95 included in the analysis after discarding subjects with missing data. Compared to the control, exposed subjects were younger (IQR [18-65]) with a higher mean blood lead level (BLL) (81.4 ng/mL vs 19.5 ng/mL, respectively, $p=0.01$). There was no difference in race, gender or injury severity between groups. After controlling for prior lead exposure, the exposed group was also more likely to have an increase in mean BLL at 1 month follow-up from baseline (see figure). There was no difference in vital signs or cognitive impairment between the groups. There was no difference in levels of non-lead heavy metals.

Conclusion: Survivors of gunshot wounds with RBFs are at increased risk of lead toxicity. The duration of this risk is unknown as our data show worsening elevation of BLL with time. This study supports the need for changes to clinical protocols regarding the removal of retained bullets and how patients are informed of the effects of leaving RBF in situ. Partnerships with toxicologists who can monitor and treat lead toxicity are warranted.



SESSION XIII B: **PAPERS 56-66**

Friday, September 23, 2022

1:15 PM - 4:55 PM

Location: Grand Ballroom

Moderator: Jonathan Tilsed, MD

Recorder: Rosemary Kozar, MD, PhD

TIMING IS EVERYTHING: EARLY VERSUS LATE PALLIATIVE CARE CONSULTS IN TRAUMA

Audrey L. Spencer, MD; Preston R. Miller, MD; Gregory B. Russell, MS;
Buddy Marterre, MD, MDiv

Wake Forest Baptist Medical Center

Invited Discussant: Kathleen O'Connell, MD

Introduction: The incorporation of dedicated palliative care (PC) services in the care of the critically injured trauma patient is not yet universal. Preexisting data demonstrates both economic and clinical value of PC consults, yet patient selection and optimal timing of these consults is poorly defined, possibly leading to underutilization of PC services. Prior studies in geriatric patients have shown benefits of PC when PC clinicians are engaged earlier during hospitalization. We aim to compare hospitalization metrics of early versus late PC consultation in trauma patients.

Methods: All patients age ≥ 18 admitted to the trauma service between 1/1/19 and 3/31/21 who received a PC consult were included. Patients were assigned to EARLY (PC consult ≤ 3 days after admission) and LATE (PC consult > 3 days after admission) cohorts. Demographics, injury and underlying disease characteristics, outcomes, and financial data were compared. Length of stay (LOS) in the EARLY group is compared to LOS-3 in the LATE group.

Results: 154 patient records met inclusion criteria (60 EARLY and 94 LATE). Injury severity score, head abbreviated injury score, and medical comorbidities (congestive heart failure, dementia, previous stroke, chronic obstructive pulmonary disease, malignancy) were similar between the groups. The LATE group was younger (69.9 ± 19.2 vs 75.3 ± 18.5 , $p=0.04$). Patients in the LATE group had significantly longer LOS (17.5 ± 16.5 vs 7.0 ± 8.4 days, $p<0.01$) and higher hospital charges ($\$291,166$ vs $\$107,046$, $p<0.01$) and costs ($\$79,080$ vs $\$24,904$, $p<0.01$).

Conclusion: Early PC consultation is associated with shorter LOS and lower charges and costs in trauma patients even after correcting for delay to consult in the late group. This association suggests the need for mechanisms leading to early PC consult in critically injured patients.

DETRIMENTAL IMPACT OF FRAILITY ON LONG-TERM PATIENT REPORTED OUTCOMES IN EGS PATIENTS

Ashley D. Meagher, MD, MPH; Chris Robbins, PhD; Gabriel Kinnaman,
BS; Pat Murphy, MD

Indiana University Hospital

Invited Discussant: Amy Gore, MD

Introduction: Frailty presents a clinical challenge and is associated with increased perioperative morbidity and mortality. Few studies examine the effect of frailty on functional outcomes and return to baseline after emergency surgery. We aimed to determine the long-term effect of frailty on patient reported outcomes in an emergency general surgery (EGS) population.

Methods: This was a prospective cohort study of adult patients admitted for emergency surgical evaluation to a tertiary referral center between 03/2020 - 01/2021 and hospitalized >36 hours. Patients enrolled during their index hospitalization and completed baseline, 6-month assessments. Frailty was identified based on the EGS-specific frailty index. Patient-reported outcome measures included SF-36, Katz and Lawton measures of independent activities of daily living (IADL), and the GAD7 and PHQ9 measures of depression and anxiety. Analyses utilized a repeated measures linear mixed effects model for each of the five outcomes of interest.

Results: Seventy-five patients were enrolled; 29 completed 6-month assessment (38%), the majority being female (n=43, 57%), and on average 56 years of age (range 23-88). Fifty-five patients (73.3%) required operative intervention, 14 (25.5%) required a second operative procedure. The average hospital length of stay was 5.9 days (range: 2-43.7). Thirty-two (43.8%) patients scored as frail. Frail patients scored 6 points lower on the SF-36 physical component score (p=0.03) and 19 points lower on the mental component score (p<0.001). Both frail and non-frail patients had a decline in IADLs, but frail patients had a significantly worse decline as compared with the non-frail (p<0.001). Frail patients also had significantly worse anxiety and depression scores on the GAD 7 (5.69; p<0.01) and PHQ 9 (6.35; p<0.01) as compared with the non-frail group.

Conclusion: Admission for an EGS evaluation results in significant functional and mental health declines in frail patients. Frail patients have worse post-discharge anxiety and depression symptoms. To return these patients to their baseline functioning, any intervention to rehabilitate these patients needs to include mental health care, as well as physical rehabilitation.

INTERFACILITY TRANSFER IS ASSOCIATED WITH SURVIVAL BENEFIT IN SEVERELY AND PROFOUNDLY INJURED PATIENTS

Sami K. Kishawi, MD; Avanti Badrinathan, MD; Justin E. Dvorak, MD;
Christopher W. Towe, MD; Vanessa P. Ho, MD, MPH
MetroHealth Medical Center

Invited Discussant: Jordan Estroff, MD

Background: Interfacility transfer may be necessary to provide appropriate level care for injured patients. We hypothesized that interfacility transfers confer a survival benefit for all patients regardless of age or injury severity.

Methods: This retrospective study utilized the 2019 iteration of ACS TQIP and included all adult patients aged 18 and older who presented to a Level I, II, or III trauma center or who required trauma surgery consultation.

Pregnant patients and patients who arrived with no signs of life were excluded. Collected variables included age, sex, vital signs at presentation, GCS score, functional dependence, fall history, anticoagulation, medical comorbidities, max. abbreviated injury scale (AIS) score, injury severity score (ISS), and interfacility transfer status. Primary outcome was mortality. Secondary outcomes were hospital length of stay (LOS), need for ICU, and vent days. Adjusted logistic regression was used to determine significant associations between interfacility transfer, age, ISS, and mortality.

Results: Of 898,807 total patients, 344,985 (38.4%) were geriatric patients aged 65 years or older. Of 217,431 total interfacility transfers, 89,160 (41.0%) were geriatric patients. After adjusting for age, sex, maximum AIS score, and ISS, adult non-geriatric patients with severe (ISS 16-24) and profound (ISS 25+) injuries demonstrated higher odds of mortality if not transferred (OR 9.72, 95% CI 8.64-10.93, $p < 0.001$) compared to their transferred counterparts (OR 8.19, 95% CI 7.22-9.29, $p < 0.001$). Similarly, geriatric patients with severe and profound injuries demonstrated higher odds of mortality when not transferred (OR 4.99, 95% CI 4.43-5.61, $p < 0.001$) compared to their transferred counterparts (OR 3.59, 95% CI 3.19-4.05, $p < 0.001$).

Conclusion: Interfacility transfer confers a survival benefit in severely and profoundly injured patients, most notably in patients aged 65 and older.

SURGICAL RESIDENT OPERATIVE AUTONOMY ON NIGHTS AND WEEKENDS: WHAT HAPPENS TO SURGICAL EDUCATION DURING OFF-HOURS?

Devashish J. Anjaria, MD; Joseph B. Oliver, MD; Yasong Yu, MD; Grace Tsui, MD; Anastasia Kunac, MD; David H. Livingston, MD

VA New Jersey Healthcare System

Invited Discussant: Amy Hildreth, MD

Introduction: Surgical resident operative autonomy is critical for trainee maturation to independence. Acute care surgery (ACS) cases commonly occur off-hours and tension between OR availability and on-call staff can affect resident operative autonomy. We examined operative resident autonomy for general, vascular, and thoracic (GVT) surgery during nights and weekends.

Methods: Utilizing the VASQIP database, we examined all GVT cases at VA teaching hospitals from 2004-2019. All cases are coded for the level of supervision at the time of surgery: (AP) attending primary surgeon; (AR) attending and resident operating together; and (RP) resident primary (attending supervising but *not* scrubbed). Cases starting between 6pm to 7am Monday thru Friday were considered nights, cases on Saturday/Sunday were considered weekends, and collectively considered “off-hours.” RP case rates were compared by start time and type.

Results: Over the 15-year study period, there were 666,421 GVT cases performed with 38,097 cases (6%) performed “off-hours”. During off-hours, 31,396 (83%) were ACS compared to 5% of daytime cases. The proportion of RP cases for case type by start time are shown in Table 1. Overall, off hours cases have higher RP rate than daytime cases (6.8 vs 5.8%, $p < 0.001$). The 3 most common (40% of total) ACS cases were appendectomy, amputation, and cholecystectomy. Daytime ACS cases have higher rates of RP than nights/weekends (7.6 vs 6.8%, $p < 0.001$). Conversely, daytime elective cases have lower RP than nights (5.7 vs 7.9%, $p < 0.001$). During off-hours, there are more RP cases on nights compared to weekends (7.1 vs 6.5%, $p = 0.02$).

Conclusions: Overall, residents were afforded more operative autonomy during off-hours, with nights having greater RP than weekends. In contrast, ACS cases have more autonomy during weekdays. These data have potentially significant implications for ACS service staffing, night float rotations and overall resident operative experience on ACS services.

Table 1. Proportion of RP cases by case type and day/time

	Weekdays	Weeknights	Weekends	Off Hours	Overall
Elective	5.7%	7.9%	5.3%	6.8%	5.7%
Emergency	7.6%	6.9%	6.8%	6.8%	7.2%
Overall	5.8%	7.1%	6.5%	6.8%	5.9%

A COMPREHENSIVE ANALYSIS OF 30-D READMISSIONS AFTER EGS PROCEDURES. ARE RISK FACTORS MODIFIABLE?

Raul Coimbra, MD, PhD; Timothy Allison-Aipa, BS; Matthew Firek, BS; Shirley LEanos-Moreno, BS; Naomi Franco, PhD; Rahul Tuli, BS; Sara Edwards, MD; Bishoy Zakhary, MPH

Riverside University Health System

Invited Discussant: Kimberly Davis, MD, MBA

Background: Post-operative hospital readmissions are costly, lead to increased resource utilization, and decreased patient satisfaction. Risk factors associated with procedure-related 30-day readmission after emergency general surgery (EGS) have not been comprehensively studied. We set out to determine risk factors for procedure-related 30-d readmission after EGS procedures identifiable in the pre-operative, post-operative (in-hospital), and post-discharge periods.

Methods: Using the NSQIP database (2013-2019), a retrospective cohort study was conducted including 9 surgical procedures encompassing 80% of the burden of EGS diseases, performed on an urgent/emergent basis. The procedures were 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). Data on patient characteristics (Age, Sex, BMI, ASA scores, and pre-op presence of sepsis), Direct Admissions/Transfers, Procedure Risk, Length of Hospital Stay (LOS), and Discharge Destination were analyzed by multivariate logistic regression.

Results: A total of 312,862 patients were included in the study [16,306 procedure-related 30-d readmissions (5.2%), and 296,556 non-readmissions]. 30-d readmission patients were on average 8 years older, with higher ASA scores, more often underweighted or markedly obese, and more frequently presented with sepsis than non-readmitted patients. Multivariate Logistic Regression identified risk factors for EGS procedure-related 30-d readmission including sepsis present at the time of surgery (AOR=1.91), BMI < 18 (AOR=1.16), BMI ≥ 40 (AOR=1.16), ASA ≥ 3 (AOR=1.39), high-risk procedures (AOR=1.51), 4 d ≤ LOS ≤ 7d (AOR=1.93), LOS > 8d (AOR=1.83), discharge to rehab (AOR=1.22), and discharge to SNF (AOR=1.36). Interestingly, transfers and low-risk procedures were not associated with 30-d readmissions. Additionally, 30-d readmissions following low-risk procedures occurred at a median of 5 days (IQR: 2-11), whereas 30-d readmissions in high-risk procedures occurred at a median of 6 days (IQR:3-11). Of the high-risk procedures, open colectomy and small bowel resection cases were the most common. Surgical site infections, postop sepsis, wound disruption, and thromboembolic events were more prevalent in the 30-d readmission group. The mortality rate was 6-fold higher in the 30-d readmission group (2.4% vs. 0.6%; p<0.001).
Conclusions: We have demonstrated that patient characteristics such as obesity and multiple comorbidities, sepsis on presentation, procedure risk, LOS > 4 days, and discharge destination except for home, are associated with increased risk of EGS procedure-related 30-d readmission. These findings are not modifiable in the short term, indicating the significant burden of EGS diseases. Instituting financial penalties to hospitals and providers will not reduce readmissions

SURGICAL STABILIZATION OF CRITICAL ABDOMINAL INJURIES PRIOR TO TRANSFER HAS IMPROVED SINCE 2010

Chandler Tinsman, Michele Lilienthal, RN; Colette Galet, PhD; James Torner, PhD; Dionne Skeete, MD

University of Iowa Hospitals & Clinic

Invited Discussant: Alison Wilson, MD

Introduction: Worse outcomes following injuries are more likely in rural compared to urban areas. Iowa established an inclusive trauma system in 2001 to improve mortality. No study has yet examined the impact of the Iowa trauma system on abdominal injuries. We hypothesized that maturation of the Iowa trauma system would be associated with more exploratory laparotomies for time-critical abdominal injuries prior to transfer to a higher level of care and better outcomes.

Methods: Our institution's trauma registry was queried to identify all patients transferred between 01/01/2010 and 12/31/2020 who underwent exploratory laparotomy (ex-lap) either before transfer or within 4 hours of arrival. We compared the first 6-year period (2010-2015) to the last 5-year period (2016-2020). Categorical and continuous variables were compared using Chi-Squared tests and Mann-Whitney tests, respectively. $P < 0.05$ was considered significant.

Results: We included 213 patients; 63 had ex-lap performed before transfer and 150 after. Rates of ex-lap before and after transfer and outcomes (mortality, hospital LOS, ICU LOS, ventilator days) were similar between the first and last periods ($p = 0.314$ for ex-lap, $p = 0.941, 0.291, 0.274, 0.588$ for outcomes). Compared to the first period, the rate of ex-lap performed before transfer for severe injuries (abdominal AIS >3) significantly increased during the last period (57.1% vs. 30.6%, $p = 0.011$). Similarly, incidence of damage control laparotomies (43.9% vs. 23.6%; $p = 0.02$) and transfusion of plasma and platelet products (33.6% vs. 13.2%; $p < 0.001, 22.4\% \text{ vs. } 8.5\%$, $p = 0.005$, respectively) significantly increased. Finally, injury to ex-lap time for patients stabilized prior to transfer significantly decreased over time (1h47min \pm 1h vs. 2h11min \pm 55min, $p = 0.04$).

Conclusion: Our results suggest improvement in the identification and stabilization of critical patients at the non-level I facilities prior to transfer to the level I facility. We also observed a significant increase in usage of blood products at these facilities and increased use of damage control techniques over time. These findings suggest a shift in the approaches to surgical stabilization and resuscitation efforts in our trauma system. Interestingly, this shift did not translate in a decrease in mortality or improved outcomes.

LONGITUDINAL STUDY EVALUATING POST-ICU SYNDROME DIFFERENCES BETWEEN ACUTE CARE SURGERY AND TRAUMA SICU SURVIVORS

Nikolay Bugaev, MD; Daniele Abela, MD; Eric Mahoney, MD; Samantha Bottom-Tanzer, MD; Janelle Poyant, Teresa Louzada, MD; Abbey Boudouvas, MD; Eileen Poon, MD; Susan Love, MD; Horacio Hojman, MD; Benjamin Johnson, MD; Woon Cho Kim, MD; Mohammed Bawazeer, MD
Tufts Medical Center
Invited Discussant: Jennifer Gurney, MD

Introduction: Recently, we identified a high occurrence of Post-ICU Syndrome (PICS) in Acute Care Surgery (ACS) and Trauma SICU survivors. Researchers are beginning to understand that critical illness due to ACS or Trauma may represent different pathophysiologic entities. In this longitudinal study, we sought to identify differences in patient characteristics, associated hospital factors, recovery, and the occurrence of PICS in these two groups.

Methods: Patients 18 years or older who required SICU care for at least 72 hours were included in the study. These patients were seen in a dedicated ICU Recovery Center at 2-, 12-, and 24-weeks after discharge. PICS sequelae, which include Physical, Cognitive, and Psychiatric domains, were diagnosed by dedicated specialists using clinical criteria and screening questionnaires. Pre-admission demographics, psychosocial histories (including substance use, psychiatric illness, baseline cognitive and physical impairments), hospital course, and recovery data were collected via retrospective chart review. **Results:** One-hundred twenty-nine patients were included in the study, with 74 (57.3%) Trauma and 55 (42.6%) ACS patients. The Trauma cohort was slightly younger (ACS 57 y.o vs. Trauma 50 y.o, $p=0.02$). Pre-hospital psychosocial histories were similar across both groups. The ACS group had significantly longer hospital lengths of stay, and higher rates of acute renal failure, sepsis, open abdomens, and readmissions. At the 2-week visit, ACS patients had higher rates of PICS (ACS 100% vs Trauma 85.9%, $p=0.009$), particularly in the Psychiatric (ACS 60.5% vs. Trauma 38.1%, $p=0.02$) and Cognitive (ACS 48.8% vs. Trauma 31.3%, $p=0.07$) domains. At the 12- and 24-week visits, the rates of PICS symptoms were equivalent between the two groups. **Conclusion:** The occurrence of PICS is high in both ACS and Trauma SICU survivors. Despite entering the SICU with similar psychosocial histories, the two cohorts have different inpatient pathophysiological experiences, which are associated with a higher rate of impairment in the ACS cohort during the early recovery period. These differences resolve during the remaining follow-up period. .

EXTERNAL VALIDATION OF THE TEMPT SCORE AS A PREDICTOR OF BLOOD TRANSFUSION

Rafael Lozano, MD; Leonardo Graeff, BS; Anamaria J. Robles, MD; Richa Kalamdani, BS; Ashli Barnes, BS; Jason Li, BS; Taylor Riedley, BS; Haradeen Dhillon, BS; Anthony Calabro, PhD; Randi McNulty, MS; Lucy Kornblith, MD; Rachael Callcut, MD, MPH
University of California, Davis Medical Center
Invited Discussants: Bryan Cotton, MD

Introduction: Most prediction tools for transfusion rely on total anatomic injury burden as a major component. This limits their utility for prompting early activation of massive transfusion protocols in the setting of occult injury, as the full injury burden is often not known at presentation. TEMPT (Trauma Early Mortality Prediction Tool) was recently created as an abbreviated injury score (AIS) independent prediction tool for emergency department (ED) use. External validation of prediction tools is the gold standard, and this study is the first external validation of TEMPT for prediction of transfusion of red blood cell (RBC) transfusion.

Methods: A prospective cohort of highest-level trauma activations aged ≥ 18 years old were enrolled in the Precision Approaches to Resuscitation in Trauma (PART III) study if a research blood sample was obtained with first intravenous access on presentation. The enrolling center did not participate in the original TEMPT derivation study and represents a validation site. Demographics, injury characteristics, labs, transfusion data, and outcomes were collected. A TEMPT score (0 to 6) was calculated for each patient using the initial ED value for each component (presence of TBI, age ≥ 59.5 years, base excess ≥ -4.35 , partial thromboplastin time (PTT) ≥ 31.5 , INR ≥ 1.25 , temperature ≤ 36.25 degrees Celsius). Multiple logistic regression was performed using R statistical package for predictors of RBC transfusion.

Results: From March 2021-Feb 2022, 102 patients were enrolled. Median age was 44 (IQR 30-61), 82% were male, 68% suffered blunt trauma, 30% had an ISS > 15 , and 53% required ICU admission. RBC transfusion occurred in 32% of the cohort with 88% (n=29/33) receiving RBCs in the first 6 hours of care. Patient TEMPT scores ranged from 0 to 5 with no patient having a positive value for all 6 components of the score. TEMPT was a strong predictor of RBC transfusion with increasing probability of RBC transfusion for each additional score point (p=0.009, Figure).

Conclusion: TEMPT is an easy-to-use tool for real-time early identification of patients likely to need PRBC transfusion and is independent of the need for an abbreviated injury score (AIS).

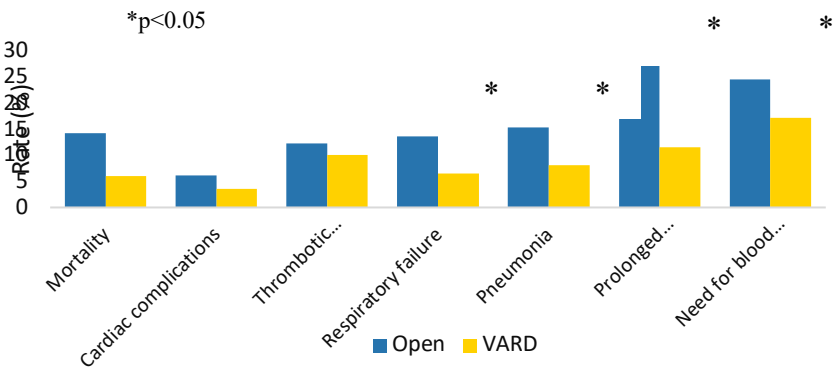
VIDEO-ASSISTED RETROPERITONEAL DEBRIDEMENT (VARD) FOR NECROTIZING PANCREATITIS IS ASSOCIATED WITH SUPERIOR IN-HOSPITAL OUTCOMES

Zachary Tran, MD; Jane Xu, MD; Arjun Verma, Nam Yong Cho, BS;
Shayan Ebrahimian, BS; Peyman Benharash, MD; Sigrid Burruss, MD
Invited Discussant: Nancy Parks, MD

Introduction: Open necrosectomy has been the traditional, standard surgical treatment for necrotizing pancreatitis. Recently, video-assisted retroperitoneal debridement (VARD) has been established as a safe and effective alternative. The present national study evaluated clinical and financial outcomes of patients undergoing VARD and open necrosectomy.
Methods: The 2016-19 National Inpatient Sample was queried for adult hospitalizations for necrotizing pancreatitis requiring operative debridement. Patients receiving any video-assisted procedures without a subsequent open debridement were classified as *VARD* while the remainder were considered *Open*. The Elixhauser Comorbidity Index was used to numerically quantify the burden of comorbidities. Multivariable regression models examined the association of operative approach on mortality, in-hospital complications, discharge disposition, hospitalization duration and adjusted costs.

Results: Of an estimated 15,240 patients with necrotizing pancreatitis, 2,615 (17.2%) required operative intervention. Of these, 990 (37.9%) underwent *VARD* with a steady trend in utilization (2016: 34.7% vs 2019: 32.4%, $p=0.07$). Compared to *Open*, *VARD* patients were similar in age and burden of comorbidities, etiology, and use of preoperative closed drainage (*Open*: 12.0% vs *VARD*: 15.2%, $p=0.30$). However, *VARD* had a lower rate of abdominal compartment syndrome (0.5% vs 6.46%, $p=0.001$). *VARD* was associated with lower rates of several unadjusted endpoints (Figure). After adjustment, *VARD* was associated with lower odds of in-hospital mortality (AOR: 0.33, 95% CI: 0.15-0.75) and pneumonia (AOR: 0.48, 95% CI: 0.23-0.97) and greater likelihood of home discharge (AOR: 1.91, 95% CI: 1.22-3.01). Furthermore, *VARD* was associated with shorter hospitalization duration (β : -11.7 days, 95% CI: -16.6- -6.7) and adjusted costs (β : -\$63.3K, 95% CI: -88.2- -38.4).

Conclusions: Compared to those receiving open pancreatic debridement, patients undergoing VARD for necrotizing pancreatitis appear to have lower mortality and significantly lower resource utilization. Although not increasing in utilization, our findings demonstrate that a minimally-invasive may be preferable in appropriate patients.



MULTIYEAR EXPERIENCE WITH MOBILE ONLINE PLATFORM FOR DOCUMENTATION OF ACUTE CARE SURGERY FELLOWS SUPERVISION

Oliver L. Gunter, MD, MPH; Stephen P. Gondek, MD, MPH; Bradley M. Dennis, MD; Oscar D. Guillaumondegui MD, MPH
Vanderbilt University Medical Center
Invited Discussant: Jasmeet Paul, MD

Introduction: There is currently no standard for documenting supervision of acute care surgery (ACS) fellows. To accomplish this goal, we developed a web-based survey that is accessible via mobile platform. We hypothesize that our mobile access survey is an effective, reproducible tool for assessing fellow clinical performance.

Methods: A retrospective review from 2016-2022 of all data captured in an encrypted database on all ACS fellows at our institution was performed. Supervision was defined as: type 1 direct face-to-face, type 2a immediately available in-house, type 2b available after notification via phone with remote electronic medical record access, and type 3 retrospective review. Data were collected by supervising faculty using a web-based clinical performance survey created by fellowship program leadership. Survey data collected included clinical summary, trainee, proctoring faculty, clinical service, operative/nonoperative, supervision type, Zwisch autonomy scale, time to input data, and graduate medical education (GME) milestone performance. Data were analyzed using descriptive statistics.

Results: A total of 883 proctoring events were identified, including the majority as type 1 (97.4%). Trauma comprised 64% of evaluations. 52% of the proctoring events were surgical cases. Complexity was graded as average (77%), hardest (16%), basic (7%). Guidance included supervision only, 491/666 (74%), with 26% requiring faculty intervention. Fellow performance was graded as average (66%), above average (31%), and below average/critical deficiency (3%). GME performance was available for 247/883 interactions identifying 31 events with potential for improvement. Average evaluation completion time: 2 minutes (n=134).

Conclusion: A mobile web-based survey is a convenient and reliable tool for documenting ACS fellow clinical activity and was effectively utilized by all ACS faculty to record supervision. A combination of clinical and objective data are useful to determine ACS fellows' performance and to provide targeted education and remediation.

EARLY THROMBOPROPHYLAXIS IN NONOPERATIVE BLUNT ABDOMINAL TRAUMA: A CLOTT RESEARCH STUDY

Mary Bokenkamp, MD; Dias Argandykov, MD; Leon Naar, MD; Ander Dorken Gallastegi, MD; Jonathan J. Parks, MD; John O. Hwabejire, MD, MPH; Haytham Kaafarani, MD, MPH; M. Margaret Knudson, MD; George Velmahos, MD, PhD for the CLOTT Research Group
Massachusetts General Hospital
Invited Discussant: Eric Ley, MD

Introduction: There is concern that early chemical venous thromboembolism (VTE) prophylaxis in patients undergoing nonoperative management of blunt abdominal injuries may lead to bleeding. We hypothesize that early VTE prophylaxis prevents VTE effectively and does not cause bleeding.

Methods: The CLOTT study was a prospective, multicenter, observational cohort study conducted at 17 trauma centers between 2018-2020 focusing on post-traumatic VTE. For the purposes of this analysis, we identified patients with an abdominal AIS of ≥ 3 who were initially managed nonoperatively. Patients were excluded if they had an associated major neurologic injury (head AIS ≥ 3 or spinal cord injury with deficit). The patients were then divided into two groups based on the timing of the initiation of VTE prophylaxis, with early defined as ≤ 24 hours after admission and late as > 24 hours. The primary outcome was the need for delayed operative or angiographic intervention. The secondary outcome was the development of VTE (DVT, PT, PE). Data points included age, sex, VTE risk factors, VTE prophylaxis type, dose, and frequency, ventilator days, ICU days, and mortality.

Results: Of the 7,880 patients in the CLOTT registry, 389 met our criteria, 153 with early and 236 with late VTE prophylaxis. In the early group, 8 (5%) required subsequent operative or angiographic intervention versus 16 (7%) in the late group ($p=0.53$). The incidence of VTE in the early group was 3% and in the late group 6% ($p=0.17$). The VTE prophylaxis agent, dose, and frequency was similar between the groups, with enoxaparin 30mg twice daily being most common.

Conclusions: In this largest-to-date prospective study on the issue, early prophylaxis appears to prevent VTE effectively without increasing the likelihood of bleeding that requires intervention.



**ANNUAL BUSINESS
MEETING:
AAST MEMBERS ONLY**

Friday, September 23, 2022

5:00 PM - 6:30 PM

Location: GR BR A-DNorth

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 extracellular 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

- 2021 Lucy Kornblith, MD
- 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

2021

M. Victoria Purvis Miles, MD

2020

Sydney Radding, MD



SESSION XIV:
QUICKSHOT
SESSION I: 1-13

Saturday, September 24, 2022

8:00 AM - 9:18 AM

Location: GR BR A-D North

Moderator: Eileen Bulger, MD

DETERMINANTS OF LONG-TERM PHYSICAL AND MENTAL HEALTH OUTCOMES AFTER INTENSIVE CARE ADMISSION FOR TRAUMA SURVIVORS

Juan Herrera-Escobar, MD, MPH; Taylor Lamarre, BA; Jordan Rosen, MD; Kaman Hau, MD; Kendall Jenkins, MS, BS; Joyce Wange, BA; Ashley Haynes, BS; Jessica Serventi-Gleeson, BS; Sabrina Sanchez, MD, MPH; Haytham Kaafarani, MD, MPH; Ali Salim, MD; Nomi-Levy-Carrick, MD, MPH; Geoffrey A. Anderson, MD, MPH
Brigham and Women's Hospital
Invited Discussant: Libby Schroeder, MD,

Introduction: We sought to identify determinants of post-intensive care physical and mental health outcomes 6 to 12 months after injury.

Methods: Adult trauma patients ISS ≥ 9 admitted to one of three Level-1 trauma centers were interviewed 6-12 months post-injury to evaluate health-related quality of life (SF-12v2), chronic pain, new limitations for activities of daily living (ADLs), and screening for PTSD. Intensive care unit (ICU) survivors (≥ 3 days in the ICU) were compared to survivors who did not require ICU admission. Multivariable regression models were built to identify factors associated with poor outcomes among ICU survivors.

Results: 2,407 patients were followed 598 (25%) ICU and 1,809 (75%) non-ICU survivors. Mean age 52y, SD= 20.1 (ICU) vs. 60y, SD= 20.5 (non-ICU), $p < 0.001$ and ISS 20, SD= 9.5 (ICU) vs. 12, SD= 4.4 (non-ICU), $p < 0.001$ differed by study group. Median ICU stay was 5 days (IQR= 3-9). Among ICU survivors, 506 (85%) reported physical or mental health symptoms. Of them, 265 (52%) had physical symptoms only, 15 (3%) had mental symptoms only, and 226 (45%) had both physical and mental symptoms. In adjusted analyses, compared to non-ICU survivors, ICU survivors were more likely to have new limitations for ADLs (OR= 1.41; 95% CI= 1.10, 1.82), and worse SF-12 mental (mean Δ = -1.44; 95% CI= -2.79, -0.09) and physical component scores (mean Δ = -1.77; 95% CI= -3.09, -0.45). Female sex (OR= 1.76; 95% CI= 1.01, 3.08), Black race (OR= 2.32; 95% CI= 1.07, 5.02), polytrauma (OR= 2.06; 95% CI= 1.16, 3.67), ventilator use (OR= 2.68; 95% CI= 1.35, 5.33), history of psychiatric illness (OR= 1.83; 95% CI= 1.14, 2.98), and delirium during ICU stay (OR= 1.34; 95% CI= 1.07, 1.69) were associated with poor outcomes in the ICU group.

Conclusions: Physical impairment and mental health symptoms following ICU stay are highly prevalent among trauma survivors. Modifiable ICU specific factors such as early liberation from ventilator support and prevention of delirium are potential targets for intervention. Future studies should investigate the causes and mediators that influence the sex and race disparities observed to identify further modifiable factors.

**HISTORIC RACISM AND CONTEMPORARY GUN VIOLENCE
INCIDENCE IN ATLANTA, GA**

Randi N. Smith, MD; Jeroson Williams, MD; Olamide Alabi, MD;
Keneeshia Williams, MD; Briana Woods-Jaeger, PhD; Elizabeth Pittenger,
BA; Ronald Hoard II, MD; Jessica H. Beard, MD, MPH; Alyasah Ali
Sewell, PhD

Emory University

Invited Discussant: D'Andrea Joseph, MD

INTRODUCTION: The Home Owner's Loan Corporation (HOLC), created a practice known as redlining, effectively sequestering racial minorities in underdeveloped, economically disadvantaged neighborhoods throughout the US. The health effects associated with redlining are far reaching and include gun violence. The objective of this study is to explore the geographic association between historic racism, resulting residential segregation and contemporary hot spots of gun violence in Atlanta, Georgia.

METHODS: Patient zip codes, socio-demographics, injury characteristics, disposition and year of injury were obtained from the registry of the only nationally verified Level 1 trauma center in Atlanta for firearm injuries between 2016 and 2021. Geospatial data were obtained by mapping 1938 HOLC neighborhoods to zip code tabulation area (TCA) crosswalk via Census data. Zip codes were then assigned a HOLC GPA, calculated as the average HOLC grade for all CTAs in a zip code. We identified the risk of firearm injury among acute trauma patients using multilevel logistic regression models.

RESULTS: There were 4,298 individuals injured by guns, rifles, or other firearms during the study period. The majority were male (88.2%) and Black (84.7%), with a median age of 28y (IQR 22,38). The mortality rate was 14.8%. Adults injured in zip codes with lower HOLC GPAs face a higher risk of firearm injuries (OR = 1.52; 95% CI: 1.11, 2.06; $p=0.008$). Home zip codes of firearm-injured adults were not associated with HOLC GPAs.

DISCUSSION: Individuals injured in places that were deemed by HOLC in the 1930s to have high lending risk face a higher rate of firearm-related injury. Due to these policies, neighborhoods with a higher concentration of Black residents and working-class laborers suffered housing and economic disinvestment – factors that continue to inform where gun violence concentrates today. Given the histories of structural racism and violence in Atlanta, violence prevention interventions should prioritize a framework of anti-racism and health equity that removes unjust barriers to health and well-being for historically marginalized populations.

**FIREARM INJURY SURVIVAL IS ONLY THE BEGINNING: THE
IMPACT OF SOCIAL DETERMINANTS OF HEALTH ON
UNPLANNED READMISSION AFTER INJURY**

Derek C. Lumbard, MD; Chad J. Richardson, MD; Frederick W. Endorf,
MD; Rachel M. Nygaard, PhD
UT Health San Antonio

Invited Discussant: Tanya Zakrison, MD, MPH

Introduction: Firearm injuries remain a national crisis in the United States, particularly in minority populations who continue to be disproportionately impacted by firearm violence. Continued exposure to risk factors associated with firearm violence increases the likelihood of recidivism. However, risk factors leading to readmission after injury remain unclear. We hypothesized that social determinants of health have a major impact on unplanned readmission following assault-related firearm injury.

Methods: The 2016-2019 Nationwide Readmission Database of the Healthcare Cost and Utilization Project was used to identify hospital admissions with assault-related firearm injury. After adjusting for severity, comorbidity, and hospital, factors associated with 90-day unplanned readmissions were assessed.

Results: Over 4 years, 20,666 assault-related firearm injury admissions were identified that resulted in 2,033 injuries with subsequent 90-day unplanned readmission. Those with readmissions tended to be older (31.9 vs 30.3), had a drug or alcohol diagnosis at primary hospitalization (27.1% vs 24.1%), and had longer hospital stays at primary hospitalization (15.5 vs 8.1) [all $P < .05$]. Overall cost of the primary hospitalization was significantly higher than those without readmissions (\$138,945 vs \$255,209 [$P < 0.001$]). The mortality rate in the primary hospitalization was 4.5%. Primary readmission diagnoses included: complications (29.6%), infection (14.5%), mental health (4.4%), trauma (15.6%), and chronic disease (30.6%). Over half of the patients readmitted with a trauma diagnosis were coded as new trauma encounters. 10.3% of readmission diagnoses included an additional 'initial' firearm injury diagnosis. Independent predictors of 90-day unplanned readmission were government insurance (aOR 1.21, $P = 0.008$), lowest income quartile (aOR 1.23, $P = 0.048$), living in a larger urban region (aOR 1.49, $P = 0.01$), discharge to a hospital or with care (aOR 1.61, $P < 0.001$), and discharge against medical advice (aOR 2.39, $P < 0.001$).

Conclusions: Here we present the first data showing risk factors for unplanned readmission after assault-related firearm injury. Better understanding of this population can lead to improved outcomes, decreased readmissions, and decreased financial burden on hospitals and patients. A potential target for mitigating interventions is the use of hospital-based violence intervention programs in this population.

EARLY VERSUS DELAYED THORACIC ENDOVASCULAR AORTIC REPAIR FOR BLUNT THORACIC AORTIC INJURY: A PROPENSITY SCORE-MATCHED ANALYSIS

Anne-Sophie C. Romijn, MD; Vinamr Rastogi, MD; Jefferson A. Proaño-Zamudio, MD; Dias Argandykov, MD; Christina L. Marcaccio, MD; Georgios F. Giannakopoulos, MD; Haytham Kaafarani, MD, MPH; Frank W. Bloemers, MD; Hence J. Verhagen, MD; Marc L. Shermerhorn, MD; Noelle N. Saillant, MD
Massachusetts General Hospital
Invited Discussant: Stephanie Berry, MD

Objectives: Following blunt thoracic aortic injury (BTAI), current guidelines recommend delayed thoracic endovascular aortic repair (TEVAR). However, this recommendation was based on small studies that did not focus on endovascular management. In this study, we examined the effect of TEVAR timing on BTAI outcomes using a nationwide database.

Methods: Patients undergoing TEVAR for BTAI in the TQIP between 2010-2019 were included. Transfer patients and patients with grade 4 aortic injury were excluded. Outcomes included in-hospital mortality and complications, and we assessed the proportion of delayed TEVAR use over time. A 1:1-propensity score-matched cohort was created based on time to repair (early: ≤ 24 hrs vs. delayed:

>24 hrs). Matching was based on demographics, comorbidities, injury severity score (ISS), vital signs, aortic injury grade which was dichotomized based on reporting standards in TQIP (grade 1 vs. grade 2-3). We performed log binomial regression to assess outcomes in the matched sample.

Results: Overall, 2,101 patients were included, 1,562 (74%) patients underwent early TEVAR. Compared with patients who underwent delayed TEVAR, those who underwent early TEVAR had a higher injury burden (ISS >25 ; 80% vs. 74%), and higher aortic injury severity (grade 2-3: 32% vs. 18%). After matching, the final sample included 454 matched patients. Compared to early TEVAR, delayed TEVAR was associated with a lower risk of in-hospital mortality (RR:0.48; 95%CI[0.31-0.75], $p<0.005$). Additionally, patients who underwent delayed TEVAR had a higher risk of acute kidney injury (RR:1.8; 95%CI[1.1-3.1]; $p=0.030$), compared with early TEVAR. However, the delayed TEVAR cohort had a statistically significantly longer ICU LOS (7 vs. 10 days; $p<0.001$). Finally, there was a decrease in delayed TEVAR use over time (2010-2016: 27% vs. 2017-2019: 24%).

Conclusion: In this propensity score matched analysis, delayed TEVAR was associated with significantly lower mortality. However, since the guideline recommendation, the use of delayed TEVAR has decreased over time. Future studies should aim to optimize the window of intervention based on patient injury characteristics.

OPIOID EXPOSURE IN TRAUMA PATIENTS WITH A POSITIVE URINE DRUG SCREEN: A SUBGROUP ANALYSIS OF A RANDOMIZED CONTROLLED TRIAL

James Klugh, MD; Chelsea Guy-Frank, MD; Shah-Jahan Dodwad, DO; Deepanjli Donthula, BS; Van Thi Thanh Truong PhD; Charles E. Wade, PhD; Lillian S. Kao, MD, MS; John A. Harvin MD, MS
McGovern Medical School

Invited Discussant: Bethany Strong, MD

Introduction: The Multi-modal Analgesic Strategies for Trauma (MAST) trial was a randomized trial of two opioid-reducing multi-modal pain regimens (MMPR). We hypothesized that patients with a positive urine drug screen (+UDS) are at increased risk for higher opioid exposure and among +UDS patients, the MAST MMPR was associated with reduced opioid exposure.

Methods: The population was drawn from the MAST trial which randomized patients to the institutional MMPR or the MAST MMPR, the latter based on generic medications. Patients without a UDS on admission were excluded. Bayesian models were developed to compare opioid exposure (measured in morphine milligram equivalents [MMEs]) and pain scores between +UDS and -UDS patients. Next, +UDS patients were compared based on randomization to the institutional versus the MAST MMPR. Models were adjusted by age, injury severity score (ISS), and actual unit of admission from the emergency department (floor, IMU, and ICU).

Results: Of 1,012 included patients, 37.3% had a +UDS. +UDS patients were younger, male, had prior opioid use, and were smokers. There were no differences in ISS or surgical operations received. +UDS patients had higher MMEs/day (RR 1.3 [1.2-1.5], posterior probability (PP) >0.99), total MMEs (RR 1.3 [1.1-1.5], PP >0.99) and reported higher pain scores (difference 0.58 [0.32-0.84], PP >0.99). Among +UDS patients on each MMPRs there were no differences in demographics, ISS, or surgical operations received. +UDS randomized to the MAST MMPR had a high probability of decreased risk of MMEs/day (RR 0.78 [0.65-0.92], PP=0.91), total MMEs (RR 0.86 [0.69-1.07], PP>0.99), and receiving an opioid at discharge (OR 0.63 [0.40-0.99], PP=0.98).

Discussion: Patients with a +UDS had higher opioid exposure and experienced more pain despite no difference in ISS. In +UDS patients, the MAST MMPR was associated with decreased opioid exposure. Generic MMPRs are effective in opioid-minimization without detriment to pain control in high-risk patient populations.

**ACHIEVING THE DAMAGE CONTROL RESUSCITATION GOALS
DECREASES MORTALITY IN MASSIVELY TRANSFUSED
TRAUMA PATIENTS**

Iver Anders Gaski, MD; Paal Aksel Naess, PhD; Nils Oddvar Skaga, PhD;
Christine Gaarder, PhD
Oslo University of Hospital

Invited Discussant: Kazuhide Mazushima, MD

Background: After 15 years of Damage Control Resuscitation (DCR), with improved outcomes, studies still report high mortality rates for the massively transfused trauma patients. Our mature high-volume trauma service runs a continuous quality improvement program including updated resuscitation strategies. We hypothesized that in the era of DCR the formalization of a 24/7 attending trauma surgeon in 2013 would further improve our system's performance through more balanced transfusions and improved survival.

Methods: Retrospective analysis of all early massively transfused (≥ 10 RBCs within 12 hours of admission) trauma patients over an 11-year period (2009-2019) at a high-volume Northern European Trauma Center was conducted. The cohort was divided in Period 1 (P1): January 2009-August 2013, and Period 2 (P2): September 2013-December 2019 for comparison of outcomes.

Results: A total of 141 patients were included, 81 in P1 and 60 in P2. Baseline characteristics were similar between the groups for ISS, Lactate, GCS, and base deficit. Patients in P2 received more units of plasma (16 units vs 12 units; $p < 0.01$), resulting in a more balanced plasma:RBC ratio (1.00 vs 0.74; $p < 0.01$), and platelets:RBC ratio (1.11 vs 0.92; $p < 0.01$). All-cause mortality rates decreased from P1 to P2; at 6-hours (22% to 8%; $p = 0.03$), at 24-hours (36% vs 13%; $p < 0.01$), and at 30-days (48% vs 30%, $p = 0.03$), respectively. Simultaneously, hemorrhage related deaths decreased (28% vs 12%; $p = 0.01$). A stepwise logistic regression model predicted an odds ratio of 0.27 (95% CI 0.08 to 0.93) for dying when admitted in P2.

Conclusions: An improvement in resuscitation strategies and a formalization of a 24/7 dedicated attending trauma surgeon coincides with a reduction in all-cause mortality and hemorrhage related deaths in massively transfused trauma patients at 6- and 24-hours, and 30-days.

DEVELOPING AN AI PREDICTION MODEL FOR TRAUMA-INDUCED ACUTE KIDNEY INJURY

Rebecca S. Stoner, MBChB, MSc; Evangelia Kyrimi, PhD; Erhan Pisirir, MSc; Jared Wohlgemut, MBChB MSc; William Marsh, PhD; Zane B.

Perkins, MBBS, PhD; Nigel R. Tai, MBBS, MD

Royal London Hospital

Invited Discussant: Brandon Bruns, MD

Introduction: Trauma-induced Acute Kidney Injury (TAKI) occurs in ~20% of trauma patients admitted to Intensive Care (ITU). Accurate prediction of which patients will develop TAKI requiring intervention such as renal replacement therapy (RRT) can ensure early resource allocation and treatment, minimizing mortality. We aimed to develop an artificial intelligence (AI) risk prediction model (TAKI-BN) for TAKI using information available at two time points: on first assessment in the emergency department (ED) and on admission to ITU.

Methods: Training and validation data was from the Activation of Coagulation and Inflammation in Trauma study, including adult trauma patients admitted to a UK Major Trauma Centre <2 hours since injury. Patients with length of stay ≤ 1 day or no serum creatinine measurement were excluded. The algorithm is a Bayesian Network (BN). BN structure was developed from literature and expert knowledge, to include known variables that influence TAKI risk and reflect known causal relations. Parameters were learned from data. Model outcome was risk of TAKI, classified as worst AKI state within first 3 days. KDIGO states 0, 1, 2&3 were classified as None, Mild, Severe.

10-fold cross-validation was undertaken and performance assessed through discrimination (Area under the receiver operator curve (AUROC)) and calibration (Slope and intercept) for binary outcome (None vs Mild/Severe), and accuracy for both binary and categorical outcomes.

Results: Dataset comprised 1234 patients with median age 36, 81% male, median Injury Severity Score 17, 20% penetrating mechanism, mortality 11%. Overall, 32% developed AKI within 3 days of admission, of which 68% were mild and 32% severe. Mortality was 7% and 33% respectively. Internal validation demonstrated excellent performance at ED time point (AUROC 0.93, calibration slope 1.034 and intercept -0.018, accuracy 0.87), as well as excellent at the ITU time point (AUROC 0.93, slope 1.020, intercept -0.005, accuracy 0.88).

Conclusions: An individual patient's risk of TAKI can be reliably predicted from information available at initial assessment as well as following resuscitation. This information can be used to allocate treatment and resources to those who need it most.

SURGEON COMPASSION MAY MITIGATE QUALITY OF LIFE DISPARITIES ASSOCIATED WITH HEALTH LITERACY

Morgan J. Hopp, MD; Kristina M. Chapple, PhD; Hahn Soe-Lin, MD; Trevor M. Low, MD; Jordan A. Weinberg, MD

St. Joseph's Hospital and Medical Center

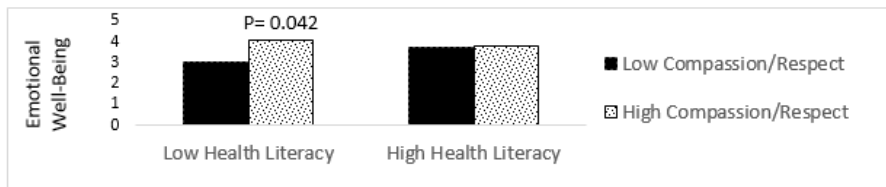
Invited Discussant: Tasce Bongiovanni, MD

Introduction: Patients with health literacy disparities are less likely to comprehend hospital discharge instructions and less satisfied with physician communication. In this study, we sought to examine the interaction of health literacy, physician communication, and quality of life after hospital discharge among post-operative emergency surgery and trauma patients.

Methods: Emergency surgery and trauma patients were prospectively enrolled between December 2020 and December 2021 at an urban level 1 trauma center. Newest Vital Sign (NVS) instrument was used to measure health literacy (HL) during hospitalization. Following hospital discharge, patients were administered Revised Trauma Quality of Life (rTQOL) and Interpersonal Processes of Care (IPC) instruments. An adjusted regression model was used to determine associations among NVS, rTQOL, and IPC.

Results: 94 patients completed all instruments. HL was proficient (HIGH HL) in 59.6% and less than proficient (LOW HL) in 40.4%. HL was positively associated with rTQOL emotional well-being ($r = 0.212$, $P=0.040$). However, higher rating of surgeon compassion/respect on IPC moderated the relationship between HL and emotional well-being such that patients with LOW HL and positive perception of physician compassion/respect had similar emotional well-being as the HIGH HL group ($P=0.042$, Figure).

Conclusion: Favorable patient perception of surgeon compassion and respect was correlated with higher emotional well-being, independent of HL proficiency. Although the allocation of resources toward improving HL disparities remains warranted, improving patient perception of caregiver compassion during hospitalization may be a target of opportunity with respect to improving quality of life after hospital discharge.



MESOTHELIAL CELL RESPONSE TO ACUTE APPENDICITIS OR SMALL BOWEL OBSTRUCTION REACTIVE ASCITES

Melissa Hausburg, PhD; Jason S. Williams, PhD; Kaysie L. Banton, MD; Robert M. Madayag, MD; Thaddeus E. Liniewicz, Do; Allen Tanner II, MD; Rebecca J. Ryznar, PhD; Charles Mains, MD; David Bar-Or, MD
Swedish Medical Center

Invited Discussant: Todd Costantini, MD

Introduction: Abdominal adhesions may cause bowel obstruction. Trauma and peritoneal inflammation, e.g., acute appendicitis (AA), activate mesothelial cells (MCs) on the outermost layer of the peritoneum to form adhesions. Pathologic adhesions may arise if normal adhesion fibrinolysis is disrupted. Disruptive signaling molecules may originate from peritoneal reactive ascites (rA). Here, we describe the morphological response of human MCs treated with rA collected during appendectomy (appy) or adhesiolysis for small bowel obstruction (SBO). **Methods:** This is a prospective observational IRB-approved study at four level 1 trauma centers where peritoneal rA is collected prior to surgical intervention for non-perforated AA or SBO. MCs were subjected to 48h of neat rA stimulation. To date, 4 appy and 3 SBO rA samples met the criteria required for this cell analysis. Control MCs were treated with human serum (hs) or medium. Cellular responses were queried by light and fluorescent microscopy, Alcian Blue quantification of extracellular glycosaminoglycans (GAG), and MC proteomics with liquid chromatography mass spectrometry. **Results:** rA-treated MCs increased cell-to-cell interactions compared to controls (low interaction=1, processes between cells=2, dense thread-like fibers=3, mean score \pm SD: controls 1.71 ± 0.46 , rA-treated 2.31 ± 0.55 , $p < 0.05$). rA-treated MCs observed with light microscopy were live-cell fluorescently stained, revealing either a dense cottony-like matrix or end-to-end cell connections. Select appy and SBO rA caused MCs to produce a GAG-positive gelatinous substance (GS) when compared with controls (mean optical density at 630nm \pm SD: hs 0.0602 ± 0.01 , appy 1.10 ± 0.24 , SBO 0.83 ± 0.30 , $p < 0.01$). Proteomics analysis of the GS and associated MCs showed enrichment in innate immune and coagulation proteins compared to hs-treated MCs. **Conclusions:** MCs robustly respond to rA, and some rA samples drive the cells to produce a GAG-rich GS of unknown consequence. Investigation of the effects of GS production on cell-cell adhesion and the molecular basis of this phenomenon are ongoing. These data may support development of prevention and treatment strategies for pathophysiologic adhesions.

Session XIV: Quickshot Session I 1-13

Quickshot 10 8:54 AM – 9:00 AM

**BIAS IN THE TRAUMA BAY: A MULTICENTER QUALITATIVE
STUDY ON TEAM COMMUNICATION**

Brittany Bankhead, MD, MS; Shannon Bichard, MA, PhD; Trent Seltzer,
MA, PhD; Barbie Chambers, PhD; Bayli Davis, BS; Lisa Thompson, BA;
Ryan Dumas, MD

Texas Tech University Health Sciences Center

Invited Discussant: Michael Cripps, MD

Introduction: Team communication and bias in and out of the operating room has been shown to impact patient outcomes. Limited data exist regarding the impact of communication bias during trauma resuscitation and multidisciplinary team performance on patient outcomes. We sought to characterize bias in communication among healthcare clinicians during trauma resuscitations.

Methods: Participation from multidisciplinary trauma team members (emergency medicine and surgery faculty, residents, nurses, medical students, EMS personnel) was solicited from verified level 1 trauma centers. Comprehensive, semi-structured interviews were conducted and recorded for analysis; sample size was determined by saturation. Interviews were led by a team of doctorate communications experts. Central themes regarding bias were identified using Leximancer analytic software.

Results: Interviews with 28 team members (54% female, 82% white) from 5 geographically diverse Level 1 trauma centers were conducted. Over 14,000 words were analyzed. Statements regarding bias were analyzed and revealed consensus that multiple forms of communication bias are present in the trauma bay. The presence of bias is primarily related to gender, but was also influenced by race, experience, and occasionally the leader's age, weight, and height. The most commonly described targets of bias were females and non-white providers unfamiliar to the rest of the trauma team. Most common sources of bias were white male surgeons, female nurses, and non-hospital staff. Participants perceived bias being unconscious but affecting patient care.

Conclusion: Bias in the trauma bay is a barrier to effective team communication. Identification of common targets and sources of biases may lead to more effective communication and workflow in the trauma bay.

HYPOXICALLY STORED BLOOD IMPROVED RESUSCITATION FROM HEMORRHAGIC SHOCK AFTER TRAUMATIC BRAIN INJURY COMPARED TO CONVENTIONALLY STORED BLOOD.

Cynthia R. Muller, PhD; Vasiliki Courelli, BA; Krianthan Govender, MS; Laurel Omert, MD; Pedro Cabrales, PhD University of California-San Diego

Invited Discussant: William Chiu, MD

Introduction: This study aims to investigate the effects of resuscitation with hypoxically stored red blood cells (hRBCs) from severe hemorrhagic shock (HS) after traumatic brain injury (TBI). Blood was collected into citrate phosphate double dextrose, leukodepleted, and stored at 4°C with additive solution 3 (AS3). The RBCs were made hypoxic using an O₂ depletion system developed by Hemanext Corp. (Lexington, MA) before cold storage for 3 weeks. Rats were randomly divided into 3 experimental groups depending on the RBCs used for resuscitation, namely: fresh RBCs (fRBCs), hypoxically stored RBCs (hRBCs), and conventionally stored RBCs (cRBCs). Animals were anesthetized using isoflurane (5%), artery and vein catheterized, and placed on a stereotaxic frame for craniotomy. The dura mater was impacted using a 5 mm diameter tip at a velocity of 5 m/s with a dwell time of 200 ms. Then, severe HS was induced by withdrawing blood to maintain a mean arterial pressure (MAP) of 40 mmHg for 90 minutes. Resuscitation was provided via transfusion equivalent to 70% of the shed volume and animals were followed for 2 hours. At the end of the study, animals were euthanized, and blood and tissues were harvested for analysis of organ function and injury. Animals resuscitated with cRBCs presented lower MAP compared to hRBCs and fRBCs after resuscitation. To assess lung inflammation and neutrophil activity we evaluated CXCL-1 (chemokine ligand 1), and CD45⁺neutrophils. CXCL-1 and neutrophils levels were higher for the cRBCs compared to fRBCs and hRBCs. Hepatic injury was evaluated using classical markers of liver damage (aspartate transaminase-AST / alanine transaminase- ALT) and CXCL-1. The results showed that resuscitation with cRBC increased liver CXCL-1 and AST, with no effect on ALT compared to fRBC and hRBCs. Remarkably, hRBCs presented similar levels of AST and liver CXCL-1 compared to fRBCs. Markers of cardiac injury (tumor necrosis factor alpha -TNF-alpha, Interleukin 6- IL-6, and C-Reactive Protein- CRP) showed lower levels for resuscitation using hRBCs compared to cRBCs, and no difference from fRBCs. Resuscitation with hRBCs presented lower levels of cardiac monocyte chemoattractant protein-1 (MCP-1), and troponin compared to cRBCs. Moreover, atrial natriuretic peptide (ANP) levels were higher for cRBCs compared to fRBCs. cRBCs presented higher levels of serum IL-6 and CXCL-1 when compared to fRBCs. Although hRBCs had higher levels of IL-6 and CXCL-1 compared to fRBCs, these levels were lower in comparison to cRBCs. IL-10 was higher only in the cRBCs. Finally, in comparison to Sham and fRBCs, cRBCs showed a decrease in superoxide dismutase (SOD) and catalase, while T-bars (thiobarbituric acid reactive substances) showed an increase, suggesting an oxidative imbalance post-transfusion. However, resuscitation with hRBCs ameliorated this status, presenting a higher level of SOD and catalase when compared to cRBCs and similar to fRBCs. These results suggest that hRBCs for 3 weeks show no difference from fRBCs in resuscitating from TBI accompanied with severe HS. Furthermore, hRBCs decreased organ injury and ameliorated oxidative status when compared to cRBCs, suggesting that storing RBCs hypoxically is safer when compared to conventional methods. However, more studies are necessary to confirm the ability of hRBCs to restore oxygen delivery in different models.

This work was supported by the NIH HLBI Grant R01-HL126945, DOD Grant W81XWH-18-1-0059, and Hemanext. Hemanext did not participate in the experiment, data collection, analysis, or interpretation.

THE GENDER GRADIENT IN ACUTE CARE SURGERY: PEAKS AND PLATEAUS

Sabrina Goddard, MD; Robin Tillery, MD; Daniel Dent, MD; Karen Brasel, MD, MPH

University of Alabama at Birmingham

Invited Discussant: Tanya Anand, MD

Introduction: In 2020, Foster et al reported on the female representation of the Trauma/Acute Care Surgery/Surgical Critical Care organizations. The AAST was identified as having the lowest proportion of female members with the highest proportion of female executive leadership. The purpose of this study was to further assess female participant contributions to the AAST organization by expanding on leadership roles, expert roles, committee interest, and presentation categories of interest.

Methods: Gender data was collected retrospectively from 2013 to 2021 digital programs. Presentations were categorized according to major topic of focus by two separate reviewers. Gender was assigned based on self-identification in demographic information, established relationships, or public sources by two separate reviewers. Expert roles included invited lecturers, panelists, moderators and discussants. Three groups were created: 2013-2015, 2016-2018, 2019-2021. ANOVA was performed to compare the effect of time on mean gender distribution. Post-hoc analysis utilized Tukey's HSD for multiple comparisons.

Results: Executive leadership in 2019 – 2021 was 35% female; 33% in 2016-2018; and 25% in 2013-2015 [$p=.609$]. Committee chairs in 2019-2021 were 40% female; 30% in 2016-2018; and 25% in 2013-2015 [$p=.224$]. Committee members were 33% female in 2019 – 2021; 24% in 2016-2018; and 22% in 2013-2015 [$p<.001$]. Expert roles for women in 2019 – 2021 was 39%; 20% in 2016-2018; and 18% in 2013-2015 [$p<.001$]. Presenters in 2019-2021 were 34% female; 37% in 2016-2018; and 31% in 2013-2015 [$p=.330$]. Gender distribution for presenters amongst acute care surgery topics was not significantly different.

Conclusion: While women may not have achieved complete parity, there are promising trends in almost all metrics. The AAST continues to see a rising trend in female senior roles. These roles are primarily at the discretion of the organization and thusly represent a conscious effort towards inclusion – aided by the creation of the DEI committee, formed in 2019. However, this trend has not been mirrored in more junior roles. This agrees with prior studies that senior roles continue to expand while junior roles have remained essentially unchanged. This further emphasizes that though women continue to advance in promotion in the organization through conscious efforts, further work is required to achieve parity in more junior roles. This can likely only be achieved by establishing an avenue to recruit more women into the organization and the field of Acute Care Surgery in general. It is of importance to note that information was obtained for gender without comment on race and ethnicity, and further studies are warranted on this topic to improve visibility in these populations as well.

REDEFINING TRAUMA DESERTS: NOVEL TECHNIQUE TO ACCURATELY MAP PREHOSPITAL TRANSPORT TIME

Leah C. Tatebe, MD; Ken Tatebe, MD, PhD

Northwestern University

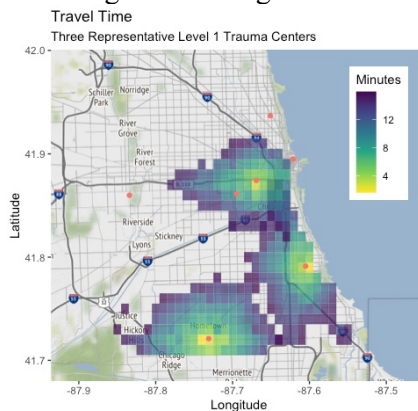
Invited Discussant: Bradley Dennis, MD

Introduction: Prehospital transport time has been directly related to mortality for hemorrhaging trauma patients. “Trauma deserts” were previously defined as being outside of a five-mile radial distance of an urban trauma center. We postulated that the true “desert” should be based on transport time rather than transport distance.

Methods: Utilizing the Chicagoland area that was used to describe “trauma deserts,” a sequential process to queries a commercial travel optimization product to map transport times over coordinates that covered the entire urban area at a particular time of day. This produces a heat map representing prehospital transport times. Travel times were then limited to 15 minutes to represent a temporal-based map of transport capabilities. This was repeated over high and low traffic times and for all centers across the city.

Results: We demonstrated that the temporal-based map for transport to a trauma center in an urban center differs significantly from the radial distance to the trauma center. We were further able to map variations in traffic patterns and thus transport times by time of day. The truly “closest” trauma center by time changed based on time of day and was not always the closest hospital by distance.

Conclusion: This novel technique of geomapping transport times can be used to create accurate trauma deserts in an urban setting with multiple trauma centers. Further this technique can be used to quantify the potential benefit or detriment of adding or removing firehouses or trauma centers.





SESSION XV:
QUICKSHOT
SESSION II 14-26

Saturday, September 24, 2022

9:40 AM - 10:58 AM

Location: GR BR A-DNorth

Moderator: Susan Evans, MD

**OUTCOMES OF SURGICAL VS NON-SURGICAL TREATMENT
FOR MULTIPLE RIB FRACTURES: A US HOSPITAL DATABASE
ANALYSIS**

Adam M. Shiroff, MD, FACS; Simone Wolf, BS; Mollie Vanderkarr, MSc;
Alex Wu, MD; Thibaut Galvain, MSc; Manoranjith Anandan, BS; Jill W.
Ruppenkamp, MSc; Chantal E. Holy, PH.D.

University of Pennsylvania

Invited Discussant: Nikolay Bugaev, MD

OBJECTIVES: Treatment for multiple rib fractures (MRF) may include surgical rib fixation (SRF) or non-operative care. Recent meta-analyses have demonstrated that SRF results in faster recovery and lower long-term complication rates. Our study evaluated characteristics, treatments, and immediate postoperative outcomes of MRF patients with and without SRF.

METHODS: All patients with inpatient hospitalization with a diagnosis of MRF in the PREMIER hospital database from 10/01/2015 to 09/01/2020 were identified. Demographics, comorbidities (as per Elixhauser comorbidity index (ECI), injuries at index (categorized by first 2 digits of ICD-10 diagnosis code), abbreviated injury scale (AIS) and injury severity scores (ISS), and provider characteristics (hospitals size, urban vs. rural, teaching status) were determined for all patients. Patients were excluded from the cohort if they had a thorax AIS < 2 (low severity patient) or a Glasgow coma score < 8 (extreme high severity patient). Two cohorts were created based on the presence of SRF at index: the SRF and the non-SRF cohort. Patients were matched using direct matching on AIS thorax and thorax injuries, and propensity score matching (PSM, method: nearest neighbor, caliper = 0.2) on other demographic, comorbid, and injury diagnoses.

RESULTS: Before matching, 2,520 SRF and 183,957 non-SRF patients were identified. The SRF cohort was significantly more severely injured, with thorax AIS > 2 in 70.8% SRF (vs 21.9% for non-SRF), and ISS of 14.07 (standard deviation (SD): 8.80) for SRF vs 10.19 (SD: 7.56) for non-SRF. In the unmatched cohort, more SRF patients were discharged home (or to home health) vs non-SRF (home or home health discharge: 61.2% SRF vs 58.4% non-SRF, $p = 0.005$). After excluding patients with extreme injuries such as spinal cord fracture and head/neck crushing injuries, and matching the remaining cohorts, 2,340 patients were analyzed, 1,170 SRF and 1,170 non-SRF (average age: 61.6 (SD): 16.0); Elixhauser: 2.6 (SD: 2.1); ISS: 8.74 (SD: 3.9). Major thorax and lung injuries included pneumothorax (22.5%), lung contusion (26.1%), pleural effusion (14.1%). Key comorbidities included hypertension (42.9%) and chronic pulmonary disease (21.7%). Home or home health discharge was observed in 72.1% of

IMAGING THE INFLAMED GALLBLADDER, ULTRASOUND, CT OR MRI, AN AAST MULTICENTER STUDY

Kevin M. Schuster, MD, MPH; Michael Cripps, MD; Haytham Kaafarani, MD, MPH; Ruchir Puri, MD, MS; Thomas Schroepfel, MD; Toby Ennis, MD; Marie Crandall, MD, MPH; Gail Tominaga, MD; Rick O'Connor, RN
Yale School of Medicine

Invited Discussant: David Blake, MD, MPH

Introduction: Patients with right upper quadrant pain are often imaged using multiple modalities with no established gold standard. Patients may undergo multiple studies based on clinician preference despite previous imaging. We hypothesized that a single imaging study would provide adequate information for diagnosis and management. **Methods:** The database from a multicenter study of patients with acute cholecystitis was queried for patients who underwent multiple imaging studies on admission. Common parameters were compared across studies including wall thickness (WT), common bile duct diameter (CBDD), pericholecystic fluid and signs of inflammation. Cutoff for above normal values were 3mm for WT and 6

	Concordant n (%)	Discordant n (%)
Gallstones		
US vs. MRI	54 (88.6)	7 (11.4)*
Gallbladder thickened wall		
US vs. CT	92 (65.3)	49 (34.8)*
Mean difference (95% CI)	-0.22 mm	(-1.02 mm - 0.58 mm)
Common bile duct dilated		
US vs. CT	50 (84.8)	9 (15.3)*
Mean difference (95% CI)	-0.27 mm	(-0.74 mm - 0.20 mm)
Inflammatory changes		
CT vs. MRI	31 (85.8)	6 (15.2)*
Pericholecystic fluid		
US vs. CT	182 (70.0)	78 (30.0)*
US vs. MRI	39 (63.9)	22 (36.1)*
CT vs. MRI	27 (73.0)	10 (27.0)*
Gallbladder wall air		
US vs. CT	257 (98.8)	3 (1.2)*
US vs. MRI	61 (100.0)	0 (0.0)*
CT vs. MRI	37 (100.0)	0 (0.0)*

US - ultrasound, CT - CT scan, MRI - magnetic resonance imaging, CI - confidence interval, *p <0.01 for agreement

nearly all <1mm (table). Large differences (>2mm) were rare (<5%) for WT and CBDD. Using CBDD to predict choledocholithiasis there was minimal difference between AUC for ultrasound (0.626) and CT (0.655). The binary parameter of pericholecystic fluid differed in less than one third of cases.

Conclusions: Imaging studies in acute cholecystitis generate nearly equivalent results for all typically measured parameters. With current imaging technology repeating imaging studies to compare or confirm findings is unnecessary and should be discouraged.

mm for CBDD. Parameters were compared using chi-square tests and areas under the receiver-operating characteristic curves (AUC). **Results:** Of 861 patients with acute cholecystitis, 759 had ultrasounds, 353 had CT and 74 had MRIs. There was statistically significant agreement for all parameters between imaging studies. Although some were considered discordant by an arbitrary cutoff value, differences between wall thickness and bile duct diameters were small with

THE CHICKEN OR THE EGG: CORRELATION OF LOW PLATELETS & POST-INJURY ACUTE RESPIRATORY DISTRESS SYNDROME

Anamaria J. Robles, MD; Richa Kalamdani, BS; James Ross, MD; Lucy Kornblith, MD; Rachael Callcut, MD, MPH

University of California Davis Department of Surgery

Invited Discussant: Adrian Maung, MD

Introduction: Pathophysiologic origins of post-injury Acute Respiratory Distress Syndrome (ARDS) remain elusive. Platelet transfusion has been proposed as a possible mechanism. The lung has recently been shown to be the key site of primary platelet biogenesis and sequestration. The interaction between initial thrombocytopenia, lung platelet production post-injury, and ARDS is undefined. This study investigates the correlation of platelet counts, ARDS risk, and platelet recovery in the first 7 days post-injury.

Methods: Secondary data analysis was performed of a prospective cohort of highest-level activations who were followed for 28 days. Demographics, injury characteristics, labs, and outcomes were collected. ARDS was defined prospectively using Berlin criteria including adjudicated radiographs. Correlation (Pearson’s) between ISS, daily lowest platelet count, and ARDS was assessed. Logistic regression was performed.

Results: 2003 patients were enrolled with 10.3% (n=207) developing ARDS. ARDS patients had higher median age, lower GCS, higher ISS, more likely to be thrombocytopenic and hypotensive on presentation (Table). Overall median

	ARDS (n = 207)	No ARDS (n = 1796)	p
Age, median (IQR)	44 (28 to 59)	36 (26 to 53)	0.0003
Male sex, (%)	82.6%	81.6%	0.7763
Glasgow Coma Scale score, median (IQR)	3 (3 to 5)	13 (3 to 15)	<0.0001
Initial SBP <=90 mmHg	11.6%	6.2%	0.0065
Blunt Injury, %	85.0%	54.3%	<0.0001
Initial Platelet counts,			
Median (IQR), in thousands	166 (104 to 229)	232 (178 to 287)	0.3113
% with count < 150 in thousands	41.5%	14.2%	<0.0001
Injury severity score, median (IQR)	30 (25 to 41)	10 (1 to 25)	<0.0001(W)
% with score < 15	10.1%	62.4%	<0.0001(F)
% with 15 ≤score <25	12.1%	12.4%	
% with score ≥25	77.8%	25.3%	
Logistic multiple regression	OR ARDS	95% CI	
Platelet count (every 10,000 increase)	0.936	(0.918-0.955)	
ISS (each 5 point increase)	1.357	(1.292-1.425)	

platelet count across the first 7 days was lower in the ARDS patients (p<0.0001). Platelet recovery as measured by total counts appeared to begin at day 7 with higher daily median counts compared with day 1-6 (p<0.05), and no day 7 difference between groups (p=NS). Lower platelet count in the first 7 days and ISS were independent predictors of ARDS (Table).

Conclusion: ARDS risk persists in the first week and is correlated with persistently lower platelet counts. Sequestration and decreased primary lung platelet production may be factors in the persistent thrombocytopenia.

COAGULOPATHY AND POSTINJURY MULTIPLE ORGAN FAILURE: IDENTIFYING THE HIGHEST RISK PATIENTS THROUGH ADMISSION THROMBELASTOGRAPHY

Lauren Dwyer, Caroline Ballard, MD; Christopher A. Guidry, MD; C
Cameron McCoy, MD; Robert D. Winfield, MD, FACS

University of Kansas Medical Center

Invited Discussant: Kaushik Mukherjee, MD

Introduction: Postinjury multiple organ failure (MOF) is costly and associated with late death. Postinjury coagulopathy has been associated with MOF; however, the relationship between specific coagulation abnormalities and MOF is incompletely understood. We undertook this study to determine features of postinjury coagulopathy that would be associated with MOF.

Methods: We conducted a retrospective review of patients at high postinjury MOF risk. Patients were included if they underwent trauma activation, had ISS of ≥ 9 , required ICU admission, and had an admission TEG. Patients were excluded for death within the first 48 hours of admission, preinjury coagulopathy, or preinjury anticoagulant therapy. Patients were divided into four groups (hypercoagulable, hypocoagulable, mixed, and normal coagulation) based on TEG measurements. The primary outcome was MOF, defined as SOFA score greater than five during hospitalization.

Results: 710 patients were assessed. The population was severely injured (mean ISS 26), had a mean age of 41, and were largely male (76%); the majority sustained blunt injury (75%). Groups were similar overall, with the hypercoagulable group having a greater proportion of females (32% vs. 14-24%, $p=0.001$) and the hypocoagulable group having a greater mortality rate (13% vs. 5-8%, $p<0.001$). The normal coagulation group had a lower crude rate of MOF relative to others (20% vs 30-34%, $p=0.01$). On multivariable logistic regression, admission creatinine (OR 1.72, 1.04-2.84, $p=0.03$) and ISS (OR 1.05, 1.03-1.07, $p<0.001$) were independently associated with increased odds of MOF, while normal coagulation status was associated with decreased odds of MOF (OR 0.57, 0.35-0.92, $p=0.02$).

Conclusion: Among a high-risk group of trauma patients, normal admission TEG was associated with a reduction in odds of MOF. The relationship between coagulation and inflammatory responses likely explains this finding; additional work to understand and modulate inflammatory responses beyond correction of coagulopathy is needed to reduce the burden of postinjury MOF.

ENHANCING UTILITY OF INTERFACILITY TRAUMA TRIAGE GUIDELINES USING MACHINE LEARNING: DEVELOPMENT OF THE GERIATRIC INTERFACILITY TRAUMA TRIAGE SCORE (GITTS)

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University of Oklahoma Health Science Center
Invited Discussant: Alison Smith, MD, PhD

Background: Prehospital under-triage of injured older adults to tertiary trauma centers (TTCs) has been demonstrated by many studies. In predominantly rural regions, a majority (>70% in OK) of trauma patients are initially transported to non-tertiary trauma centers (NTCs). Current inter-facility triage guidelines identify risk markers for secondary triage, but this is an exhaustive list of more than 25 unweighted indications that do not allow for individual risk prediction. We sought to develop a transfer risk score that may simplify identification of injured older adults requiring transfer to TTCs and decrease under-triage.

Methods: This was a retrospective prognostic study of injured older adults ≥ 55 years initially transported to an NTC from the scene of injury and subsequently transferred for definitive care elsewhere. The study utilized data reported to the Oklahoma State Trauma Registry between 2009 and 2019. The outcome of interest was either mortality or serious injury (ISS ≥ 16) requiring a life-saving or operative intervention at the receiving facility. The prognostic model for risk scoring was developed and internally validated (bootstrap) using data for patients who were transferred to a TTC and was further validated using data for patients transferred to NTCs (n=4310). To reduce the number of candidate variables and assess potential interactions between predictors, variables *recorded at the initial facility* were screened for importance using random forests/boosted trees/classification trees, bivariate comparisons and a careful review of current interfacility triage guidelines.

Results: Of the 5913 injured older adults initially transported to an NTC before subsequent transfer to a TTC, 32.7% (1696) had the outcome of interest at the TTC. The final prognostic model (AUC, 75%; 95% CI: 74-76%) included the following predictors (weighted score contribution in parentheses): airway intervention (11), traffic-related femur fracture (6), spinal cord injury (5), ED GCS ≤ 13 (5), hemodynamic support(4), polytrauma (3), head/face injury (3), shock index > 0.9 (3), pre-existing coagulopathic disorder (3), prehospital EMS transport (2), RR ≤ 10 or RR ≥ 24 (3), pre-existing cardiac disease (2), thorax injury (2), internal organ injury (1), pelvic fracture (3), male gender (2), and traffic-related injury (1). Bias-corrected and validation AUCs were 74% and 72% respectively. A risk score of 7 yields a sensitivity of 81% and specificity of 50%. A risk score of 5 has $> 94\%$ sensitivity but leads to significant over-triage (specificity of 25%).

Conclusion: Identification of high-risk injured older adults requiring transfer to tertiary trauma centers could be improved by use of a risk score in addition to clinician assessment. Our study is the first to develop a risk stratification tool for injured older adults requiring transfer to a higher level of care.

**AN ASSESSMENT OF THE SAFETY, HEMOSTATIC EFFICACY,
AND CLINICAL IMPACT OF LOW-TITER GROUP O WHOLE
BLOOD IN CHILDREN AND ADOLESCENTS**

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Jason Brill, MD; Konstantinos Boukas, MD; Charles Cox, MD; Charles E.

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University of Texas Health Science Center Houston

Invited Discussant: Romeo Ignacio, MD

Background: Low-titer group O whole blood (LTOWB) use has been associated with improved survival and less blood transfusions in adult trauma patients. Its use in pediatric trauma has been shown to be safe when using leukoreduced, LTOWB with anti-A, anti-B antibody titers of <1:50. A recent TQIP analysis noted that WB may decrease overall blood transfusion requirements in this patient population. We set out to evaluate the safety, hemostatic potential, and impact on pediatric outcomes at a center using non-leukoreduced, LTOWB with anti-A, anti-B antibody titers of <1:200.

Methods: Patients less than 18 years old, who received emergency-release, uncrossed matched blood, and presented to our trauma center 11/17-4/21 were included. Patients were divided into those receiving any LTOWB and those receiving only RBC and or plasma (COMP). Primary outcome was safety profile, with secondary outcomes evaluating hemostatic efficacy and clinical outcomes. Univariate and multivariate modeling was performed using STATA 12.1, with significance was set at $p < 0.05$.

Results: During the study period, 164 patients arrived to our center and received emergency release blood products. Of these, 73 received at least one unit of LTOWB. The LTOWB group were younger (14 vs 13 yr), more likely to be male (87 vs 49%), and to have sustained penetrating trauma (44 vs 23%); all $p < 0.05$. Given their field physiology, LTOWB patients received more blood than their COMP counterparts prior to arrival (Table). Serial hemolysis panels (K+, bilirubin, LDH, haptoglobin) obtained at 3-hrs, 24-hrs, and 48-hrs were similar between groups; all $p > 0.05$. There was no difference in survival by univariate analysis, but there was a trend towards improved survival in the LTOWB group (OR 2.7, 95% C.I. 0.88-7.81 $p = 0.080$), controlling for male sex, chest AIS, scene physiology, and lactate.

Conclusion: Non-leukoreduced, LTOWB in anti-A/anti-B antibody titers of <1:200 appear safe in children and adolescents. While patients receiving LTOWB had more evidence of shock, higher torso injury severity, and received more prehospital blood products, there may be a mortality benefit with whole blood. Larger, multi-center studies are needed.

MORTALITY AFTER MASSIVE TRANSFUSION: TEACHING HOSPITAL STATUS, NOT TRAUMA CENTER DESIGNATION, IS ASSOCIATED WITH IMPROVED SURVIVAL

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Ryder Trauma Center - Jackson Memorial Hospital

Invited Discussant: Mark Hemmila, MD

BACKGROUND: Previous studies have shown improved survival for patients treated at American College of Surgeons (ACS) verified level I trauma centers compared to level II, level III, and undesignated centers. This mortality difference is more pronounced in severely injured patients. As massive transfusion (MT) is associated with high mortality, we hypothesize that patients receiving MT will have lower mortality at level I/II trauma centers compared to level III or undesignated trauma centers.

METHODS: All patients ≥ 16 years of age with ISS > 15 who underwent MT, defined as > 10 units of packed red blood cells in the first 4 hours after arrival, in the 2019 Trauma Quality Improvement Project (TQIP) database were eligible. Patients with severe head injury (AIS Head ≥ 3), pre-hospital cardiac arrest, and interhospital transfers were excluded. Logistic regression models were used to assess the effects of trauma center designation and hospital teaching status on the adjusted odds of 3-hour, 6-hour, and 24-hour mortality.

RESULTS: 1,959 patients received MT [81.0% male, median ISS 27 (21-36)], 76.3% were admitted to level I/II centers, and 23.7% were admitted to level III or undesignated centers. Overall mortality was 42%; 16% patients died in 3 hours, 25% in 6 hours and 32% in 24 hours. Trauma center designation was not an independent predictor of mortality at any timepoint. However, non-teaching hospitals were associated with increased 6-hour (OR 1.77, 95% CI 1.22-2.57) and 24-hour (OR 1.60, 95% CI 1.12-2.30) mortality compared to teaching hospitals, controlling for sex, age, heart rate, ISS, injury mechanism, and trauma center designation.

CONCLUSIONS: Severely injured patients requiring MT experience significantly lower mortality at teaching hospitals compared to non-teaching hospitals, independently of trauma center designation. These findings may be partially explained by the rapid proliferation of non-teaching level I/II trauma centers across the country.

**SETTLING THE DEBATE REGARDING OPTIMAL TIMING OF FRACTURE
FIXATION FOR POLYTRAUMA TBI PATIENTS: A TQIP ANALYSIS**

Sarah Lombardo, MD; Jennifer Belzer, MD; Marta L. McCrum, MD; Raminder
Nirula, MD, MPH
University of Utah

Invited Discussant: Haytham Kaafarani, MD

Introduction: Initial care after traumatic brain injury (TBI) aims to minimize secondary insults by reducing exposures to physiologic stressors. Early fixation of femur fractures is associated with improved outcomes, however the optimal timing of definitive repair in patients with TBI remains controversial. We hypothesize that among polytrauma patients with moderate and severe TBI, early repair will be associated with increased risk of in-hospital mortality as compared to delayed intervention.

Methods: Adult patients with TBI that underwent definitive femur fracture repair within 2 weeks of admission were identified from the 2017-2019 American College of Surgeons Trauma Improvement Quality Program Participant Use Files. Operative timing was categorized as (1) < 24 hours, (2) 24-95 hours, or (3) \geq 96 hours. Primary outcome of interest was in-hospital mortality, and secondary outcome was morbidity. Multivariate logistic regression modeling was used to adjust for potential confounders. Sensitivity analysis employed three strategies for regression modeling: complete case analysis, forward stepwise analysis, and multiple imputation with chained equations.

Results: 11,231 patients with TBI had definitive femur fixation within 2 weeks of admission. Operative timing was < 24 hours for 6385 (56.9%), 24 - 95 hours for 3943 (35.1%), and \geq 96 hours for 903 (8.0%). Patient demographics and injury patterns differed significantly by operative timing and TBI severity. A trend towards higher mortality was seen with delayed fixation for mild TBI. Among patients with severe TBI delayed repair \geq 96 hours was associated with a significantly reduced risk of in-hospital mortality (adjusted OR [aOR] 0.29, 95% confidence interval [CI] 0.13, 0.66; Figure 1) and increased morbidity (aOR 2.35, 95% CI 1.59, 3.46).

Conclusion: Early definitive femur fixation should not be delayed for mild TBI patients but is associated with increased risk of in-hospital mortality among patients with greater TBI severity.

**A MAJORITY OF FAILURES-TO-RESCUE IN HOSPITALIZED
TRAUMA PATIENTS WOULD BE AVOIDED WITH FULL
SUPPORTIVE CARE**

Charles Shahan, MD; Ben Zarzaur, MD; Stephanie Savage, MD; Ann O'Rourke, MD MPH; John Scarborough, MD, FACS; Charles Shahan, MD
University of Wisconsin School of Medicine and Public Health
Invited Discussant: Anupamaa Seshadri, MD

Background: Failure-to-rescue (FTR, defined as hospital death after adverse events) is increasingly being used as a discriminator of trauma center quality. The extent to which withdrawal/withholding of life-sustaining therapies (WOLST) decisions might contribute to FTR has not been previously examined. Our study sought to determine whether hospitalized trauma patients who forego life-sustaining therapies to treat hospital complications would have survived had they received full supportive care.

Methods: The 2017-2018 Trauma Quality Improvement Program (TQIP) database was used to identify patients who sustained one or more adverse events after being hospitalized for survivable injury (Injury Severity Score < 75). Patients in whom life-sustaining therapy was withdrawn or withheld (WOLST group) were propensity-matched with patients receiving full supportive care (FSC group) for demographics, comorbid conditions, injury severity, and the occurrence of specific adverse hospital events.

Results: 39,548 patients [34,963 (88.4%) FSC and 4,585 (11.6%) WOLST] were included for analysis. FTR occurred in 6,371 (16.1%) of patients. Propensity-matching techniques produced a cohort of 4,525 WOLST patients who were well-matched with an FSC counterpart. 3,481 FTR deaths (54.6% of all FTR deaths) occurred in WOLST patients whose propensity-matched FSC counterpart survived hospitalization.

Conclusions: Our study predicts that a majority of FTR deaths in trauma centers occur in patients who would have survived hospitalization had they received full supportive care, and that FTR may be driven more by patients' goals of care than by hospital quality. The contribution of WOLST decisions to FTR for trauma and other surgical disciplines merits further investigation.

TAKING CARE OF THE BLOCK: ASSOCIATES BETWEEN AREA DEPRIVATION INDEX AND OUTCOMES IN TRAUMA PATIENTS

Seth Quinn, MD; Ashley W. Quinn, MD; Josh Aldridge, MD; Michelle R. Brownstein, MD; David Trisler, DO; William Irish, PhD; Eric Toschlog, MD
Vidant Medical Center

Invited Discussant: Rochelle Dicker, MD

BACKGROUND: Disparities between racial groups in outcomes and delivery of care in both trauma and non-trauma patients have been well documented. This study sought to further analyze these disparities by not only looking at differences between racial groups, but also discrepancies based on place of residence utilizing the state-level Area Deprivation Index

(ADI). ADI is a freely available measure of neighborhood socioeconomic disadvantage including access to educational institutions, internet access, health systems, not-for-profit organizations, and government agencies. A state-level ADI ranking of 1 represents the area of least deprivation within a state, while a ranking of 10 represents an area with the most deprivation. Our hypothesis was that worse outcomes would be seen in patients living within higher ADI areas.

METHODS: The National Trauma Registry of the American College of Surgeons at our level 1 trauma center was queried from January 2016 to December 2020. Inclusion criteria were trauma patients aged 18 years or older cared for at a level 1 trauma center with a primary residence in North Carolina. Federal Information Processing Standard (FIPS) codes were determined and used to assign their associated ADI decile, which were then categorized according to ADI rank (1-3, 4-6, 7-10). Generalized linear models (Logit and Poisson) were used to evaluate the association of ADI with risks of complications. Odds ratio (OR), relative risk (RR) and their associated 95% confidence intervals (CIs) are provided as measures of strength of association and precision, respectively. Results are adjusted for age, sex, and race.

RESULTS: 8,854 patients were included in the analysis. Of these, 14.2% were in ADI ranking 1-3, 24.8% in ADI ranking 4-6 and 61.1% in ADI ranking 7-10. Patients in the ADI rank group 7-10 were more likely to be male, minority, and younger (all $p < 0.0001$). There was no difference in injury severity score (ISS) between ADI rank groups ($p = 0.769$). Patients living in areas with higher ADI rankings were significantly more likely to present following violent trauma, such as gunshot wounds, stabbings, and assaults as well as vehicular trauma. Patients from lower ADI areas were more likely to have injuries related to falls, burns, bicycles, and animals. An ADI of 7-10 was associated with a statistically significant increased risk of developing ventilator associated pneumonia (VAP) compared to ADI of 1-6 (OR=2.375, 95% CI=1.162-4.854; $p = 0.018$). Patients in the ADI rank 7-10 group are at increased risk of developing acute kidney injury (AKI) (OR=1.918, 95% CI=0.955-3.853;

$p = 0.067$) as well as dying in the hospital (OR=1.260, 95% CI=0.999-1.590; $p = 0.051$), although results did not reach statistical significance. Patients in the ADI 7-10 group as well as minorities had significant increase in hospital length of stay (RR=1.068 vs ADI 1-6, 95% CI=1.021-1.117; $p = 0.004$ and RR=1.169 vs White, 95% CI=1.120-1.221; $p < 0.0001$ respectively).

CONCLUSION: This study identifies the profound impact that poverty and other socioeconomic factors have on the mechanisms and outcomes in trauma patients. These trends are maintained despite similar ISS suggesting that impoverished patients suffer from a unique disadvantage. These differences may be related to a host of factors, alone or in combination, ranging from lack of primary care to lack of broadband access or undiagnosed medical conditions on admission. Further study is warranted to identify the community specific factors that most impact outcome. Identifying these factors may help trauma system better focus their outreach in areas that have the greatest need and margin for improvement.

THE COST OF LIVER DISEASE: THE CIRRHOSIS OUTCOMES SCORE IN TRAUMA STUDY

Rachel D. Appelbaum, MD; Katherine M. Riera, MD; Madeline R. Fram, BA; R. Shayn Martin, MD, MBA; Andrew M. Nunn, MD; J. Jason Hoth, MD, PhD; Nathan T. Mowery, MD

Wake Forest University School of Medicine

Invited Discussant: Krista Kaups, MD

Background: Cirrhosis in trauma patients is an indicator of a poor prognosis, but current trauma injury grading systems do not take into account liver dysfunction as a risk factor. Our objective was to construct a simple clinical mortality prediction model in cirrhotic trauma patients: Cirrhosis Outcomes Score in Trauma (COST).

Methods: Trauma patients with pre-existing cirrhosis or liver dysfunction who were admitted to our ACS Level I trauma center between 2013 and 2019 were reviewed. Patients with liver dysfunction secondary to traumatic injury were excluded. Demographics as well as ISS, MELD, complications, and mortality were evaluated. COST was defined as the sum of age, ISS, and MELD. Univariate and multivariate analysis was used to determine independent predictors of mortality. The C-statistic was calculated to assess the ability of COST to predict mortality.

Results: A total of 109 patients were analyzed of which the majority were males (68%) who suffered blunt trauma (94.5%). Mortality at 30-days, 90-days, and 1 year was 17%, 21%, and 33%, respectively. COST was associated with inpatient, 30-, and 90-day mortality on regression analysis and the C-statistic for COST predicting inpatient, 30-day, and 90-day mortality was 0.863, 0.869, and 0.891, respectively. COST > 110 has a 100% positive predictive value of death at 90 days.

Conclusion: There is not currently a readily available tool to assess trauma outcomes in cirrhotic patients. COST is highly predictive of mortality in cirrhotic trauma patients. It is easy to calculate real time in the clinical setting and may be useful in optimizing goals of care discussions. Further prospective studies to validate this prediction model are required prior to clinical use.

EFFECT OF TRANEXAMIC ACID ON ENDOTHELIAL VON WILLEBRAND FACTOR/ADAMTS-13 RESPONSE TO IN VITRO SHOCK CONDITIONS

Lawrence N. Diebel, MD; David Liberati, MBA

Wayne State University

Invited Discussant: Lucy Kornblith, MD

Introduction: Traumatic/hemorrhagic shock (T/HS), sepsis and other inflammatory processes lead to endothelial activation and a loss of the endothelial glycocalyx. Von Willebrand Factor (vWF) is an acute phase reactant that is released from endothelial cells and megakaryocytes. Stimulated but not basal vWF leads to significant formation of ultralarge multimers (ULVWF) and thrombotic complications. ULVWF is cleaved by ADAMTS-13; alterations in ULVWF/ADAMTS-13 ratio may contribute to trauma induced coagulopathy (TIC). Salutary effects of tranexamic acid (TXA) on TIC have been described. These effects appear apart from antifibrinolytic actions of TXA. We hypothesized that TXA would mitigate the effects of shock conditions on endothelial vWF/ADAMTS-13 release and activity. This was studied in endothelial cells in vitro.

Methods: Human umbilical vein endothelial cell monolayers (HUVEC) established under flow conditions were then subjected to hypoxia/reoxygenation (HR; 1% oxygen) and epinephrine (epi) or control conditions. TXA was added after 90 minutes of perfusion. Tissue plasminogen activator (tPA) activity and plasminogen activator inhibitor 1 (PAI-1) activity were assayed at timed intervals as were vWF antigen and ADAMTS-13 activity. Western blot analysis was performed for vWF characterization from perfusion media.

Results: Mean \pm SD, N = 4 for each group.

	tPA (pg/ml)		vWF (μ g/ml)		ADAMTS-13 (pg/ml)	
	1hr.	6hr.	1hr. 6hr.	8.8 \pm 0.5	1hr.	6hr.
HUVEC control	4.4 \pm 0.9	5.5 \pm 1.4	8.4 \pm 1.1	8.8 \pm 0.5	736.5 \pm 25 21	742.2 \pm 21
HUVEC + HR + epi	380.5 \pm 34* 42*	374.8 \pm	26.8 \pm 3.1* 2.6*	25.8 \pm	202.5 \pm 10* 13*	221.5 \pm
HUVEC + HR + epi + TXA (20 μ M)	11.6 \pm 1.8*# 1.4*#&	25.6 \pm	15.4 \pm 1.2*# 1.4*#	15.8 \pm	478.6 \pm 12*# 10*#	469.8 \pm
HUVEC + HR + epi + TXA (150 μ M)	5.8 \pm 1.3* 2.5*#&	11.2 \pm	10.8 \pm 0.8# 1.2*#	11.5 \pm	551.3 \pm 13*# 18*#	532.5 \pm

* $p < 0.05$ vs. HUVEC control, # $p < 0.05$ vs. HUVEC + HR + epi, & $p < 0.05$ vs. same group 1hr. PAI-1 activity decreased significantly following HR + epi exposure and was partially reversed by TXA administration. Western blot analysis revealed that vWF ultra large forms were predominant following HR + epi exposure. TXA lead to significant reductions in ULVWF consistent with the findings with ADAMTS-13 activity.

Conclusion: TXA ameliorated profibrinolytic and vWF/ADAMTS-13 effects of endothelial HR and epi exposure. This may be another mechanism whereby administration of TXA early following T/HS may mitigate microvascular perfusion abnormalities and subsequent organ failure. The resultant effects on platelet adhesion and aggregation require further study.

TRANEXAMIC ACID REGULATES PYRUVATE KINASE M2

Joseph F. Rappold, MD; Doreen Kacer, BS; Carolyne Falank, PhD; Damien Carter, MD; Igor Prudovsky, PhD
Maine Medical Center

Invited Discussant: Karim Brohi, MD, MD

Introduction: Tranexamic acid (TXA) is widely used as antifibrinolytic agent in hemorrhagic trauma and cardiac surgery patients. However, the beneficial effects of TXA exceed the simple suppression of blood loss and includes the ability to decrease inflammation and edema. Our previous findings demonstrated that TXA enhances mitochondrial respiration, increases the size of mitochondria, and suppresses mitophagy. Using the method of Drug affinity Responsive Stability

(DARTS), we have recently found that TXA binds Pyruvate Kinase M2 (PKM2), a glycolytic enzyme responsible for production of pyruvate, a major fuel of mitochondrial respiration. We also demonstrated that TXA increases the activity of PKM2. Interestingly, PKM2 is known to increase mitochondrial biogenesis and stimulate angiogenesis. PKM2 is present in the cells as a metabolically active cytoplasmic homotetramer and a homodimer, which localizes in the nuclei and plays a role of transcriptional regulator enhancing the expression of proinflammatory genes. In this study, we assessed the effects of TXA on oligomerization and nuclear localization of PKM2.

Methods: Human Umbilical Endothelial Cells (HUVEC) in full growth medium (EGM, Lonza) were pre-incubated for 3 days in presence or absence of 100 g/ml TXA. To study the effect of TXA on PKM2 oligomerization, HUVEC were collected by scraping, lysed in Laemmli buffer, and the proteins were then resolved by PAAG electrophoresis in buffers with or without SDS. Then, immunoblotting with anti-PKM2 rabbit antibodies (Cell Signaling) was used to detect the monomers and oligomers of PKM2. To study the effect of TXA on PKM2 nuclear localization, cells pre-incubated with or without TXA were collected by scraping and fractionated using the QProteome kit (Qiagen). The nuclear and cytoskeletal fractions were then resolved by electrophoresis and immunoblotted with anti-PKM2 antibodies.

Results: TXA did not change the total amount of PKM2 in HUVEC as judged by the amount of PKM2 monomer detected after electrophoresis in SDS+ buffer (Figure 1A). Electrophoresis in the buffer without SDS showed that without TXA PKM2 was predominantly present in a homodimer form and with TXA almost exclusively PKM2 tetramers were detected. (Figure 1A). Cell fractionation also showed that TXA decreased the presence of PKM2 in the nuclear and cytoskeletal fractions (Figure 1B).

Conclusions: TXA stimulates the formation of metabolically active PKM2 tetramers and decreases the dimerization-related localization of PKM2 in the nuclei, where it plays a pro-inflammatory role (Figure 1C). We propose that the beneficial effects of TXA on PKM2 can result in the enhancement of energy metabolism and suppresses inflammation. The combination of PKM2-dependent effects of TXA and its well-known anti-fibrinolytic activity dependent on the suppression of plasmin production could explain its extensive beneficial effects in hemorrhagic trauma patients.

POSTERS



SESSION V:
POSTER SESSION I

Wednesday, September 21, 2022

6:15 PM - 7:15 PM

Location: Riverside East

GROUP ONE (POSTERS 1-9)

ABDOMINAL TRAUMA (INCLUDING GI)

Ali Salim, MD and Sean Nix, MD

GROUP TWO (POSTERS 10-19)

CRITICAL CARE (INCLUDING INFECTION AND SEPSIS)

Lewis Kaplan, MD and Clay Cothren Burlew, MD

GROUP THREE (POSTERS 20-28)

EMERGENCY GENERAL SURGERY

Caroline Reinke, MD and Neil Parry, MD

GROUP FOUR (POSTERS 29-38)

GERIATRICS I (TRAUMA AND EGS)/PALLIATIVE CARE

Anastasia Kunac, MD and Sasha Adams, MD

GROUP FIVE (POSTERS 39-46)

GERIATRICS II (TRAUMA AND EGS)/PALLIATIVE CARE

Charles Adams Jr., MD and Caroline Park, MD

GROUP SIX (POSTERS 47-56)

**HEALTH DISPARITIES/DIVERSITY, EQUITY,
AND INCLUSION**

Selwyn Rogers Jr., MD and Terri deRoon-Cassini, MD, PhD MD, MSc

GROUP SEVEN (POSTERS 57-65)

PEDIATRICS/INJURY PREVENTION

David Notrica, MD and Barbara Gaines, MD

BED AND BREAKFAST: AN INSTITUTIONAL APPROACH TO LOW GRADE SPLENIC INJURIES

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Introduction: Low grade splenic injuries (LGSI) defined as grade 1 (G1) and grade 2 (G2) are often managed nonoperatively; however, no consensus regarding their optimal care exists. With the latest update to the AAST guidelines classifying any splenic injury with a pseudoaneurysm (PSA) as at least a grade 4 injury, a uniform approach to the management of LGSI should be defined. The aim of this study was to describe the natural history of LGSI given the new AAST classification.

Method: This is a single-center retrospective analysis of all patients admitted with LGSI after blunt trauma from January 1, 2017 to December 31, 2020. Patients who went to the operating room (OR) or died within 24 hours were excluded. Descriptive statistics were performed after data was abstracted. Primary outcomes included need for angioembolization (AE) or OR for spleen.

Results: 753 adult patients with blunt splenic injuries were identified. 256 patients were originally classified as having LGSI. After reclassification based on the latest AAST guidelines, 241 patients had true LGSI: 134 (56%) G1 and 107 (44%) G2. The majority were male (61%) with a median age and injury severity score of 37 and 19, respectively. 127 patients underwent repeat CT scan at 24 hours: 44 patients with G1 and 83 with G2. Of these, only 3 patients (2 G1 and 1 G2) displayed interval worsening on repeat CT scan (3 vs 124, $p=0.211$): none required further intervention. 22 patients (7 G1 and 15 G2) underwent angiography. Of these, only 2 (1 G1 and 1 G2) were therapeutic (2 vs 20, $p=1.0$). 14 patients (6 G1 and 8 G2) required splenectomy; all became symptomatic (decreasing hematocrit, tachycardia, hypotension, physical exam change) within 24 hours post-injury. There were no spleen-related mortalities.

Conclusions: 6.6% patients with LGSI required further intervention prior to discharge – all within the first 24 hours post-injury. Routine 24-hour CT scans in asymptomatic patients did not impact management. Thus, for patients with LGSI, 24-hour observation with repeat hematocrit prior to discharge provides the foundation for a safe and effective management strategy for these injuries.

CHANGES IN REACTIVE ASCITES PROTEINS WHEN CULTURED WITH MESOTHELIAL CELLS

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Introduction: Adhesions involving mesothelial cells (MCs) of the outermost layer of peritoneum are a common response to abdominal surgery and may also form in response to peritoneal inflammation, e.g., acute appendicitis (AA). Molecules in reactive ascites (rA), produced in response to peritoneal insult, may modulate adhesion dynamics. We observed that select rA fluids triggered cultured MCs to produce a glycosaminoglycan (GAG)-rich gelatinous substance (GS) in vitro. We explored what rA components are associated with formation of this GS as well as the GS composition.

Methods: This is a prospective observational study at four level 1 trauma centers where peritoneal rA is collected prior to surgical intervention for non-perforated AA or small bowel obstruction (SBO). Four appendectomy (Appy) and three SBO rA samples met the inclusion criteria required for this cell analysis. Human MCs were treated for 48h with neat rA. Within Appy and SBO groups, GAG-high vs -low MC-conditioned rA proteins were compared and will be referred to as 'Appy GS' and 'SBO GS.' Trypsin digested proteins were identified with liquid chromatography mass spectrometry (LC-MS) and Mascot Distiller software.

Results: Appy GS and SBO GS were enriched ($p < 0.05$) in 'acute phase immune response,' 'complement,' and 'coagulation' cascades. Appy GS was enriched with a classical complement protein, Complement C1q (2.7-fold change (FC), $p < 0.01$), and Complement Factor I (1.4-FC $p < 0.05$), an inhibitor of the downstream membrane attack complex (MAC). Conversely, the MAC complement proteins C5 and C9 were enriched in SBO GS (7.7- and 6.9-FC, respectively, $p < 0.05$). Several extracellular matrix (ECM) proteins were also significantly increased in Appy GS and SBO GS. All three chains of fibrinogen (FIB), FIBA, FIBB and FIBG were significantly decreased in GAG-high vs -low Appy and SBO samples.

Conclusions: rA treatment of MCs produced innate immune and ECM secretory responses. As this GS is extracellular to the cultured MCs, we were also able to confirm the presence of several ECM proteins that increased in MC-conditioned rA. We are exploring if this GS is associated with the cause or resolution of adhesions. These findings add to our knowledge of the molecular mechanisms associated with acute and chronic adhesion formation.

IS THE USE OF NON-STEROIDAL ANTI-INFLAMMATORIES AFTER BOWEL ANASTOMOSIS IN TRAUMA SAFE?

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Background: With an increasing interest in multimodal and opioid reducing pain strategies, non-steroidal anti-inflammatory drugs (NSAIDs) have become common-place in the care of injured patients. Long-standing concerns of increased anastomotic leak rate with the use of NSAIDs, however, have persisted. We hypothesized that there would be no significant risk associated with NSAID use after bowel anastomosis in trauma patients.

Methods: All patients presenting to a level 1 trauma center who required intestinal resection and anastomosis from 2011 to 2017 were reviewed. Patients receiving NSAIDs were compared to those managed without NSAIDs. Primary outcome of interest was anastomosis-related complications (anastomotic leak, intraabdominal abscess, anastomotic bleed, fascial dehiscence, fascial dehiscence, and enterocutaneous fistula). Multivariable logistic regression analyses were performed with propensity adjustment for inverse probability of NSAID treatment weights.

Results: 295 patients met inclusion criteria with 192 receiving NSAIDs. Patients receiving NSAIDs had lower abdominal AIS, and ISS scores ($p < 0.046$). Arrival SBP, DBP, and GCS were higher in the NSAID group ($p < 0.013$). After propensity weighting, NSAID use was not a major predictor of anastomotic complication ($p = 0.39$). There was an increased risk of anastomotic leak with perioperative vasopressor exposure (OR=3.33(95%CI=1.17-9.05), $p < 0.001$). Increasing RBC transfusions in the first 24 hours were associated with intra-abdominal complications (OR=1.02, 95%CI=1.00-1.04, $p = 0.05$). NSAID exposure demonstrated a weak association with anastomotic leak (OR=1.92, 95%CI=0.97-3.90, $p = 0.06$).

Conclusion: Consistent with previous studies, peri-operative vasopressor exposure and increased number of RBC transfusions are risk factors for anastomotic leaks and intra-abdominal complications, respectively. NSAID use in trauma patients with multiple risk factors may be associated with an increased risk of anastomotic leak and should be used with caution in the setting of other established risk factors.

MULTI-CENTER STUDY OF INTRA-ABDOMINAL ABSCESS FORMATION AFTER MAJOR OPERATIVE HEPATIC TRAUMA

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Introduction: One of the significant complications of operative liver trauma is intra-abdominal abscesses (IAA). The objective of this study was to determine risk factors associated with post-operative IAA in surgical patients with major operative liver trauma.

Methods: A retrospective multi-institutional study was performed at 13 Level 1 and Level 2 trauma centers from 2012-2021. Adult patients with major liver trauma (grade 3 and higher) requiring operative management were enrolled. Univariate and multivariate analyses were performed.

Results: 372 patients were included with 21.2% (n=79/372) developing an IAA. No difference was found for age, gender, injury severity score, liver injury grade, and liver resections in patients between the groups (p>0.05). Penetrating mechanism of injury (OR 2.6, 95% CI 1.2-5.3, p=0.01), number of days with an open abdomen (OR 1.1, 95% CI 1.0-1.1, p=0.03), massive transfusion protocol (MTP) (OR 2.8, 95% CI 1.5-5.4, p=0.002), and biloma/bile leak (OR 2.9, 95% CI 1.3-5.2, p=0.008) were independent risk factors for IAA. Intra-abdominal drains, damage control laparotomy, total units of packed red blood cells, and blood loss during surgery were not found to be associated with a higher risk of IAA.

Conclusions: Patients with penetrating trauma, open abdomens, and MTP were at higher risk for the development of an IAA following operative liver trauma. Results from this study could help to refine existing guidelines for managing complex operative traumatic liver injuries.

	IAA n=79	No IAA n=293	p value
Penetrating mechanism, n (%)	66 (83.5)	205 (70.0)	0.02
Total units packed red blood cells, median (IQR)	9 (5-15)	4 (2-10)	<0.001
Estimated intra-op blood loss L, median (IQR)	1.0 (0.5-2.0)	0.7 (0.3-1.5)	0.004
Massive transfusion protocol, n (%)	45 (57.0)	84 (28.7)	<0.001
Damage control laparotomy, n (%)	70 (88.6)	203 (69.3)	<0.001
Intra-abdominal drain, n (%)	53 (67.1)	152 (51.9)	0.01
Days with open abdomen, median (IQR)	1 (1-4)	1 (1-2)	<0.001

NATIONAL TRENDS IN THE MANAGEMENT OF TRAUMATIC SPLENIC INJURY IN THE UNITED STATES: 2012-2019

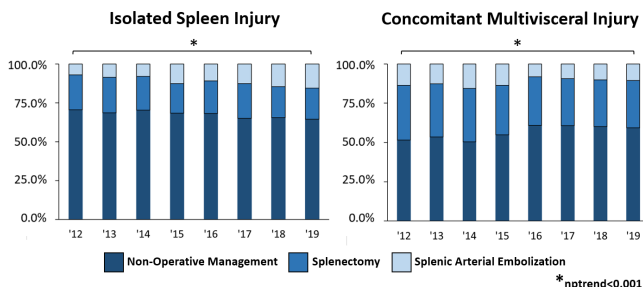
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Introduction: Non-operative management and splenic artery embolization have emerged as common approaches to managing traumatic splenic injury. We aimed to characterize trends in operative management and splenic salvage modalities for traumatic splenic injuries using a nationally representative cohort.

Methods: Adults admitted for traumatic splenic injury were identified in the 2012- 2019 National Inpatient Sample. Patients were stratified into isolated splenic injury (ISI) and with concomitant multivisceral injury (MVI) cohorts. ISI was defined as those with only splenic visceral or vascular injury while MVI patients were defined as those with injuries to the spleen and other organs in the abdomen, chest or pelvis. In both cohorts, patients with concomitant injuries to the extremities or head were not excluded. Trends in management approach were examined, while patient characteristics and mortality were subsequently analyzed by approach.

Results: Of an estimated 84,915 patients, 30,415 (35.8%) had ISI while the remainder had MVI. Compared to the ISI cohort, MVI patients with high-grade injuries (grade IV-V) more frequently required splenectomy (40.7 vs 28.6%, $P<0.001$). From 2012 to 2019, rates of splenectomy decreased among patients with ISI (22.6 vs 20.0%, $P<0.001$) and those with MVI (34.9 vs 30.2%, $P<0.001$) (Figure). Unadjusted mortality of ISI cohort remained similar (2.5 vs 2.4 %, $P=0.58$) while that of MVI group increased over the study period (9.5 vs 11.2%, $P=0.003$).

Conclusion: In the past decade, splenic salvage has been increasingly adopted in treatment of both isolated and multitrauma splenic injuries. The significant drop in operative management may reflect improvements in conservative treatment algorithms and use of multi-disciplinary teams.



OUTCOMES OF CLOSED PASSIVE GRAVITY AND SUSTAINED LOW NEGATIVE PRESSURE SUCTION DRAINAGE FOR PANCREATIC TRAUMA: A PROPENSITY-MATCHED ANALYSIS

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Background: Although management strategy for operatively placed drains after pancreatic trauma (PT) have been widely recommended, few studies to date have elucidated potential differences in the postoperative outcomes related to drainage type. The current study sought to evaluate the clinical outcomes of closed passive gravity drainage (PG) and sustained low negative pressure suction drainage (NPS) in patients with PT.

Methods: Patients with PT who underwent operative treatment were enrolled consecutively in this study at a tertiary referral trauma center from January 2009 to October 2021, and then divided into PG and NPS groups according to initial drainage type. Primary outcome was the occurrence of severe complications (Clavien-Dindo classification \geq IIIb). Secondary outcomes were in-hospital mortality, specific postoperative complications, reoperation rate and length of stay (LOS). A 1:1 propensity score matching (PSM) schemes were constructed to account for differences in baseline demographics and injury parameters.

Results: Two hundred seventy-four patients with PT were identified; 196 underwent pancreatic surgery were included in the analysis, and of these, 146 underwent PG drainage and 50 underwent NPS drainage. PSM analysis resulted in a total of 88 patients (44 PG, 44 NPS). The proportion of each operative procedure performed in the PG group was comparable to that of the NPS group ($P > 0.05$). Compared with PG group, patients who underwent NPS were significantly lower risk of severe complications (25.0% vs 45.5%, $P = 0.045$). No significant difference in in-hospital mortality was found between the two groups (6.8% vs 4.5%, $P = 1.000$). The incidence of pancreatic fistula (grade B/C) was significantly higher in the PG group (50.0% vs 25.0%, $P = 0.015$). Furthermore, the reoperation rate of NPS group was significantly lower than that of PG group (15.9% vs 38.6%, $P = 0.017$). There was a shorter LOS in the NPS group (median [IQR], 44.0 [33.0-69.75] vs 62.50 [43.75-97.0] days; $P = 0.047$).

Conclusions: Comparing PG and NPS drainage, decreased Clavien-Dindo severity and improved postoperative outcomes were observed for NPS drainage in patients with PT. Further randomized controlled trials are warranted to validate these results.

THE AAST-OIS IS ASSOCIATED WITH ENDOSCOPIC AND PERCUTANEOUS BILIARY PROCEDURES IN HEPATIC INJURIES

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Background: The American Association for the Surgery of Trauma (AAST) Organ Injury Scale (OIS) for the liver (and other organs) was created in 1989. It has been validated, perhaps best by Tinkoff et al in 2008, to predict mortality, need for operation, length of stay (LOS), and intensive care unit (ICU) LOS. It does not consider mechanism of trauma in its interpretation.

Methods: We analyzed the Trauma Quality Improvement Program (TQIP) database from 2017-2019, including all patients with a liver injury. Outcomes included the rates of mortality, operation, liver-specific operation, hepatic embolization, endoscopic retrograde cholangiopancreatography (ERCP), and percutaneous drainage procedures. Odds ratios and 95% Confidence Intervals (OR, CI) for outcomes were calculated for each grade compared to the immediately lower grade.

Results: 58627 patients had a liver injury with an OIS grade. In penetrating trauma, mortality rates increased at each grade level ($p < 0.001$). Operative and percutaneous hepatobiliary drainage rates increased in grades III-V ($p < 0.03$). Embolization and ERCP rates increased in grades III-IV ($p < 0.001$). In blunt trauma, mortality and operative rates increased in grades IV-VI ($p < 0.002$). Hepatic embolization, ERCP, and hepatobiliary drainage rates increased in grades III-V ($p < 0.005$).

On binomial logistic regression of AAST-OIS, penetrating trauma is associated with higher odds of mortality (1.80, 1.62-1.99), operation (12.1, 11.4-12.8), ERCP (1.02, 1.01-1.03), and percutaneous hepatobiliary drainage (3.58, 2.88-4.45), but lower embolization rates (0.86, 0.75-0.98).

Conclusion: AAST-OIS is associated with endoscopic and percutaneous biliary procedures in addition to being previously validated for mortality, operative intervention, and hepatic angioembolization. In addition, the AAST-OIS does not appear to equally evaluate penetrating and blunt hepatic injuries.

TO CLOSE OR NOT TO CLOSE: COMPARISON OF THE OPEN ABDOMEN IN THE EGS AND TRAUMA POPULATIONS

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INTRODUCTION: Damage Control Laparotomy (DCL) is well established in the trauma literature. When trauma surgeons expanded their practice to emergency general surgery (EGS), DCL was utilized despite little data to support its utility outside of trauma. Research to date for DCL in EGS has focused on indications. We hypothesized that due to varying populations and pathology that DCL would carry higher complications in EGS.

METHODS: We examined patients admitted to our lvl 1 center from 9/1/12 to 2/28/21 who underwent DCL. All patients >16 yrs who survived to one additional laparotomy were included. Patients were divided into two groups, Trauma (TR) or EGS, based on their operative indications.

RESULTS: 1808 procedures were performed in 509 patients. EGS patients were older and more comorbid but less likely to be in shock on presentation. Mortality was higher in the EGS group when compared to TR (41% vs 22%, $p < .001$) and successful primary fascial closure was lower (77% vs 85%, $p < .001$). Age correlated with mortality in TR with increasing risk of death each decade ($p=0.001$) while the same was not true in EGS. Closure within 48hrs was associated with improved outcomes in both populations although more in the EGS grp, this was especially true in those over age 65.

CONCLUSION: Damage control surgery has nearly twice the mortality in EGS when compared to TR. While this a byproduct of the pathology present it is not explained by age alone. Optimal outcomes are reached when closed within 48hrs, however continued attempts at closure can be successful beyond this period. While the utility of DCL in the TR population is well established, surgeons should consider that DCL may not improve outcomes in the EGS population in particular at risk groups like the elderly.

ENDOVASCULAR BALLOON OCCLUSION OF THE INFERIOR VENA CAVA IN TRAUMA: A SINGLE-CENTER CASE SERIES

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Background: Injury to the inferior vena cava (IVC) can produce bleeding that is difficult to control. Endovascular balloon occlusion provides vascular control without extensive dissection and may be useful in large venous injuries, especially in the juxtarenal IVC. We present the first series utilizing this technique.

Technique: We use the Bridge Occlusion Balloon (Philips Healthcare) which measures 20 mm by 80 mm and is mounted on a 90 cm catheter. We commonly obtain femoral venous access in patients with shock and/or an injury pattern that may be helped with a Bridge balloon. That venous catheter is then then upsized to a 12-French introducer sheath. The Bridge balloon catheter is inserted over a guidewire under direct visualization and palpation to ensure the wire remains intraluminal and the balloon spans the entire injured segment. The balloon is inflated with 60 mL of saline and secured using a three-way stopcock prior to caval mobilization and repair.

Methods: We conducted a single-center retrospective review from January 1, 2021 to October 31, 2021 of injured patients in which endovascular balloon occlusion of the IVC was employed for hemorrhage control. We collected data regarding patient demographics, injury mechanism, hemodynamics, initial laboratory values including serum lactate, transfusion requirements, specific injuries and their management, hospital course and complications, and survival. We used descriptive statistics to summarize the data.

Results: We used emergent endovascular balloon occlusion of the infrahepatic IVC in five patients (see Table 1). All five patients were males with the median age being 35 years old (range 22 - 42 years). They all suffered penetrating injuries with four gunshot wounds and one stab wound. Median presenting Shock Index was 0.7 (range 0.5 - 1.5), and median initial lactate was 5.4 mmol/L (range 4.6 - 6.9 mmol/L). There was one suprarenal IVC injury, two juxtarenal injuries, and three infrarenal injuries. Four patients underwent primary repair of their injury, and one patient underwent IVC ligation. Four patients also had intraoperative Resuscitative Endovascular Balloon Occlusion of the Aorta (REBOA) for inflow control. The median number of total blood products transfused during the initial operation was 37 units (range 16 - 77 units). Four patients underwent damage control operations with planned return to the operating room, and one patient had a single definitive operation. Four of the five patients (80%) survived to 30 days with the lone mortality being due to other injuries.

Conclusions: Endovascular balloon occlusion serves as a valuable adjunct in the management of IVC injury and demonstrates the potential of hybrid open-endovascular operative techniques in abdominal vascular trauma.

Table 1.

Patient and Mechanism	IVC Injury Description	Injury Management	Associated Injuries	30-day survival?
28 y/o M stab	Posterior suprarenal laceration extending to orifice of left renal vein, anterior juxtarenal laceration	Primary repair of both lacerations	Duodenal laceration	Yes
36 y/o M GSW	Anterior juxtarenal laceration	Primary repair	Shattered right renal pelvis, central liver injury, right colon laceration	Yes
22 y/o M GSW	Two small anterior and posterior infrarenal lacerations on lateral wall	Laceration extension into one and primary repair	SMV injury, duodenal laceration	No
35 y/o M GSW	Large anterior and lateral wall infrarenal injury	IVC ligation	Two small bowel lacerations	Yes
42 y/o M GSW	Posterior suprarenal injury extending to but not involving origin of right renal vein	Primary repair	Duodenal laceration, right colon laceration	Yes

IMPACT OF IMPLEMENTING A VTE GUIDELINE AND ORDER SET ON VTE RATES: A MULTICENTER STUDY

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Introduction: Appropriate chemical prophylaxis (ppx) can reduce the risk of venous thromboembolism (VTE) in trauma patients. A systemwide VTE clinical practice guideline (CPG) and electronic medical record (EMR)-based VTE ppx order set was implemented. The CPG initiated ppx earlier, favored low molecular weight heparin (LMWH), and monitored anti-Xa for BMI>35 or ICU admissions. The purpose of this study is to evaluate the impact of CPG implementation and VTE ppx order set on the rate of VTE.

Methods: A retrospective review of trauma patients 15 years or older admitted to three trauma centers between 7/2018—12/2021. Exclusion criteria included burn injury, readmission, length of stay (LOS) <2 days, and comfort care. The VTE CPG and EMR order set were implemented November 2020 and a pre-implementation (PRE)/post-implementation (POST) comparison conducted.

Results: 12,479 patients were included. There were no differences in age, gender, and injury severity score (ISS). The POST group had a higher usage of LMWH (64.0 vs 67.5%, $p=0.0001$), a lower rate of no ppx (17.2 vs 12.5%, $p<0.0001$), and a shorter time to ppx (1763 vs 1555 min, $p<0.0001$). The rates of VTE (1.6 vs 1.0%, $p=0.004$) and deep vein thrombosis (1.1 vs 0.7%, $p=0.032$) were lower in the POST group. There was no difference in the rate of pulmonary embolism (0.6 vs 0.4%, $p=0.055$). The POST group had a higher mortality (0.7 vs 1.1%, $p=0.033$) on univariable analysis, but there were no differences between groups on adjusted analysis. Independent predictors of VTE were longer time to ppx, higher ISS, bleeding disorder, longer LOS, higher ventilator days, and ventilated-associated pneumonia. Use of LMWH was protective from VTE.

Conclusion: The implementation of systemwide VTE CPG and EMR-based ppx order set was associated with a reduced incidence of VTE in trauma patients without an associated mortality difference.

INCIDENCE, OUTCOMES AND COSTS OF SEVERE SEPSIS AND SEPTIC SHOCK IN GERIATRIC TRAUMA PATIENTS

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INTRODUCTION: Severe sepsis/septic shock (Sepsis) is a leading cause of death in hospitalized trauma patients. Geriatric trauma patients are an increasing proportion of trauma care but little recent, large-scale, research exists in this high-risk demographic. The objectives of this study are to identify incidence, outcomes and costs of Sepsis in geriatric trauma patients.

METHODS: Patients at short-term, non-federal hospitals aged ≥ 65 with ≥ 1 injury ICD-10 code were selected from 2016-19 CMS IPSAF. Sepsis was defined as ICD-10 diagnosis codes R6520 and R6521. A log-linear model was used to examine the association of Sepsis with mortality, adjusting for age, sex, race, Elixhauser Score and ISS. Dominance analysis using logistic regression was used to determine the relative importance of individual variables in predicting Sepsis. IRB exemption was granted for this study.

RESULTS: There were 2,563,436 hospitalizations from 3284 hospitals (62.8% female; 90.4% white; 72.7% falls; mean ISS: 6.6). Incidence of Sepsis was 2.1%. Sepsis patients had significantly worse outcomes (Table 1). Mortality risk was significantly higher in septic patients (aRR, 3.98, 95% CI, 3.92-4.04). Elixhauser Score contributed the most to the prediction of Sepsis, followed by ISS (McFadden's $R^2=9.7\%$ and 5.8% , respectively).

Table 1. Unadjusted comparisons of outcomes between septic and non-septic patients and overall

Outcomes	Septic		Non-septic		Overall	
	n= 53,001		n= 2,510,435		N= 2,563,436	
CMS payment per capita, mean (SD)	\$27,133	(\$37,487)	\$11,735	(\$12,733)	\$12,052	(\$13,879)
Hospital LOS, mean (SD)	11.2	(13.1)	4.98	(5.1)	5.11	(5.4)
ICU LOS, mean (SD)	7.8	(8.9)	4.14	(4.4)	4.33	(4.8)
ICU use, n (%)	31,528	(59.5)	575,926	(22.9)	607,454	(23.7)
Ventilator use, n (%)	19,022	(35.9)	87,867	(3.5)	106,889	(4.2)
Mortality, n (%)	19,619	(37.0)	151,806	(6.0)	171,425	(6.7)

All comparisons between septic and non-septic were significant at $p < .001$. ICU=intensive care unit, LOS=length of stay

CONCLUSION: Severe sepsis/septic shock occurs infrequently among geriatric trauma patients but is associated with increased mortality and resource utilization. Pre-existing comorbidities influence Sepsis occurrence more than ISS or age in this group, identifying a population at high risk. Clinical management of geriatric trauma patients should focus on rapid identification and prompt aggressive action in high-risk patients to minimize the occurrence of Sepsis and maximize survival.

LIPID METABOLIC PROFILE IN MESENTERIC LYMPH AFTER INTESTINAL ISCHEMIA/REPERFUSION

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Background: After intestinal ischemia/reperfusion (IR) injury, a variety of inflammatory mediators enter the systemic circulation through mesenteric lymph (ML) ducts, leading to acute lung injury/multiple-organ dysfunction syndrome (MODS). Although intestinal IR injury drives systematic inflammation and MODS, the functions of post-intestinal IR ML are not fully understood. The present study assessed the biological activities of post-IR ML on polymorphonuclear leukocytes (PMNs) and obtained a comprehensive profile of lipids in the ML.

Methods: In this study, we performed superior mesenteric artery occlusion (60 min) and reperfusion (120 min), which is specific for intestinal ischemia, to investigate the post-IR ML biological activities and profile. To assess the biological activities on PMNs, male Sprague-Dawley rat ML was collected before (b-ML) and after (a-ML) intestinal IR. The lipids in the ML were extracted using the methods of Bligh and Dyer, and liquid chromatography/electrospray ionization mass spectrometry was performed. We analyzed the changes in the lipid profile between b-ML and a-ML.

Results: The biological activities of ML were significantly altered by intestinal IR. a-ML induced PMN activities, CD11b expression, reactive oxygen species (ROS) production, and morphological changes ($p < 0.05$). Lipid metabolic analyses revealed that arachidonic acid (AA) in ML was significantly increased after intestinal IR. Furthermore, the metabolites of AA, such as prostaglandin E2 (PGE2) and prostaglandin F2 α (PGF2 α), were significantly increased in a-ML compared with b-ML ($p < 0.05$).

Conclusions: ML after intestinal IR has biological functions that activate PMNs. In addition, we found that intestinal IR boosted the concentrations of AA and prostanoids, such as PGE2 and PGF2 α , in ML. To our knowledge, this is the first report to identify prostanoids in ML, which might be a pathogenesis of MODS.

OUTCOMES IN CRITICALLY ILL COVID-19 PATIENTS WITH IDENTIFIABLE ANTIMICROBIAL RESISTANCE GENES

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Background: Developments in RNA sequencing technology have increased our capability to use blood samples from critically ill patients and compare them to the human genome. We have been able to identify the presence of unusual sequences in these blood samples that are from non-human organisms' genomes. These unmapped sequences are hypothesized to map to bacterial resistance genes and provide further insight into a patient's clinical course.

Methods: Blood samples from patients on the first day in the ICU were collected in Paxgene tubes after informed consent. RNA was extracted and sequenced with approximately 100 million reads per sample. 30-40 million of those reads were unmapped and subsequently aligned against known antibiotic resistance genes from McMaster University's Comprehensive Antibiotic Resistance Database (CARD). Newly aligned sequences were subject to two-tailed t-tests. Outcome variables studied included death, hospital stays, ICU stays, thrombotic events, ECMO, dialysis and mechanical ventilation. Both absolute number of reads and percentage of reads for each patient were used as basis for analysis.

Results: Reads aligning to a A16S rRNA mutation conferring resistance to Kasugamicin was more common in patients that died versus patients that lived (2.29 vs 0, $p=0.045$). Resistance to tetracyclines was associated with increased thrombotic events ($p=0.022$) and a A23S rRNA mutation conferring resistance to erythromycin increased risk for mechanical ventilation ($p=0.048$).

Discussion: Identification of antibiotic resistance genes, at even very small levels, is associated with some outcomes. Future testing of these genes through techniques such as PCR could not only better guide antimicrobial treatment but could also aid in prognosis. More studies must be done to understand the mechanism as why these resistance genes are associated with clinical outcomes.

PREDICTING THE DIFFICULT GALLBLADDER PREOPERATIVELY: NEUTROPHIL-TO-LYMPHOCYTE RATIO AS A PREDICTOR FOR DIFFICULT CHOLECYSTECTOMY

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Background The Tokyo guidelines recommend percutaneous cholecystostomy (PC) be considered for grade II acute cholecystitis (AC), but this group consists of both uncomplicated and difficult cholecystectomy (DC) patients. Since neutrophil-to-lymphocyte ratio (NLR) can differentiate those with acute versus complicated appendicitis, we hypothesized that it would identify DC patients who might be better served with PC.

Methods We performed a retrospective cohort study of adult emergency patients who underwent cholecystectomy at a single academic medical center from 2016 to 2021. DC was defined as those who had conversion to open, subtotal, or fenestrated cholecystectomy, a CPT 22 modifier, or drain placement. Wilcoxon Rank Sum and Kruskal-Wallis tests were performed for subgroup comparisons. ROC curve analyses were performed to evaluate NLR cutoffs for DC, AC, and gangrenous cholecystitis (GC).

Results 787 patients were included; 13.0% had DC, 51.7% had AC, and 5.0% had GC. NLR was higher in patients who had a DC compared with uncomplicated cholecystectomy and in patients with AC or GC ($p < 0.01$) (Table 1). NLR cutpoints for DC and GC are summarized in Table 2.

Conclusion Preoperative NLR has predictive value for AC, GC, and DC, but is most discriminative for GC. When used in conjunction with other diagnostic tools, it may help identify and appropriately classify patients with severe disease in whom PC may be more appropriate.

Table 1

	NLR median (IQR)	AUC (95% CI)
All patients (n=787)	4.8 (2.7-7.9)	---
Surgery Type		
Uncomplicated (n=685)	4.6 (2.5-7.6)	---
Difficult Cholecystectomy (n=102)	6.8 (4-10.7)	0.64 (0.58-0.69)
Pathology		
Neither AC or GC (n=341)	3.8 (2.2-6.5)	---
Acute Cholecystitis (n=407)	5.0 (3.2-8.2)	0.57 (0.53-0.61)
Gangrenous Cholecystitis (n=39)	12.1 (7.7-16.7)	0.83 (0.77-0.89)

Table 2

NLR Cutpoint	Sensitivity (%)	Specificity (%)	AUC	Youden's Index
Difficult Cholecystectomy				
≥4.0	75.5	43.1	0.59	18.6
≥5.0	66.7	54.2	0.61	20.9
≥6.0	56.9	63.5	0.60	20.4
≥7.0	46.1	71.5	0.59	17.6
≥8.0	37.3	77.4	0.57	14.7
Gangrenous Cholecystitis				
≥5.0	92.3	53.7	0.71	46.0
≥6.0	87.2	63.4	0.75	50.6
≥7.0	82.1	71.9	0.77	54.0
≥8.0	74.4	78.1	0.76	52.5
≥9.0	69.2	82.5	0.76	51.7
≥10.0	61.5	85.8	0.74	47.3

PREPERITONEAL PELVIC PACKING IS ASSOCIATED WITH INCREASED RISK OF SURGICAL INFECTIONS AFTER PELVIC FIXATION

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Background: Unstable pelvic fractures are frequently associated with hemorrhage and uniformly require operative fixation. Preperitoneal pelvic packing (PPP) may be used to control hemorrhage, but no large study has evaluated the relationship between PPP and surgical site infection (SSI) following pelvic fixation. We hypothesized that PPP is associated with higher rates of SSI.

Methods: From a 1-year (2019) retrospective review of the American College of Surgeons (ACS) Trauma Quality Improvement Program (TQIP) database, we identified all patients who underwent operative pelvic fixation based on ICD-10 procedure codes. Patients who were discharged to another hospital were excluded. Deep SSI, superficial incisional SSI, osteomyelitis, and organ/space SSI were included. Chi square analysis identified patient and hospital factors. Multivariable logistic regression determined odds ratios (OR) and 95% confidence intervals.

Results: The study population was comprised of 17,299 patients (67% male). In those that received PPP vs those who did not, SSI was more common (7% vs 1%), Injury Severity Score was higher (38 [27-45] vs 14 [8-12]) and median units of blood transfused was greater (7 [3-16] vs 0 [0-0]) (all $p < 0.001$). Multivariable logistic regression showed PPP carried an increased risk of developing SSI (OR = 2.31 [1.21-4.43]), as did having an injury severity score (ISS) over 14 (OR = 4.47 [2.78-7.18]) and undergoing pelvic bone fixation as opposed to acetabular or sacral fixation (OR = 2.06 [1.34-3.18]). Controlled risk factors included age, gender, transfusion volume, pelvic angioembolization, TBI, hypotension, ISS, PPP, and type of fixation.

Conclusions: PPP is an independent risk factor for SSI after pelvic fixation. Preventative protocols should be developed to mitigate infection risk in this patient population.

REDUCING OPIOID EXPOSURE AND PAIN IN TRAUMA PATIENTS AT HIGH RISK FOR OPIOID MISUSE

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Introduction: Acute pain strategies are needed that effectively minimize opioid exposure in patients who are at high risk for opioid misuse and opioid use disorder (OUD) after traumatic injury. A recently published trial found that an opioid-minimizing multimodal pain regimen (MMPR) consisting of generic medications (Multimodal Analgesic Strategies for Trauma, or MAST) was more effective for reducing opioid exposure and opioid prescribing at discharge during hospitalization compared to an original MMPR. Here we extend these findings by examining the effects of MAST as a function of opioid misuse risk level.

Methods: The current secondary data analysis included $N=631$ participants classified as low- or high-risk of opioid misuse via the Opioid Risk Tool (ORT). Analyses evaluated the moderating influence of ORT risk level (high/low) on the effect of MMPR (MAST vs. original) on three outcomes: opioid prescribing at discharge, numeric rating scale (NRS) pain scores, and opioid exposure (morphine milligram equivalents/day; MMEs/d). Bayesian inference characterized the effect of MMPR, including a point estimate (regression coefficient b or relative risk RR), 95% credible interval (CrI), and posterior probability (PP) that the effect exists.

Results: ORT risk moderated the effect of MMPR on opioids prescribed at discharge and pain scores such that the MAST MMPR was more effective than the original MMPR in the high-risk group (opioid prescribing at discharge: 63% vs. 77%, $RR=0.86$ [0.66, 1.08], $PP(RR<1)=90\%$; NRS: $b=3.8$ [3.2, 4.4] vs. $b=4.0$ [3.4, 4.6], $PP(b<0)=87\%$) but not in the low-risk group. There was no differential effect of MMPR by ORT risk on MMEs/d; for both low- and high-risk groups, the MAST MMPR was more effective than original MMPR for reducing MMEs/d (low-risk: 37 [32, 43] vs. 50 [43, 58], $PP(b>0) > 99\%$; high-risk (48 [37, 62] vs. 64 [49, 86], $PP(b>0)=98\%$).

Conclusion: These findings have implications for MMPR use in trauma patients based on opioid misuse risk. The beneficial effects of the opioid-minimizing MAST MMPR appear to be amplified for patients at higher misuse risk.

THE IMPACT OF BACTERIA RESISTANCE TO EMPIRIC ANTIBIOTICS ON MORTALITY AND HOSPITAL LENGTH OF STAY

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Introduction: Early administration of antibiotics (abx) is an essential therapy for presumed sepsis. Empiric, broad-spectrum abx are employed to treat typical organisms. However, clinicians usually do not have timely and easily-available information about bacteria-specific resistance patterns within their unit, and abx resistance causes poor outcomes. The association between empiric abx resistance and patients' outcomes was evaluated.

Methods: All positive blood, urine, and bronchial cultures and the resulting bacteria species and sensitivities at an academic medical center from 2019-2021 were reviewed. Only the first positive culture for any selected bacteria during a hospital stay was analyzed in patients with multiple positive cultures. The five most common gram-negative bacteria were then evaluated for resistance to commonly used empiric abx (piperacillin/ tazobactam, cefepime, and meropenem). Outcomes were death and length of stay. Wilcoxon and Fisher's exact tests were used to compare length of stay and mortality, between sensitive and resistant cultures. P-values <0.05 were considered statistically significant.

Results: During the 3-year period, 103,957 cultures were reported, of which 5,445 were positive for the most common gram-negative bacteria: Acinetobacter (n=117), Enterobacter (n=366), E. coli (n=3,004), Klebsiella (n=1,229), and Pseudomonas (n=729). Mortality in patients found to have any of the five gram-negative bacteria resistant to the empiric abx ranged from 7.8-11.5%. Conversely, when patients with these bacteria were treated with non-resistant empiric abx, the mortality was reduced to 4.3-4.6% (p <0.0001). Similarly, treating patients with bacteria-sensitive empiric abx was associated with a reduced hospital length of stay (p <0.001).

Antibiotic	<i>all p < 0.0001</i>		Mortality		HLOS (days)	
	SENS	RESIST	SENS	RESIST	SENS	RESIST
Pip-tazobactam	4.4%	9.2%	4.3	7.2	4.3	7.2
Cefepime	4.3%	7.8%	8.8	17.3	8.8	17.3
Meropenem	4.6%	11.5%	4.6	10.3	4.6	10.3

Conclusion: Appropriate antibiotic coverage for gram-negative infections was associated with improved mortality and decreased length of stay. Constantly updated, unit-specific sensitivities may improve outcomes by allowing tailored antibiotic therapy after the species is identified, but before culture-based sensitivities are available.

WEIGHT-BASED DOSING OF LMWH TO ACHIEVE VENOUS THROMBOEMBOLISM PROPHYLAXIS IN TRAUMA PATIENTS

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Introduction: Patients admitted after traumatic injuries are at high risk for developing venous thromboembolism (VTE). Low-molecular-weight-heparin (LMWH) is commonly used to prevent VTE in this patient population; however, the optimal dosing strategy has not been determined. To address this need, a fixed-dosing strategy of LMWH was compared to a weight-based dosing strategy of LMWH for VTE prophylaxis.

Methods: A retrospective, pre-post implementation cohort study was conducted comparing a fixed vs. weight-based dosing strategy of LMWH for VTE prophylaxis. Patients admitted to a Level 1 trauma center were included if they had an estimated glomerular filtration rate >30 mL/min/1.73m², received at least three doses of LMWH, and had an appropriately drawn anti-Xa level on their initial dosing regimen. Patients in the pre cohort received 30 mg LMWH twice daily as the initial dosing regimen. Patients in the post cohort received 0.5 mg/kg (max 60 mg) LMWH twice daily as the initial dosing regimen. A goal anti-Xa of 0.2-0.4 IU/mL was targeted for prophylaxis.

Results: There were 817 patients in the fixed-dosing group (FDG) and 874 patients in the weight-based dosing group (WBDG). In the FDG, 42.8% of the patients achieved goal initial anti-Xa levels, with 54.1% and 3.1% reaching sub- and suprathreshold doses, respectively. In the WBDG, 66.5% of patients reached goal initial anti-Xa levels, with 23.5% and 10.1% at sub- and suprathreshold levels. The distribution of dose ranges was significantly different between the dosing strategies (p-value < 0.001). There was no difference in the number of patients who received blood products (39.1% vs 41.7%. p-value = 0.299).

Anti-Xa levels	Dosing		p-Value
	Fixed	Weight-Based	
< 0.2 IU/mL	442 (54.1%)	205 (23.5%)	< 0.001
0.2-0.4 IU/mL	350 (42.8%)	581 (66.5%)	
> 0.4 IU/mL	25 (3.1%)	88 (10.1%)	
Patients Given Blood Products			
Transfused	320 (39.2%)	364 (41.7%)	0.299

Conclusions: In our study, weight-based dosing of LMWH yielded a significantly higher proportion of patients who achieved goal prophylactic anti-Xa levels when compared to fixed-dosing of LMWH. Larger-scale studies are needed to assess the risk of VTE events and bleeding with these dosing strategies.

PREDICTIVE VALUE OF A PREHOSPITAL TRANEXAMIC ACID PROTOCOL FOR TRAUMA PATIENT HEMORRHAGE

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Introduction: The use of tranexamic acid (TXA) in the civilian trauma setting has dramatically increased following the publication of the CRASH and MATTERs trials. The protocol for prehospital administration of TXA in the pre-hospital setting varies widely, both nationally and among individual EMS agencies within a single trauma system. Accordingly, given growing literature that a minority of the highest level activations arriving at a trauma center are actually hyperfibrinolytic, TXA is likely being significantly over-utilized. The purpose of this study was to evaluate the accuracy of a single, system-wide prehospital TXA protocol for the identification of hemorrhage.

Methods: A prehospital TXA protocol was developed and implemented by our level I trauma center. For individual EMS agencies to utilize TXA, a written letter of authorization from the trauma medical director with oversight of the trauma system must be submitted to the central office of Emergency Medical Services. We authorized county-based EMS agencies to utilize TXA predicated upon use of our protocol, thus standardizing administration criteria within the trauma system.

Our system-wide criteria for prehospital administration of TXA includes heart rate greater than 120 or systolic blood pressure less than 90 mmHg and obvious clinical evidence of hemorrhage. To ensure assessment of our standardized protocol, scene transfers only by our trauma center based prehospital division were studied. This prehospital database, as well as the National Trauma Registry of the American College of Surgeons (NTRACS) databases were queried to identify adult trauma patients transferred from the scene to our level one trauma center (2016-2019). We analyzed prehospital administration of TXA and red blood cell transfusion in the initial 4 hours of hospitalization as a marker for hemorrhage.

Patients were divided into four cohorts based on the collected data: true positive (TP) (TXA given and hemorrhage present), false positive (FP) (TXA given and no hemorrhage present), true negative (TN) (TXA not given and no hemorrhage present), false negative (FN) (TXA not given and hemorrhage present). We evaluated the sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and overall accuracy of the protocol.

Results: 980 patients met inclusion criteria for this study. 138 (14.1%) patients had signs of hemorrhage, while 94 (9.6%) received TXA. The true positives, as defined by administration of TXA at the scene followed by transfusion of blood in the hospital, was 67 (6.8%). The other indices include: FP 27 (2.8%), TN 815 (83.2%), FN 71 (7.2%). The sensitivity of the protocol, which we interpreted as patient who is bleeding and receives TXA, is 48.6%. The specificity is 96.8%, NPV 92%, and PPV 71.3%. Diagnostic accuracy for the protocol is 90%

Conclusions: Standardization of prehospital TXA administration across a trauma system is an achievable goal. The system wide protocol proved to be 90% accurate. The strong negative predictive value of the protocol allows prehospital providers to exclude patients who would not benefit from TXA, potentially reducing overutilization based upon mechanistic criteria or level of activation alone. We theorize that refinement of the protocol to include both tachycardia and hypotension as triggers will improve sensitivity.

A LOCAL AFFAIR: GEOSPATIAL ANALYSIS OF SOCIOECONOMIC STATUS IN EMERGENCY GENERAL SURGERY OUTCOMES

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Introduction: Patient socioeconomic status (SES) has been linked to disparities in postoperative outcomes for Emergency General Surgery (EGS) patients. Past studies using national databases consist only of patients undergoing surgery. This excludes patients managed nonoperatively, which represents a significant proportion of EGS clinical work, and may not capture important nuances and heterogeneity in local patient populations. We hypothesize that due to the emergent nature of the patients served by a comprehensive EGS service, negative outcomes will cross SES boundaries and not be clustered only in underserved areas.

Methods: This was a retrospective cohort analysis of all patients managed, both operatively and nonoperatively, by the EGS service at an urban academic hospital from 2018 to 2020. Patients with a hospital length of stay (LOS) > 24 hours and not experiencing homelessness were identified in our previously published local EGS registry. Neighborhood Socioeconomic Status (NSES) was calculated using 2015 American Community Survey, with median NSES set to 50 on a scale of 1 to 100. Outcomes were in-hospital mortality adjusted for total cases per census tract, discharged to rehabilitation facility (Rehab), and LOS. Getis-Ord G_i^* statistic was used to evaluate geospatial outcomes by hot/cold spot analysis.

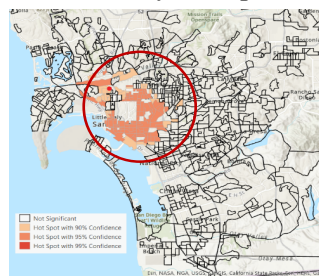
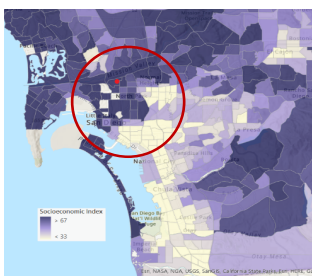
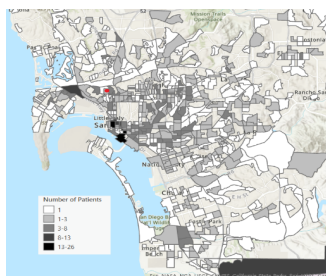
Results: We identified 1589 patients in our cohort (mean age 53.7 years, 57.6% male) with median LOS of 4 days, and median NSES of 46.1. Mortality was 4.9% and Rehab rate was 14%. Geospatial analysis showed that patients come from all NSES areas (Fig. 1A and 1B) and that there was a significant hot spot of mortality in the city center, accounting for 36% of all mortalities ($p < 0.05$, Fig. 1C). However, this hot spot spanned both high and low NSES areas as noted by corresponding red circles in Fig. 1B and 1C. This also held true for Rehab and LOS.

Conclusion: Hot spots of negative EGS outcomes extend beyond low SES areas. This heterogeneity will need to be accounted for in future studies on socioeconomic determinants of EGS outcome and quality improvement initiatives.

1A- All EGS Patients

1B- NSES By Census Tract

1C- Mortality Hot Spot



A TALE OF TWO CENTERS: ACS MODEL IS ASSOCIATED WITH DECREASED EGS MORTALITY AT A LEVEL III CENTER

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Introduction: The Acute Care Surgery (ACS) model has had great success; however, little is known regarding its impact on EGS outcomes outside of tertiary centers. The aim of this study was to evaluate the effect of the ACS model on EGS operative mortality between two Level III Trauma Centers (L3TC).

Methods: EGS operative patients were queried from our EGS Registry (based on AAST EGS diagnosis codes) from two ACS-verified L3TC (2013-2020). In April 2016 one center (ACSc) created an in-house ACS service while the other continued a traditional home call model (TRADc). Inpatient mortality was compared before and after implementation and between centers. Multivariate regression (MVR) was performed controlling for age, gender, BMI, race, insurance, high risk cases (HRC) (exploratory laparotomy, colectomy, bowel resection, perforated peptic ulcer repair), and sepsis.

Results: There were 7,833 patients: 5409 (69.0%) at the ACSc, 2,424 (31.0%) TRADc. There were 2068 (38.2%) Before and 3341 (61.8%) After patients at the ACSc. Before ACS implementation the centers had similar rates of HRC (19.8 vs 20.2%), mortality (2.5 vs 2.1%), and HRC mortality (10.5 vs 9.0%; $p>0.05$ for all). Afterwards, the ACSc had higher rates of HRC (24.1 vs 19.0; $p<0.001$), but similar mortality (2.5 vs 2.4, $p=0.875$), and HRC mortality (8.6 vs 10.3%, $p=0.39$). On MVR, after controlling for severity and confounders, ACS model implementation was associated with decreased inpatient mortality (OR 95% CI: 0.49, 0.29-0.84).

Conclusion: Implementation of an ACS model at a L3TC was associated with 50% lower odds of inpatient EGS mortality compared to a contemporaneous control, despite performing more HRCs. Adoption of an ACS model could have significant benefits to EGS patients at community-based trauma centers.

APPENDICITIS ON LOCKDOWN? DECREASED PRESENTATION OF APPENDICITIS IN NEW YORK CITY'S PUBLIC HOSPITALS DURING THE COVID19 PANDEMIC

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Objectives: New York City was the first COVID-19 epicenter in the United States, and city and state response included a shelter-in-place mandate. During this time, a decreased presentation of patients with acute appendicitis was observed. This study aims to establish whether the decrease was a true phenomenon, and to characterize the management of these cases.

Methods: Billing records from New York City Health and Hospitals were utilized to identify admissions for acute appendicitis. Data acquired included demographic, diagnostic, operative and outcome data. Data was compared from January to May for 2019 and 2020.

Results: Twenty-one day moving averages of admissions for acute appendicitis within the system were similar until the third week of February, after which admissions in 2020 diverged to be less than 2019 for the remainder of examined months. On March 22nd, there were 3.43 admissions for acute appendicitis in 2019, compared to 2.29 in 2020. After March 29th, there were consistently 2 or fewer admissions for acute appendicitis per day in 2020, compared to 2.43-3.19 in 2019. While there was a significant decrease in the total number of appendectomies performed in April and May of 2020 compared to 2019, the proportion of overall appendicitis cases managed operatively only trended toward decline, and there was no difference in the frequency of non-operative management of appendicitis. There was no increase in presentation of complicated appendicitis.

Conclusion: Overall, these results demonstrate decreased presentation of appendicitis and to New York's Public Hospitals with fewer appendectomies performed during the height of the COVID-19 pandemic without a concurrent increase in non-operative management or complicated cases. These data raise questions regarding the role of nonsurgical management for acute appendicitis

APPYS AND BEYOND: SAFETY IN ALLOWING RESIDENTS TO INDEPENDENTLY PERFORM CHOLECYSTECTOMY, A RETROSPECTIVE REVIEW

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Introduction: In an era of competency-based education and concern about graduating resident readiness for practice, early resident autonomy in teaching is increasingly important. In this study, we expanded on previous research that demonstrated equivalent patient outcomes in “teaching resident” appendectomies to the more complex cholecystectomy case including both patient and financial outcomes.

Methods: A single-center retrospective review of 781 patients from April 2017 to January 2019 who underwent cholecystectomy at an academic medical center. We examined how two residents (compared to one resident with an attending) attempting a case affect outcomes while controlling for sex, age, ASA class, BMI, prior abdominal surgery, acuity, and attending surgeon seniority.

Results: We identified 622 one-resident cases and 159 teaching resident cases. We performed multiple logistic regression to assess teaching resident cases as a predictor of post-operative outcomes. There were no significant differences in surgical site infection (superficial or organ space) 1.46 (0.45, 4.7); $p = 0.53$, conversion to open 0.55 (0.20, 1.56); $p = 0.26$, whether a drain was left 1.21 (0.61, 2.34); $p = 0.59$, intraoperative perforation 1.51 (0.95, 2.41); $p = 0.08$, prolonged operation 1.67 (0.86, 3.22); $p = 0.13$, post-operative CT 1.06 (0.48, 2.34); $p = 0.88$, or readmission within 30 days 0.93 (0.39, 2.21); $p = 0.86$. Additionally, multiple linear regression did not reveal a difference in cost \$172 (-248, 591); $p = 0.42$.

Conclusions: Senior surgical trainees can safely and cost-effectively supervise more junior trainees in performing cholecystectomy procedures. Training programs should encourage such models in order to maximize the educational reach of each case.

COMPARISON OF OUTCOMES AMONGST PATIENTS WITH HIGH SEVERITY AAST SCORES FOR COMMON EGS DISEASES

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Introduction: The AAST Emergency General Surgery (EGS) grading system for anatomic severity has been validated within specific disease processes. Across the spectrum of diseases, however, it is unclear whether equivalent severity grades correlate with comparable patient outcomes. We hypothesize that AAST severity grade is not generalizable across common EGS diseases; similar grades will be associated with different morbidity and mortality between diseases.

Methods: We performed a secondary analysis of patients selected from the AAST-sponsored MERIDIAN database, comprised of 766 patients compiled from 21 sites admitted to the ICU with an open abdomen. Patients with high severity (AAST 3-5) scores for the four most common EGS diagnoses (appendicitis, diverticulitis, small bowel obstruction, mesenteric ischemia) were compared between disease processes for mortality and other complications. Results: There were 596 patients identified with a mean age of 60 ± 16.7 years; 44.1% women. Overall mortality was 18.8%. There was a wide range of complication rates between disease processes (Table 1A).

Table 1A. Diagnoses and Complications for AAST score 3-5

Complications	Appendicitis (%)	Diverticulitis (%)	SBO (%)	Mesenteric Ischemia (%)	p-value
Mortality	3.7	10.4	10.6	39.0	<0.001
AKI	20.0	36.8	47.1	62.5	<0.001
Dehiscence	3.7	8.8	9.4	11.5	0.097
Evisceration	0.7	3.2	1.2	2.0	0.5
Anastomotic Leak	1.5	2.4	5.9	9.5	0.005
Intestinal Fistula	1.5	1.6	5.9	5.0	0.13
C. difficile	0	0.8	5.9	4.0	0.015
Pneumonia	3.0	15.2	18.8	12.0	0.001
UTI	1.5	7.2	14.1	8.0	0.005
Tracheostomy	0.7	4.0	12.9	10.5	<0.001

Conclusion: While the AAST system may have utility in allowing discrete categorization of disease severity within a given disease, morbidity and mortality varies widely between disease presentations despite similar severity ranges. Quality metrics cannot rely on the AAST EGS grading system when comparing amongst diseases.

DEFINING THE EMERGENCY GENERAL SURGERY PATIENT POPULATION IN THE ERA OF ICD10

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Objectives: In 2011, the AAST created a broad list of ICD9 coded conditions that has defined the field of emergency general surgery (EGS). A recent AAST Committee on Patient Assessment effort to translate the ICD9 list to ICD10 faced several limitations. We sought to evaluate the General Equivalence Mapping (GEM) crosswalk from ICD9 to ICD10.

Methods: We used the GEM to generate a list of ICD10 codes equivalent to the ICD9 AAST EGS diagnosis codes. A manual review performed independently by 2 authors identified diagnosis categories and codes that were incompletely or improperly matched. We then used the 2013-2014 (ICD9) and 2016-2017 (ICD10) National Inpatient Sample to evaluate patient volumes across diagnosis categories in each coding era using an observed to expected (O:E) ratio. Diagnosis categories with an O:E ratio of >1.20 or <0.80 (set a priori), underwent further review to identify if specific matched codes were the source of differences in patient volume.

Results: There were 89 clinical diagnosis categories with 485 individual ICD9 diagnosis codes which mapped to 1206 unique ICD10 diagnosis codes, with 192 (39%) of the ICD9 diagnoses having an exact 1-to-1 ICD10 match. There were 13 diagnosis categories considered to be incompletely matched on manual review. There were 16 diagnosis categories over-represented and 18 under-represented in ICD10 patient volumes. We identified 5 key sources of significant discrepancy between the established ICD9 diagnosis code set and the GEM generated set of ICD10 codes.

Issue/Deficiency Identified	Example (ICD9→ICD10)
Change in admission volume despite 1:1 match	"Cardiac tamponade" (423.3) → "Cardiac tamponade" (I31.4); O:E 1.77
Mapping with loss of necessary modifier	"Acute and chronic respiratory failure following trauma and surgery" (518.53) → "Acute and chronic respiratory failure, unspecified whether with hypoxia or hypercapnia" (J96.20)
Lack of specific crosswalk code in ICD10	"Rupture of bladder, nontraumatic" (596.6) → "Other specified disorders of bladder" (N32.89)
Mapping to an ICD10 code for a different condition	"Acute and subacute necrosis of liver" (570) → "Acute and subacute hepatic failure without coma" (K72.00)
Change in coding nomenclature from ICD9 to ICD10	"Regional enteritis of large intestine" (555.1) → "Crohn's disease of large intestine without complications" (K50.10)

Conclusions: We identify several important technical considerations for using the GEM in EGS

research, which if not properly accounted for, could result in the unintended inclusion of large numbers of non-EGS patients and/or the exclusion of EGS patients of interest.

LACK OF HEALTH CARE COVERAGE WIDENS THE SURVIVAL GENDER GAP IN EGS: AN ANALYSIS OF 30,000 CASES FROM THE DEVELOPING WORLD

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Introduction: Factors associated with in-hospital mortality in emergency general surgery (EGS) are underexplored in the developing world. Given the very different health care structures, it is important to uncover modifiable risk factors associated with worse outcomes as these may be very different in areas with disparate resources. This study aims to identify the factors associated with in-hospital mortality for EGS patients using a large patient sample from South Asia.

Methods: Patients aged ≥ 18 with AAST defined EGS diagnoses admitted to a large tertiary hospital from 2010-2019 were identified. Primary outcome was 30-day in-hospital mortality. Parametric survival regression with Weibull distribution was performed and adjusted hazard ratios were reported for significant factors associated with in-hospital mortality.

Results: We analyzed 31,297 index admissions with a primary EGS diagnosis. Mean age was 49 years (SD \pm 0.10) and 46 % were female. Mortality was 2.14% and 11% had at least 1 complication. Table 1 shows patient factors associated with in-hospital mortality. For both genders, lack of financial health coverage increased the mortality risk. However, there was a substantial increase in mortality risk for women (HR:2.55 95CI:1.54-4.22) compared to men (HR:1.46 95CI:1.01-2.11).

Patient Characteristics	HR(95 CI)
Charlson Comorbidity Index(CCI) (Referent: CCI 0)	
CCI 1	1.61(1.16-2.22)
CCI 2	2.48(1.77-6.46)
CCI ≥ 3	3.00(2.31-3.91)
Number of complications	1.27(1.18-1.37)
Sepsis (Referent: Without sepsis)	2.27(1.73-2.99)
Emergency Admission (Referent: Elective Admissions)	2.10(1.64-2.69)
Age Category (Referent: ≤ 40)	
41-60	0.86(0.69-1.07)
61-80	1.32(1.07-1.63)
>80	1.61(1.13-2.29)
Males	
With financial health coverage (referent)	
Without financial health coverage	1.46(1.01-2.11)
Females	
With financial health coverage (referent)	
Without financial health coverage	2.55(1.54-4.22)

Table 1 Adjusted risk of mortality in all EGS diagnoses

Conclusion: EGS patients in the developing world have the same clinical risk factors; age, co-morbidities and presence of complications independently worsen survival. Additionally, gender disparities in the setting of reduced health coverage widen differences in survival, which may be explained by a lower priority on health care access and delayed care for women. This important finding will help develop policy towards improving emergency surgery access for women.

PATIENT REPORTED OUTCOMES AND PTSD SYMPTOMS IN EMERGENCY GENERAL SURGERY

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Background: Patient reported outcomes (PRO) are increasingly recognized as an important measure of surgical quality and long-term outcomes. While there are good data available regarding morbidity and mortality for patients undergoing emergency general surgery (EGS) procedures, there are few long-term PRO data. Sudden critical illness and injury are associated with worse health-related quality of life, and symptoms of depression and post-traumatic stress. There has been no evaluation of the incidence of these symptoms in EGS patients, and this study aimed to evaluate PRO and PTSD symptoms in an EGS population.

Methods: Patients who underwent an operation from a predetermined list based on national definitions and were included in quality improvement data from Jan 2020-Jan 2021 were eligible for inclusion. Patients were contacted via phone and asked to participate in an online survey of demographics, socio-economic status, PROMIS® PRO measures for general life satisfaction (GLS), general self-efficacy (GSE), and physical function (PF), and the PCL-5 PTSD symptom screening tool. Descriptive statistics and multiple regression were performed.

Results: 128 patients were eligible for inclusion, 72 (56%) were reached via phone. Of those, 40 (56%) completed the study. Median time between operation and response was 308 (IQR 243-337) days. 48% underwent appendectomy, 25% cholecystectomy, 28% small bowel or colon resection. 13% had a pre-existing stress disorder, none PTSD. Mean PRO scores were 52.5 ± 9.3 for GLS, 48.6 ± 8.0 for GSE and 48.7 ± 9.6 for PF. 12.5% had a low or very low GLS and GSE score, while 32.5% had mild, moderate, or severe PF scores. 7 (17.5%) scored >31 on PCL-5, 3 had a pre-existing stress disorder. Regression analysis found ASA score, emergency case, and lower income were associated with lower GLS scores. Age, BMI, and lower income were associated with lower PF scores.

Conclusions: Following EGS most patients have average PRO, but there are a concerning number with lower scores, and some patients may benefit from mental health services based on PTSD symptoms. There may be groups of patients more at risk for adverse outcomes. We plan to use this data to design prospective studies to evaluate the role that EGS plays in these outcomes, and how they can be improved on.

**PERIOPERATIVE MANAGEMENT OF PATIENTS UNDERGOING
PARTIAL CHOLECYSTECTOMY: DEFINING ADJUNCTIVE
CARE REQUIREMENTS AND A PROPOSED CLINICAL
PATHWAY**

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Introduction: Laparoscopic subtotal cholecystectomy (SC) is a commonly used technique when faced with severe inflammation, especially when the critical view of safety cannot be reliably obtained. Published experience with SC is limited. We hypothesized that increased multidisciplinary resources are required after SC.

Methods: We conducted a retrospective review of all laparoscopic cholecystectomies between 2017 and 2021 at a large regional referral center. SC cases were identified using a centralized medical record-based tool. Primary outcome was endoscopic retrograde cholangiography (ERC) within 60-days post-operatively. Univariate analysis was performed with student's t-test for continuous variables and chi-square for categorical. Logistic regression was performed to assess odds of reconstituting SC on post-op ERC.

Results: A total of 1325 laparoscopic cholecystectomies were performed by our Emergency General Surgery service between 11/2017 and 11/2021. Of these, 89 (7%) were SC with 2 open conversions. Male ($p<0.001$) and older ($p<0.001$) patients were more likely to undergo SC. There were a significantly higher proportion of ERC required post-operatively in the SC group (42% vs. 7%, $p<0.001$). There was no significant difference in pre-op ERC across groups (16% vs 21% $p=0.19$). A majority (97%) of SCs had a surgical drain left at time of operation. Reconstituting SC had significantly lower odds of post-op ERC (OR 0.19, 95% CI 0.02-0.72 $p=0.015$).

Discussion: We present one of the largest case series published to-date. SC is an accepted surgical technique in difficult cholecystectomy operations with low rates of conversion to open surgery. SC should be performed at institutions with access to advanced procedural adjuncts such as interventional gastroenterology/ERC and interventional radiology, as many cases require perioperative intervention for control of biliary fistula. Absent these adjuncts, reconstituting SC decreases the need for early ERC, but long-term outcomes are unknown.

A NATIONAL EVALUATION OF DYSPHAGIA IN THE GERIATRIC TRAUMA POPULATION

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Introduction: Dysphagia is associated with increased morbidity, mortality, and resource utilization in hospitalized patients. The rate of dysphagia increases with age and may be increased by injuries such as cervical spine fractures and traumatic brain injury. Nationwide, the number of injured geriatric patients is increasing, but studies regarding prevalence and impact of dysphagia in this highly vulnerable population are lacking.

Methods: A retrospective study of patients 65 years and older using National Inpatient Sample (NIS) data from 2016 to 2018 was performed to evaluate the association of dysphagia with in-hospital mortality in trauma patients. Trauma patients were identified based on trauma related diagnosis codes (S or T code). Dysphagia was identified with diagnosis of International Classification Code-10 "R131.x". Survey weighted logistic regression analysis with interaction terms (dysphagia x trauma) was used to obtain the odds ratio for in-hospital mortality adjusting covariates age, sex, race, insurance, hospital size, Charlson Comorbidity Index, and frailty.

Results: A total of 7,814,998 patients age 65 and older were identified including 1,749,814 geriatric trauma patients. Dysphagia was identified in 289,486 (4.77%) non-trauma patients and 93,159 (5.32%) trauma patients. In trauma patients, the prevalence of dysphagia increased with age: 5.32% in those 65-79 years, 6.13% in those 80-90 years, and 7.40% in those over 90 years old. The incidence of dysphagia increased with increasing degree of frailty including: 4.84% with moderate frailty and 13.81% with severe frailty. The adjusted odds ratio of inpatient mortality in non-trauma patients with dysphagia was 1.06 (CI:1.05 – 1.06) and increased to 1.14 (CI:1.12 – 1.15) in trauma patients.

Conclusions: Dysphagia was more commonly seen with increasing age and worsening frailty. Additionally, dysphagia was more common in geriatric trauma patients overall and was associated with higher odds of death in both groups. Further studies are necessary to investigate if dysphagia represents a modifiable risk factor or a direct indicator of worsened outcomes in this population.

	Trauma w/ Dysphagia	Trauma w/o Dysphagia	Total Trauma
N	93,159 (5.32%)	1,656,655 (94.68%)	1,749,814
AGE			
65-79yo	46,386 (4.52%)	979,747 (95.48%)	1,026,113
80-89yo	32,544 (6.13%)	498,742 (93.87%)	531,286
90+yo	14,229 (7.40%)	178,166 (92.60%)	192,395
Frailty			
Mild	7,549 (1.56%)	477,628 (98.46%)	485,117
Moderate	47,977 (4.84%)	944,089 (95.16%)	992,066
High	37,633 (13.81%)	234,938 (86.19%)	272,571

ASSOCIATION OF FRAILTY WITH OUTCOMES OF RESECTION FOR COLONIC VOLVULUS: A NATIONAL ANALYSIS

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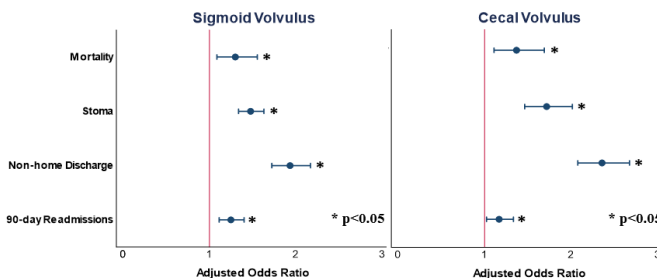
Introduction: With limited national studies available, we characterized the association of frailty with outcomes of surgical resection for colonic volvulus.

Methods: Adults with sigmoid or cecal volvulus undergoing non-elective colectomy were identified in the 2010-‘19 Nationwide Readmissions Database. Frailty was identified using the Johns Hopkins indicator which utilizes administrative codes. Multivariable models were developed to examine the association of frailty with in-hospital mortality, stoma use, length of stay (LOS), costs, non-home discharge, and 90-day non-elective readmissions.

Results: Among an estimated 66,766 patients with volvulus (Sigmoid: 30.6%, Cecal: 60.4%) 21.6% were considered frail. Compared to the rest of the group, frail patients were older (76 vs 66 years, $p < 0.001$), less commonly female (46.9% vs 61.5%, $p < 0.001$), and had a greater burden of comorbidities as estimated by the Elixhauser Comorbidity Index (4 vs 2, $p < 0.001$). After adjustment, frailty was independently associated with greater odds of index mortality, stoma use, non-home discharge, and 90-day, non-elective readmissions (Figure). Frailty was also associated with incremental increases in LOS (Sigmoid: +3.0 days, 95% CI 2.5-3.6; Cecal: +3.4 days, 95% CI 2.8-3.9) and hospitalization costs (Sigmoid: +\$6.6k, 95% CI 5.0k-8.2k; Cecal: +\$10.5k, 95% CI 8.5k-12.5k).

Conclusion: Frailty, measured by using a simplified administrative tool, is associated with significantly worse clinical and financial outcomes following non-elective resections for colonic volvulus. Standard assessment of frailty may aid risk-stratification and better inform shared-decision making.

Figure: Associations of Frailty with Outcomes (ref: non-frail)



DEVELOPING AND VALIDATING AN INDEX FOR MEASURING FRAILITY IN HIP FRACTURE PATIENTS: A NOVEL MODEL FOR PREDICTING SHORT-TERM POSTOPERATIVE MORTALITY

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Introduction: Frailty is common among hip fracture patients and may, in part, contribute to the increased risk of mortality and morbidity following hip fracture surgery. This study aimed to develop a novel frailty index for traumatic hip fracture patients that could be used to predict postoperative mortality as well as facilitate further research into the role of frailty in hip fracture patients.

Methods: The Orthopedic Hip Frailty Index (OFI) was developed using a national dataset, retrieved from the Swedish National Quality Registry for Hip Fractures, that contained all adult patients who underwent surgery for a traumatic hip fracture in Sweden between January 1, 2008, and December 31, 2017. Candidate variables were selected from the Nottingham Hip Fracture Score, Sernbo Score, Charlson Comorbidity Index, 5-factor modified Frailty Index, as well as the Revised Cardiac Risk Index and ranked based on their permutation importance, with the top 5 variables being selected for the index. The OFI was then validated on a local dataset that only included patients from Orebro County, Sweden.

Results: The national dataset consisted of 126,065 patients. 2,365 patients were present in the local dataset. The most important variables for predicting 30-day mortality were congestive heart failure, institutionalization, non-independent functional status, an age ≥ 85 , and a history of malignancy. In the local dataset, the OFI achieved an AUC (95% CI) of 0.77 (0.74-0.80) and 0.76 (0.74-0.78) when predicting 30-day and 90-day postoperative mortality, respectively.

Conclusion: The Orthopedic Hip Frailty Index is a significant predictor of short-term postoperative mortality in hip fracture patients that outperforms, or performs on par with, all other investigated indices.

IDENTIFYING FACTORS AFFECTING CHANGES IN GOALS OF CARE FOLLOWING EMERGENT LAPAROTOMY: A RETROSPECTIVE ANALYSIS

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For patients with surgical emergencies, balancing timely goals of care conversations with acuity of presentation and operative urgency can be challenging. Identifying patients who may benefit from more in-depth pre-operative discussions is critical to providing goal-concordant care and may help some patients avoid surgery at the end-of-life. Failure to do so may lead to changes in goals of care post-operatively. We sought to understand which patient factors are associated with post-operative changes in goals of treatment, including code status. A retrospective analysis was conducted using an institutional database of 484 patients over four years who underwent an exploratory laparotomy within 6 hours of surgical consultation. Demographic and clinical factors were compared between patients who did and did not have a change in treatment goals. Descriptive statistics were computed, and chi square p -values were obtained. A total of 66 patients had a post-operative change in goals, either implementing a DNR or transitioning to comfort measures only. Patients who changed code status were more likely to lack pre-operative localization of their abdominal pathology (46.3% vs 28.6%, $p=0.049$), and more likely to have three or more comorbidities (34.3% vs 9.4%, $p<0.001$), including active cancer (36.9% vs 16.8%, $p=0.0002$), neurodegenerative disorder (10.8% vs 4.1%, $p=0.024$), bleeding disorder (6.15% vs 1.29%, $p=0.009$), weight loss > 10% in the past 6 months (7.7% vs 2.3%, $p=0.021$), and malnutrition (15.4% vs 5.7%, $p=0.005$). Finally, patients who were subjectively described as having a “very supportive” social network were more likely to have a change in treatment goals (23.9% vs 13%, $p=0.005$). This analysis demonstrates that individuals with these pre-operative factors could benefit from more in-depth pre-operative discussions to establish values, facilitate limits to post-operative treatment, and potentially avoid surgery altogether. Care should be taken with these patients to ensure operative intervention remains within their goals.

IMPACT OF THE COVID-19 PANDEMIC ON FATAL FALLS IN OLDER ADULTS

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Introduction: Falls are a leading cause of injury and death in older adults (age ≥ 65). Formal and informal efforts to slow the spread of COVID-19 in the United States (US) led to increased social isolation, decreased physical activity, and hesitancy to seek medical care among many older adults, potentially worsening frailty, leaving elderly individuals particularly vulnerable to falls and fall-related sequelae. We hypothesized that the COVID-19 pandemic led to an increase in fall-related fatalities and that fatalities occurring at medical facilities decreased while fatalities occurring at decedents' homes increased.

Methods: We conducted an interrupted time series analysis using a Poisson regression model on monthly fall fatalities amongst older adults from January 2015 through December 2020. Fall fatality data were extracted from the Centers for Disease Control and Prevention Wide-ranging OnLine Data for Epidemiologic Research (CDC WONDER), along with the estimated annual population of US residents age ≥ 65 . The COVID-19 pandemic, defined as starting in the US in March 2020, was our interruption variable.

Results: There were 192,586 fall fatalities among older adults in the study period, with a mean of 2,614 deaths per month (SD 228.4) pre-pandemic, and 3,051 deaths per month (SD 215.1) post-pandemic onset. Monthly incidence rate of fall fatalities for any place of death increased 4.0% post-pandemic onset (IRR=1.04, 95% CI 1.01, 1.07). Fall fatality incidence rate within a medical facility as place of death did not change (IRR=1.00, 95% CI 0.96, 1.03), while the incidence rate in which death occurred in decedents' homes increased 37% (IRR=1.37, 95% CI 1.30, 1.44).

Conclusion: There was a significant increase in fall-related fatalities among older adults in the United States after onset of the COVID-19 pandemic. Fall-related deaths in the home primarily contributed to this overall increase. The rate of fall fatalities in which death occurred at a medical facility did not change. During times of social distancing increased social supports are needed to prevent and quickly respond to falls among older adults.

PREDICTION MODEL FOR POSTOPERATIVE FUNCTIONAL DECLINE IN THE ELDERLY USING PSOAS MUSCLE AREA

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Introduction: Emergency abdominal surgeries have increasingly been performed in elderly patients worldwide. Accordingly, postoperative functional decline (PFD) has become a public health concern. However, predicting PFD before surgery remains challenging. This study aimed to develop a predictive model for PFD in elderly individuals using the preoperative total psoas muscle area (TPA).

Methods: This retrospective, single-center study included patients aged ≥ 65 years who underwent emergency abdominal surgery during 2019-2021. TPA was measured using computed tomography (Fig). The TPA (cm^2) was normalized by height to calculate the total psoas index ($\text{TPI} = \text{TPA}/\text{height [m]}^2$). The Barthel index (BI) was used to determine functional evaluation scores. PFD was defined as a ≥ 5 -point decrease in the BI 28 days postoperatively. A simple scoring system was developed to predict PFD using a multivariable logistic regression model.

Results: The data of 270 patients were analyzed. PFD occurred in 78 patients (28.9%). The regression model identified TPI (AOR 7.1; 95% CI 3.5-14.8) as the most significant independent predictor for PFD (age: AOR 5.5, 95% CI 2.6-11.6; albumin: AOR 2.6, 95% CI 1.3-5.1; American Society of Anesthesiologists physical status; AOR 3.8, 95% CI 1.9-7.5). Using these predictors with the cutoff points (table), the area under the curve of the score was 0.856 (the optimal cutoff point was 2.5 [Youden index]). The bootstrap optimism estimate showed a low discrimination (0.001).

Conclusion: This score may be potentially useful to predict PFD in elderly patients who undergo emergency abdominal surgery. Early detection of the condition using this score enables prompt initiation of preventive measures against PFD.



Table. Diagnostic ability of the scoring system

Cut-off	Specificity	Sensitivity	LR +	LR -	True Positive	True Negative
≥ 4	0.97	0.27	10.4	0.75	0.81	0.77
≥ 3	0.83	0.72	4.2	0.34	0.63	0.88
≥ 2	0.59	0.95	2.3	0.09	0.49	0.97
≥ 1	0.25	1.00	1.3	0.00	0.35	1.00
0	0.00	1.00	1.0	-	0.29	-

RESTRICTIVE FLUID MANAGEMENT IMPROVES TIME TO AMBULATION FOR GERIATRIC HIP FRACTURES

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Background: Recent studies found restrictive fluid management (RFM) for hemodynamically unstable trauma patients improves outcomes. As geriatric hip fracture patients are not typically hemodynamically unstable, the study objective was to compare outcomes among geriatric hip fracture patients who received RFM to those with standard fluid management (SFM).

Methods: This retrospective propensity matched study at five Level I trauma centers from 1/1/2018-12/21/2018 included geriatric (≥ 65 y/o) hip fractures. Excluded patients had multiple injuries, were managed non-operatively, or received preoperative blood products. Patients were grouped by the fluid volume received preoperatively, or within 24 hours of arrival, whichever came first: 1) SFM was ≥ 150 mL, 2) RFM was < 150 mL. Fluids included normal saline (NS), lactated ringers (LR), dextrose 5% in water (D5W), electrolytes, LR in D5W, potassium chloride (KCl) in NS, KCl in NS and D5W, and medications given in fluid. Outcomes included: postoperative fluid volume, hospital length of stay (LOS), late ambulation (> 1 day), and mortality. Paired Student's t-tests, Wilcoxon paired rank sum test and McNemar's tests were used, $p < 0.05$.

Results: There were 523 patients: 209 received RFM, 314 received SFM. After propensity matching on baseline characteristics, there were 266 patients (133/group). The matched patients' characteristics were well balanced, including no difference in time to surgery. They were 67% female, 45% ≥ 85 y/o, and 94% had a ground level fall. The RFM group received a median of 80 mL preoperative fluids and the SFM received 1000 mL, $p < 0.001$. The total fluid volume admission to discharge was significantly lower for the RFM group, 3490 vs. 4530 mL, $p < 0.001$. The median intraoperative fluid volume was 1000 mL for both groups, $p = 0.26$. There was no difference in the median total postoperative fluid volume, 2100 vs 1850 mL, $p = 0.13$. LOS was similar for RFM and SFM, 4 days vs 5, $p = 0.83$. There was a significantly lower proportion of RFM patients with late ambulation than SFM, 8.3% vs 17.3%, $p = 0.04$, mean (SD) time 34.3h (16.7) vs 41.7 (23.8), respectively, $p = 0.01$. Mortality and complications, including acute kidney injuries, were similar between groups.

Conclusions: Nil per os orders may impact the results, but RFM led to early ambulation for geriatric hip fractures when compared to SFM.

SECONDARY TRAUMA: A LONGITUDINAL STUDY OF POST-DISCHARGE CAREGIVER BURDEN AMONG INFORMAL CAREGIVERS OF OLDER TRAUMA PATIENTS

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Introduction: Caregiver burden, characterized by psychological distress and physical morbidity, afflicts over 50 million informal caregivers of older adults in the U.S. Risk factors for caregiver burden among caregivers of older trauma patients have not been characterized. We hypothesized that lower caregiver self-efficacy is independently associated with greater caregiver burden.

Methods: Using a repeated cross-sectional design, we conducted telephone interviews with informal caregivers (family or friends who provided unpaid care) of adults ≥ 65 years admitted to two level I trauma centers at 4 and 12 weeks post-discharge between December 2019-May 2021. Caregiver burden and self-efficacy were measured using the *Zarit Burden Interview Short Form 12* and the *Revised Scale for Caregiving Self-Efficacy* respectively. Multivariate mixed effect logistic regression tested associations between self-efficacy and caregiver burden.

Results: Among 154 informal caregivers in this study, mean age was 60.6 (SD,13.0) years, most were female (70%) and White (88%). Most caregivers (59%) experienced burden and one third (31%) experienced high burden. Repeated measures showed sustained levels of burden at both time points. Caregivers with lower self-efficacy had significantly greater caregiver burden (odds ratio: 7.79, 95% CI 2.54-23.8, $p < 0.001$).

Conclusion: Most informal caregivers of older trauma patients experience caregiver burden up to 3 months post-discharge. Targeted interventions to increase caregiver self-efficacy may reduce caregiver burden.

THE REVISED CARDIAC RISK INDEX IS ASSOCIATED WITH MORTALITY INDEPENDENT OF INJURY SEVERITY IN ELDERLY PATIENTS WITH ISOLATED THORACIC INJURIES

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Introduction: Thoracic injuries are common among trauma patients. In geriatric patients, who often are frail and burdened with other comorbidities, these injuries could potentially contribute to worse overall outcomes. The Revised Cardiac Risk Index (RCRI) has previously shown to be associated with mortality risk in patients subjected to major surgery or traumatic injury. This investigation aimed to determine the association between the RCRI and in-hospital mortality among geriatric patients who had suffered isolated thoracic injuries.

Methods: All geriatric patients (65 years and older) registered in the TQIP database between 2013 and 2017 who suffered an isolated thoracic injury, defined as a thorax AIS ≥ 1 with an AIS ≤ 1 in all other body regions, were included. Patients were excluded if they had a thoracic AIS of 6. The association between different RCRI scores (0,1,2,3, ≥ 4) and in-hospital mortality was analyzed using a Poisson regression model with robust standard errors while adjusting for potential confounders, with RCRI 0 as the reference.

Results: A total of 77,981 patients met study inclusion criteria. All comorbidities increased in prevalence at higher RCRI scores, except for those related to cancer. After adjustment, an RCRI score ≥ 2 was significantly associated with elevated risk of mortality. Patients with an RCRI score of 2 had a 60% increased risk of in-hospital mortality compared to those with RCRI 0 ($p < 0.001$). An RCRI score of 3 or ≥ 4 was associated with an even higher risk of mortality, 216% ($p < 0.001$) and 241% ($p < 0.001$), respectively, as compared to a RCRI score of 0.

Conclusion: An elevated RCRI ≥ 2 is significantly associated with an increased risk of in-hospital mortality among geriatric patients with isolated thoracic injuries. Patients with an elevated RCRI should be treated as high-risk patients and would most likely benefit from pre-operative cardiac assessment as well as closer postoperative cardiac attention.

VARIATION IN HOSPICE USE AMONG TRAUMA CENTERS MAY IMPACT ANALYSIS OF GERIATRIC TRAUMA OUTCOMES

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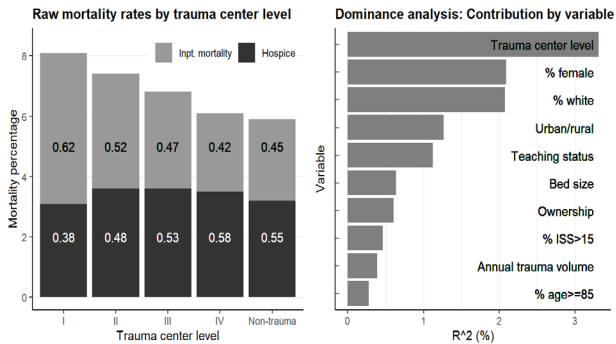
Center for Trauma and Acute Care Surgery Research, HCA Healthcare

Introduction: Defining patients discharged to hospice as “deaths” has been shown to be vital for proper assessment of trauma center outcomes. This may be even more critical as more geriatric patients are discharged to hospice. The goal of this study was to evaluate differences in hospice use rates between Non-Trauma (NTCs) and Trauma Centers (TCs) and identify variables most affecting hospice use in a representative geriatric cohort.

Methods: Patients from CMS Inpatient Standard Analytical Files for 2017-19 aged ≥ 65 with ≥ 1 injury ICD-10 code at hospitals with ≥ 50 trauma pts/yr were selected. Total Mortality (TM) was defined as inpatient deaths (ID) + hospice discharges (HD). Dominance analysis was used to identify the most important contributors to a multilinear regression model on hospice use rate.

Results: 1.96M hospitalizations (62% female, 90% white, mean ISS 6.6) from 2,317 hospitals (Level I-10%, II-14%, III-18%, IV-7%, NTC-51%) were included. HD as a proportion of TM varied by TC level and was lowest (0.38) at Level I TCs.

Dominance analysis showed TC level was the strongest factor explaining HD rate ($R^2 = 3.3\%$) followed by % female (2.1%), % white (2.1%), rural/urban (1.3%), teaching status (1.1%), bed size (0.6%), ownership (0.6%), % ISS >15 (0.5%), trauma volume (0.4%), and %age ≥ 85 (0.3%).



Conclusion: In this near-population based analysis, hospice discharge rates varied significantly among hospital types caring for geriatric trauma and should be included in mortality assessments of hospital outcomes. Level I TCs had lower hospice use rates as a fraction of Total Mortality. As the population ages, accurate assessment of geriatric trauma outcomes becomes more critical. Further studies are needed to evaluate optimal utilization of hospice in end-of-life decision-making for geriatric trauma patients.

ANSWERING THE AGE-OLD QUESTION: SHOULD WE KEEP, OR SHOULD WE TRANSFER OUR SEVERELY INJURED GERIATRIC PATIENTS TO HIGHER LEVELS OF CARE?

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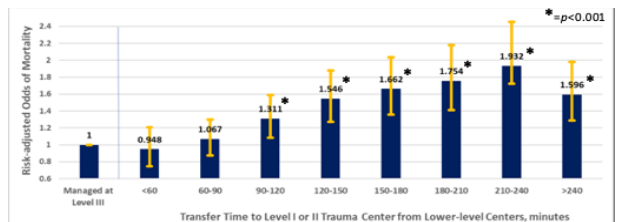
The University of Arizona

Background: Interfacility transfer to higher levels of care is becoming increasingly common, but drawbacks include potential over-triage, wasteful resource utilization, and poor outcomes from transfer delays. The aim of our study is to evaluate the effect of transfer to higher levels of care and prolonged transfer times on outcomes of severely injured geriatric trauma patients compared to those who are managed definitively at lower-level trauma centers

Methods: Analysis of the 2017-2018 ACS-TQIP. All severely injured (ISS >15) geriatric (≥60 yrs) trauma patients who were managed at an ACS/State Level III trauma center or were transferred to an ACS/State Level I or II trauma center were included. Patients with missing transfer time or ACS/State trauma center verification level information, and those presenting without signs of life were excluded. Outcomes were mortality and withdrawal of care.

Results: 41,135 severely injured patients were identified. Mean age was 76±8 yrs, 54% were male, 97% had blunt injury, and median ISS was 17 [16-21]. For patients transferred to Level I/II trauma centers, median transfer time was 122 [91-164] mins, and transport mode was: ground ambulance (77%); helicopter (22%); fixed-wing (1%). 24-hour and in-hospital mortality were 3% and 10%, and care was withdrawn for 8% of patients. Transfer to higher level of care within 90 minutes was associated with similar risk-adjusted odds of mortality as those managed at Level III centers, but mortality progressively increased with every 30-minute delay in transfer beyond this period (**Figure**). Patients transferred to higher levels of care were more likely to have their care withdrawn than if managed at Level III centers (aOR 8.2, $p < 0.001$).

Conclusions: Transfer to higher level of care for geriatric trauma patients may be detrimental compared to definitive management at lower-level centers. Transfer delays longer than 90 mins are independently associated with higher mortality, and such patients are often being transferred only to have their care withdrawn. Transfer decision protocols must be re-evaluated, and if expected transfer time exceeds 90 mins, air transport may be warranted.



DECISIONS, DECISIONS: FUTILITY OF RESUSCITATION MEASURE IDENTIFIES ELDERLY TRAUMA PATIENTS WHO MAY NOT BENEFIT FROM HEROIC MEASURES

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Introduction: Withholding further resuscitation for severely injured geriatric patients with low likelihood of survival is a challenging decision to make, for both caregivers and patient families. There are currently no evidence-based recommendations that can help guide such decisions and reduce potentially inappropriate healthcare resource utilization. The aim of this study is to develop a scoring system that can identify futility of further resuscitation.

Methods: Analysis of the 2017-2018 ACS TQIP. We included all severely injured geriatric patients (≥ 60 yrs) who received early transfusions (≤ 4 hrs). We excluded patients who had withdrawal of care. Frailty was defined using the 11-factor modified frailty index (mFI ≥ 0.27). Patients were stratified into age decades and resuscitative endpoints and interventions employed were identified. Dataset was randomly divided into a derivation cohort (80%) and a validation cohort (20%). Multivariate regression analysis was performed and a regression coefficient-based weighted scoring system for mortality was developed using the Schneeweiss method and subsequently validated.

Results: 5,562 severely injured geriatric trauma patients were identified (4,468 derivation; 1,094 validation). Mean age was 71 ± 8 years, 64% were male, 8% frail, ISS was 25 [18-30], and SBP was 77 ± 33 mm Hg. Eighteen percent underwent emergency laparotomy, 2% ED thoracotomy, 3% REBOA, 1% craniectomy, 3% required early vasopressors, 8% had prehospital cardiac arrest, 13% had an episode of hypotension < 50 mm Hg, 22% had severe TBI with GCS ≤ 8 , 10% had TBI midline shift, and mortality was 31%. Futility of Resuscitative Measure was developed and validated (AUROC 0.836, $p < 0.001$). On multivariate analysis, FoRM score was associated with mortality in the validation cohort (aOR 1.33, $p < 0.001$).

Conclusion: The FoRM accurately identifies risk of futile resuscitation among geriatric trauma patients where further efforts may not confer additional survival benefit. Our findings inform withdrawal-of-care decision-making between caregivers and patient families. This may improve quality of end-of-life while reducing potentially inappropriate resource utilization.

Futility of Resuscitation Measure	Points			FoRM Score	Mortality
		REBOA	1		
		PRBC Within 4 hrs ≤ 5 Units	0		
Age 60-70 yrs	0			0-4	10%
70-80 yrs	2	6-10 Units	3	5-8	40%
>80 yrs	3	11-15 Units	6	9-12	55%
Frailty	1	16-20 Units	7	13-16	79%
Prehospital Cardiac Arrest	7	>20 Units	9	17-20	81%
≥ 1 Episode of SBP < 50 mm Hg	6	Severe TBI and GCS ≤ 8	7	21-24	94%
Early Vasopressors (< 6 hrs)	2	TBI Midline shift	1	>24	100%
ED Thoracotomy	9	Cranioectomy	1		

FALLS ON SAME LEVEL IN PATIENTS WITH PRE-INJURY ANTICOAGULATION USE

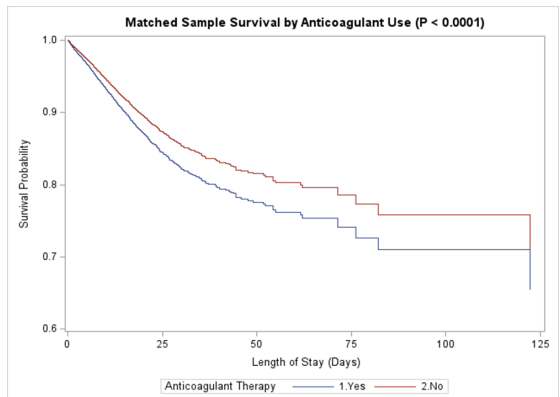
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Introduction: Growing evidence has shown that falls on same level (FSL) are a not-so-minor mechanism of injury. FSL are common in the geriatric population who are commonly on anticoagulation (AC) therapy for underlying medical conditions. In this study, we sought to investigate the impact of pre-injury AC on the outcomes after FSL.

Methods: We queried the 2017-2019 TQIP database for patients aged ≥ 55 years old who sustained FSL. Patients with pre-injury anticoagulation [AC (+)] were propensity-score-matched with those without anticoagulation [AC (-)] to control for possible confounding factors. The outcome measures were mortality, LOS (hospital and ICU), mechanical ventilation, as well as complications.

Results: There were 52,182 patients in each group. The AC (+) patients had a longer hospital and ICU LOS than the AC (-) patients (both $p < 0.0001$). The AC (+) patients required more PRBC transfusion within 4 hours of admission (2 ± 62 ml vs 1 ± 39 ml, $p < 0.0001$) and more plasma transfusion within 24 hours (60 ± 310 ml vs 45 ± 235 ml, $p < 0.0001$). The ICU admission rate was higher in the AC (+) than the AC (-) group (33% vs 29%, $p < 0.0001$). The complications (MI, pressure ulcer, sepsis, stroke/CVA, VAP) were significantly increased in the AC (+) compared to the AC (-) patients ($p < 0.01$). The 24-hour (1.18% vs 0.76%) and in-hospital (4.94% vs 3.64%) mortality was significantly higher in the AC (+) group than the AC (-) group (both $p < 0.0001$). The Cox regression model analysis showed a significantly lower survival probability in the AC (+) group than the AC (-) counterpart (HR 1.284, 95% CI 1.206-1.368, $p < 0.0001$).

Conclusion: Pre-injury AC use is associated with worse outcomes in patients who sustained FSL. These patients require special attention and care. A prospective trial is warranted to assess whether pre-injury AC use should be incorporated as a criterion for trauma team activation.



GERIATRIC TRAUMA EDUCATION: A NOVEL PROTOCOL FOR ASSESSMENT OF EQUITY AND REACH OF TRADITIONAL DISSEMINATION CHANNELS

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Medical Center of the Rockies

Introduction: The dissemination and implementation of evidence-based practice guidelines is essential for high-quality, up to date care. While effectiveness research abounds in trauma, in-depth analysis of the barriers and facilitators of dissemination are lacking. This methodological approach will elucidate the effectiveness of conventional dissemination channels for a pilot set of evidence-based practices within geriatric trauma care.

Methods: Recorded lecture series on the management of anticoagulation associated traumatic brain injury created by the Geriatrics committee of the American Association for the Surgery of Trauma will be disseminated through parallel channels, including departmental didactics, professional and societal meetings, social media, partner websites, and email campaigns. The target audience will include all United States trauma care providers. Bitly links will be assigned to each source channel (e.g. social media, QR codes at conferences, etc.) so that click volume can be accurately attributed. YouTube analytics will allow us to track video clicks, impressions, view rates and video completion. Both data sources will provide geographic and digital viewer location information. Channels with higher click through rates and video view rates will be identified as more favorable for information dissemination. Further, participants will complete a survey to obtain demographic information, relevant knowledge gained, and to interrogate the participants usual information procurement strategies. Equity of reach with regard to age, race/ethnicity and practice setting will be assessed.

Results: This digital analytics approach, which is novel to professional society medical information dissemination, allows for assessment of dissemination channels as well as granular assessment of the knowledge acquisition process, from initial engagement, to consumption of material, to internalization and endorsement of adoption of that material.

Conclusion: This protocol can help researchers and professional societies understand how to modify efforts to improve the effectiveness and equity of information dissemination in the trauma community.

RISK FOR PEDESTRIAN INJURY: OPPORTUNITY FOR INJURY PREVENTION IN GERIATRICS AND SUBSTANCE ABUSE

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Background: Many individuals utilize walking as their main method of transportation. In 2019, 6,205 pedestrians were killed and 181,599 pedestrians were treated in emergency departments for non-fatal incidents in the US. These large numbers of fatalities and injuries of pedestrians struck, along with their uptrend in recent years, make this an important topic to study. Our goal is to identify risk factors and trends within the pedestrian struck population, which may provide insight into areas of opportunity for intervention and risk reduction in this population.

Methods: The trauma registry at a level 1, urban trauma center was queried for all pedestrian struck patients 1/2017-10/2021. Demographic factors and health based risk factors were collected, including alcohol intoxication, history of mental health problems, and BMI. Hospital outcomes were identified. Patients were divided into children (<14 yrs), adults (14-64), and geriatric (65+). Regression analysis and T tests identified differences in risk factors and outcome between groups, $p < 0.05$ significant.

Results: 2,180 patients were identified for inclusion, 180 pediatric, 1767 adult and 233 geriatric. There was a bimodal distribution of age, with peaks at 29 and 57 years. Average ISS was significantly higher in geriatric patients (11.2) than adult patients (8.38) and children (5.875). Overall mortality is 4.4%, but was significantly higher in the geriatric patients (11.3%) than adult (3.9%) or pediatric (0.6%) populations, and is directly correlated with increasing age. 18.3% of all patients, including 9.4% of geriatric patients, were intoxicated with alcohol at the time of injury. Mental health disorders was associated with higher ISS (8.97, 8.44), but no increased risk of death or hospital LOS. BMI was not associated with increased mortality, ISS or hospital LOS.

Discussion: Pedestrian injury prevention programs often focus teaching on safe pedestrian habits to children, however, geriatric patients suffer higher injury burden and mortality than their younger counterparts. Opportunities exist to develop injury prevention programming specific to the geriatric population to address pedestrian safety, and to continue to reinforce the relationship of alcohol use to injury.

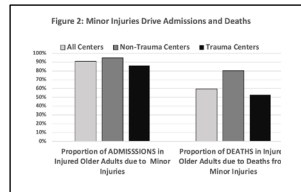
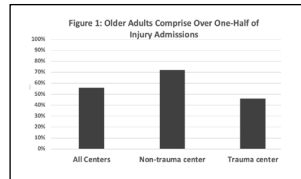
THE EPIDEMIOLOGY OF INJURIES IN OLDER ADULTS: IMPLICATIONS FOR THE US TRAUMA SYSTEM

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Stanford School of Medicine

Introduction: Older adults are growing segment of the injured population and are known to have worse outcomes. The scope of this challenge in the U.S. has not been fully characterized despite being often quoted. We sought to define the burden of injuries in older adults in both trauma (TC) and non-trauma (non-TC) centers in the U.S. We hypothesized that high proportions of older adults are admitted to non-TCs and that older adults with even minor injuries would have high rates of mortality.

Methods: We analyzed the Nationwide Emergency Department Sample 2018-2019 to evaluate all visits to U.S. emergency departments (EDs). We included all patients seen with a primary diagnosis of injury (ICD-10-CM) and excluded those with missing age. Older adult was defined as age 65 or older. Injury severity scores (ISS) were derived using the ICDP-R program. Unadjusted and adjusted analyses were performed. Weighted numbers are presented.

Results: A total of 34,957,005 injured adults were included in our study. Older adults comprised 19% (n=6,608,874) of ED visits but accounted for 55% of inpatient admissions. Admissions for older adults were divided almost evenly between TCs and non-TCs (48% vs. 52%, respectively). At non-TCs, a large proportion of adults admitted for injury were 65 or older (72%, [Figure 1](#)), and for TCs it was almost one half (46%, [Figure 1](#)). Most admitted older adults had minor injuries (ISS<15 in 80% for TCs; 95% for non-TCs; [Figure 2](#)). However, most inpatient deaths occurred in those with minor injuries. In non-TCs, 80% of deaths were for those with an ISS<15, compared to 53% for TCs (p<0.001).



Conclusion: The largest opportunity to improve outcomes for injured older adults is among those with minor injuries, given this is where the bulk of admissions and mortality occurs. As these patients are evenly distributed throughout U.S. hospitals, quality improvement efforts will need to consider novel models of trauma system care that extend beyond the walls of trauma centers.

THE FINAL DECISION AMONG THE INJURED ELDERLY, TO STOP OR TO CONTINUE? A NATIONWIDE STUDY OF PREDICTORS FOR WITHDRAWAL OF CARE

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Background: End of life decision practices have been described before, with more severe injuries & racial disparities playing an important role. However, there is paucity of data on these practices among elderly patients & the possible influence of frailty. We aimed to identify predictors of withdrawal of care among elderly patients & evaluate the role of frailty.

Methods: We analyzed the ACS-TQIP (2017–2019) including all severely injured trauma patients ≥ 65 y. Patients were stratified into Frail & Non-Frail using the 11-factor modified Frailty Index (mFI). Outcome measures were withdrawal of care rates & time to withdrawal of care. Multivariable logistic regression was performed to identify independent predictors of withdrawal of care, adjusting for patient demographics, injury parameters & mechanism, admission vitals, severe TBI, & ACS trauma center verification level.

Results: 155,583 severely injured elderly trauma patients (Frail, 29,061; Non-frail, 126,792) were included. Mean age was 77+7 years, 55% were male, 43.5% sustained blunt injury, & the median ISS was 17 [16-25]. Overall withdrawal of care rate was 10.8%. On univariate analysis, Frail group had higher rates of withdrawal of care (11.9% vs 10.5%; $p < 0.001$) & longer time to withdrawal of care (3 days [1-8] vs 2 days [1-7]; $p < 0.001$). On multivariate logistic regression, increasing age, male sex, white race, frailty, penetrating injury, severe TBI, & management at an ACS Level I trauma center were independently associated with higher odds of withdrawal of care (**Table**).

Conclusion: Our results suggest that one in ten severely injured elderly trauma patients undergo withdrawal of care. Severe TBI, older age, & frailty were patient-related factors, while management at an ACS Level I trauma center was a system-related factor associated with higher odds of withdrawal of care. Further research is needed to clarify the reasons behind withdrawal to identify patterns that may help lead to standardization of practice of withdrawal of care.

Table. Independent Predictors of Withdrawal of Care	aOR	95% CI	p-value
Age	1.03	1.02 – 1.03	<0.001
Male	1.4	1.4 – 1.5	<0.001
White	1.2	1.1 – 1.2	<0.001
Severe TBI	2.2	2 – 2.3	<0.001
Frailty	1.07	1.02 – 1.1	<0.001
Blunt	0.8	0.8 – 0.9	<0.001
Penetrating	2.8	2.5 – 3.1	<0.001
ACS Trauma Center Level I	1.6	1.5 – 1.6	<0.001
ACS Trauma Center Level II	1.3	1.3 – 1.4	<0.001
ACS Trauma Center Level III	0.2	0.1 – 0.2	<0.001

AMONG GERIATRIC TRAUMA PATIENTS, NON-DIABETIC HYPERGLYCEMIA IS AN INDEPENDENT PREDICTOR OF DEATH WHILE DIABETIC HYPERGLYCEMIA IS NOT

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Introduction: Geriatric trauma patients have increased mortality compared to younger patients. Non-Diabetic (stress induced) hyperglycemia is associated with mortality in trauma patients; however, this has not been studied in geriatric patients. We sought to evaluate the association of non-diabetic hyperglycemia with mortality in geriatric trauma patients and compare it to the association of diabetic hyperglycemia with mortality in geriatric trauma patients.

Methods: A retrospective review of geriatric trauma patients who were admitted to our level 1 trauma center from January 2018 to December 2021. IRB approval was obtained, and data collected from the trauma database included vital signs, demographics, injury characteristics, laboratory data and mortality. Emergency Department blood glucose level of >120 mg/dl was considered as hyperglycemia.

Multivariable logistic regression analysis was performed for the association of hyperglycemia and mortality among non-Diabetic (stress-induced) and Diabetic patient, controlling for age-group, pre-existing co-morbidities, injury severity (ISS) and low systolic blood pressure in the emergency department (shock).

Results: 5817 geriatric (age >65) trauma patients were admitted to our level 1 trauma center during the study period. This included 1419 diabetic and 4398 non-diabetic patients. The incidence of hyperglycemia among non-diabetics was 43.9% while among diabetics it was 77.6%. Among those with diabetes, the mean age was 79.2 ± 8 years, median ISS was 5 (4, 9), and median length of stay (LOS) was 5 (3, 8) days. Among those without diabetes, the mean age was 81.5 ± 9 years, median ISS 5 (2, 9), and median length of stay (LOS) 4 (2, 7) days. There were 125 deaths.

Non-Diabetic hyperglycemia was an independent predictor of death (OR 1.54, 95% CI 1.06 to 2.26). Age-group (75-85 vs 65-75: OR 2.5 95% CI: 1.5 to 4.3; 85+ vs 65-75: OR 4.2, 95% CI 2.3 to 7.2), SBP <90 mmHg (OR 4.8, 95% CI 2.39 to 9.64), having more than 1 co-morbidity (OR 2.44, 95% CI 1.71 to 3.48) and Injury Severity Score "ISS" (OR 1.11, 95% CI 1.09-1.14) were also independently predictive of death on multivariable logistic regression analysis. Diabetic hyperglycemia was not associated with mortality (OR 0.78, 95% CI 0.40-1.52).

Conclusion: Hyperglycemia is an independent predictor of mortality among non-diabetic geriatric trauma patients, but not among diabetic patients.

DISPARITIES IN RATES OF HOSPITALIZATION AMONG PATIENTS WITH MINOR FIREARM INJURIES

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American College of Surgeons

Introduction: Firearm injuries have an immediate and significant impact on patients, with fears related to personal safety and injury sequelae. Discretionary use of hospital admission might be used to mitigate these fears. We postulated that there might be disparities in access to hospital admission, which might further disadvantage vulnerable populations.

Methods: Admission rates after minor (AIS<3) isolated extremity firearm injuries were evaluated. Vulnerable populations were defined as either racialized or underinsured patients.

The cohort was identified using the Statewide Inpatient Database (SID) linked to State Emergency Department Database over 2016-2017 from four states and hospital characteristics were determined from the AHA database. Patients were defined as having an inpatient admission if there was an associated SID record with their encounter. We evaluated the association between admission status and patient and facility characteristics using a hierarchical multivariable logistic model.

Results: There were 7,428 ED encounters over 2016-17 and 1,741 (23%) patients were admitted. 19.0% of self-pay patients were admitted, compared to 25.4% of other insurance types, ($p<0.001$). On multivariate analyses, female gender, self-pay insurance status and unintentional injury were negatively associated with admission. Black race was associated with 16% lower odds of admission, but this did not meet statistical significance (Table 1).

Discussion: Where hospital admission might be discretionary, vulnerable populations might be further disadvantaged. This effect was not mitigated by trauma center status. Centers should strive to ensure equitable access to social supports to reduce the personal burden of firearm injuries.

	Odds Ratio (95 th CL)
Insurance Status	
Private Insurance	Ref
Medicare	0.83 (0.57, 1.20)
Medicaid	1.04 (0.87, 1.25)
Self-Pay/No-Charge	0.63 (0.52, 0.76)
Gender	
Female	0.81 (0.66, 0.98)
Race	
NH White	Ref
NH Black	0.84 (0.70, 1.01)
Hispanic	0.94 (0.73, 1.21)
Asian/Pacific Islander	1.14 (0.47, 2.82)
Trauma Center Status	
Non-Trauma Center	Ref
Level 1	1.17 (0.78, 1.74)
Level 2	1.32 (0.94, 1.84)
Level 3/4	1.23 (0.77, 1.98)

LONG-TERM PATIENT-REPORTED OUTCOMES FOR INJURED WOMEN

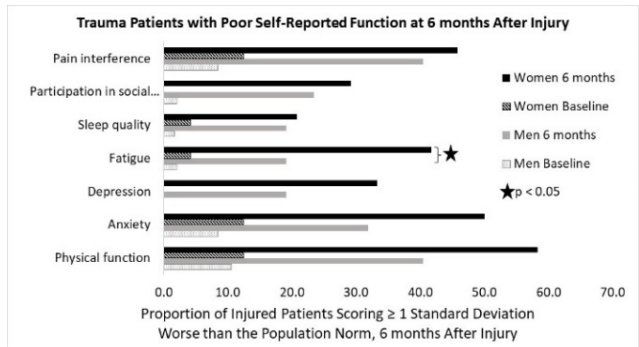
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 University of Pennsylvania

Introduction: One in 3 seriously injured patients treated in U.S. trauma centers is a woman, but gender-specific physical, mental, and social functioning is not established after injury. We compared patient-reported outcomes (PROs) for women and men with the hypothesis that women would have better outcomes at 6 months after injury.

Methods: Trauma patients admitted to an urban Level I trauma center from October 2020 to December 2021 were included. PROs were collected at enrollment (questions referred to pre-injury state) and 6 months using the PROMIS-29 and primary care PTSD screen. PROMIS-29 scores were converted to t-scores to compare outcomes to population norms, and proportions scoring ≥ 1 standard deviation worse than the norm are reported.

Results: Of 376 participants enrolled for $> 6m$, 71 (18.9%) completed 6-m surveys, including 24 women (33.8%). Compared to men, injured women were older, (median age 47 vs.35, $p=0.08$), more often bluntly injured (96% vs. 66%, $p=0.005$), and less often taken to the OR (13% vs. 26%, $p=0.20$). Median ISS was 9 for women and 10 for men. PTSD rates were equivalent: 4% at baseline and 17% at 6 months for both women and men. PROMIS-29 scores are in the figure.

Conclusion: At 6 months after injury, women and men had high rates of poor physical, mental, and social health. Women fared worse than men in all areas, with a significant difference in fatigue that was not explained by pre-injury differences. Interventions to promote holistic recovery after trauma should attend to the distinctive needs and experiences of injured women.



NATIONAL ANALYSIS OF THE ASSOCIATION WITH RACE AND VENOUS THROMBOEMBOLISM AFTER TRAUMATIC INJURY

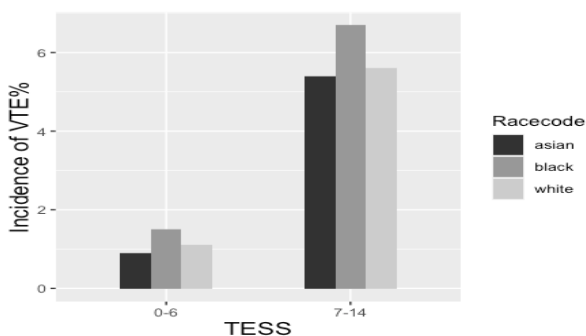
Chih Ying Chien, MD; Morgan Schellenberg, MD; Kazuhide Matsushima, MD;
Kenji Inaba, MD; Matthew J. Martin, MD
LAC + USC Medical Center

Introduction: Pharmacologic prophylaxis such as heparin and LMWH are recommended for moderate to high venous thromboembolism (VTE) risk patients. However, there is limited data available on the intersection of race and baseline VTE risk profiles. We sought to examine the association of race and VTE rates from a large national trauma dataset.

Methods: The TQIP database (2013-18) was queried for all adult trauma admissions and stratified by injury type and severity. The Trauma Embolic Scoring System (TESS) was used to assess VTE risk. Race was categorized as Black, white, or Asian, and VTE risk was categorized as low (0-6) or moderate to high (7-14) by TESS. Univariate and multivariate models were developed to characterize the association of race and VTE.

Results: There were 477,818 patients in the low-risk group and 231,151 high risk. The unadjusted incidence of VTE for Black race was more than white and Asian patients in the low risk (Black:1.5%; white:1.1%; Asian:0.8%, $p<0.01$) and in moderate/high risk groups (Black:6.7%; white:5.6%; Asian:5.3%, $p<0.01$). After adjusting for gender, comorbidities, obesity, TESS, VTE prophylaxis medication, and injury mechanism, Black race was associated with significantly increased VTE rates in both low and moderate/high risk groups (Figure). Asian race was associated with the lowest incidence and risk of VTE in all risk groups, but remained higher than that reported in non-U.S. Asian populations.

Conclusions: Post-traumatic VTE risk and rates vary significantly between self-reported race categories, and race is an independent risk factor for VTE even after adjustment for injury severity and other risk factors.



PATIENTS LOST-TO-FOLLOW-UP AFTER INJURY: WHO ARE THEY AND WHAT ARE THEIR LONG-TERM OUTCOMES?

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Background: Trauma patients are at a high risk for loss to follow up (LTFU) after hospital discharge. In this study, we sought to identify risk factors for LTFU and investigate associations between being LTFU and long-term health outcomes in the trauma population.

Methods: Trauma patients with an Injury Severity Score ≥ 9 admitted to three Level-1 trauma centers between 2015 and 2020 and discharged home were surveyed via telephone six months after injury to evaluate health care utilization and functional, physical, and mental health outcomes. LTFU was defined as no outpatient health care contact of any kind after discharge and evaluated based on patient report during research specific phone surveys. Univariate analysis was used to identify factors associated with LTFU. Multivariate models were utilized to assess whether being LTFU was independently associated with several long-term outcomes, including new functional limitations, health-related quality of life, anxiety, depression, PTSD, injury related readmission, and injury related ED visits.

Results: 1692 patients were analyzed, of which 24% were LTFU. Patients LTFU were more likely to be male (71% vs 61%, $p=.001$), black (22% vs 14%, $p=.003$), have high school or lower education (50% vs 42%, $p=.003$), have public insurance (23% vs 13%, $p<.001$), have a penetrating injury (13% vs 8%, $p=.006$), have a shorter length of stay (days) (3.64 ± 4.09 vs 5.06 ± 5.99 , $p<.001$), and be discharged home without assistance (79% vs 50%, $p<.001$). In multivariate analyses, compared to LTFU patients, followed up patients were more likely to require assistance at home (6% vs. 11%; OR 2.23, 1.26-3.92, $p=0.005$), have new functional limitations for activities of daily living (11% vs. 26%; OR 2.91, 1.97-4.31, $p<0.001$), have daily pain (30% vs. 48%; OR 2.11, 1.54-2.88, $p<0.001$), and have more injury related ED visits (7% vs. 10%; OR 1.93, 1.15-3.22, $p=0.012$); there was no difference in mental health outcomes or injury-related readmissions.

Conclusion: Vulnerable populations are more likely to be LTFU after injury. Although LTFU was not associated with worse long-term health outcomes, outcomes such as daily pain rate were still high in the LTFU cohort. Improvement in follow-up rates could help address potential racial and socioeconomic disparities in long-term health outcomes after injury.

RACIAL DISPARITIES IN ADMINISTRATION OF VTE PROPHYLAXIS AND VENOUS THROMBOEMBOLIC EVENTS: A TQIP ANALYSIS

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Introduction: Race has been shown to be associated with worse outcomes in trauma patients with Black patients being more likely to be diagnosed with pulmonary embolism. Disparities in the use of venothromboembolism (VTE) prophylaxis have not been elucidated. We aim to determine if racial disparities exist in the administration of VTE prophylaxis in trauma patients.

Methods: We queried the Trauma Quality Improvement Project database from 2017-2019. Patients ages ≥ 16 with ISS ≥ 15 were included. Patients with no signs of life on arrival, AIS ≥ 6 , LOS < 1 , anticoagulant use before admission, or without recorded race were excluded. Patients were grouped by race: White, Black, Asian, Native American, and Pacific Islander. Variables included demographics, comorbidities and hospital interventions. Primary outcome was the probability of VTE prophylaxis use. A Poisson regression model was used to determine incidence rate ratio for VTE prophylaxis administration.

Results: A total of 285,341 patients were included. Black patients had the highest rates of VTE prophylaxis (73.8%), shortest time to administration (1.6 days) and highest use of low molecular weight heparin (56%). Black patients also had the highest incidence of deep vein thrombosis (2.8%) and pulmonary embolism (1.4%). On regression modeling, Black patients were 5% more likely to receive VTE prophylaxis than White patients [adj. IRR (95% CI):1.05 (1.04-1.06), $p < 0.001$]. Native Americans were 7% less likely to receive VTE prophylaxis [adj. IRR [95% CI]:0.93 (0.89-0.97), $p = 0.002$] than White patients. No differences between White and Asian/Pacific Islander patients existed.

Conclusion: While Black patients had the highest incidence of DVT and PE, they had higher administration and earlier initiation of VTE prophylaxis. Further work can elucidate modifiable causes of these differences.

RACIAL VARIATION IN EMERGENT SURGICAL CARE AND OUTCOMES DURING THE COVID-19 PANDEMIC: POST-HOC ANALYSIS OF AN EAST MCT

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Objective: The COVID-19 pandemic highlighted concerns regarding the equity of medical care across races and ethnicities. We sought to evaluate associations between race, timing of hospital presentation and outcomes of acute appendicitis (AP) and acute cholecystitis (AC) during the initial pandemic peak.

Methods: Post-hoc analysis was performed on a prospective, observational, multicenter study of adults with confirmed or suspected AP or AC. Patients were categorized as admitted pre-pandemic (pre-CoV: October 2019-January 2020), or during the first pandemic peak (CoV: April 2020 through 4 months following the end of local pandemic restrictions). Data including American Association for the Surgery of Trauma (AAST) imaging and pathology grades, duration of symptoms before hospital triage, time from triage to initial intervention and hospital length of stay (LOS) were collected. Student's *t* test and ANOVA were performed to assess differences between races during pre-CoV and CoV. Logistic regression was used to estimate the odds of postoperative complications.

Results: A total of 2,165 patients were included from 19 participating centers. For AC, there was no significant difference in symptom duration prior to hospital triage for CoV versus pre-CoV (42.7 vs 49.6 hours, $P=0.19$). For AP, there was a significant decrease in time to presentation during CoV (52.8 vs 39.9 hours, $P<0.01$). Compared to pre-CoV, time from triage to intervention significantly increased for all AC patients during CoV (34.4 vs 43.3 hours, $P<0.05$) but not AP (28.1 vs 23.8 hours, $P=0.70$). When stratified by race, Asian patients with AC had a significantly longer duration of symptoms prior to presentation during CoV than pre-CoV (100.6 vs 37.5 hours, $P<0.01$) and presented later than Black (100.6 vs 34.3 hours, $P<0.01$) and White (100.6 vs 37.9 hours, $p<0.01$) patients, but there was no difference in time from triage to intervention or hospital length of stay. During CoV, Asian patients presented with higher AAST pathology grade for both AP (1.58 vs 1.90, $P<0.01$) and AC (1.45 vs 2.57, $P<0.01$). Postoperative complications did not differ between groups.

Conclusion: Asian patients had a longer duration of symptoms before presentation during the initial COVID-19 peak and presented with more advanced pathologic disease. Further research is needed to understand the reasons for delayed presentation in this group.

SOCIAL AND RACIAL DISPARITY IMPACTS VICTIMS OF PHYSICAL ABUSE AMONGST TRAUMA PATIENTS IN THE UNITED STATES

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Introduction: Violence in the form of physical abuse is an underreported crime and a significant social problem in the United States. The aim of our study was to assess the prevalence of reported physical abuse among trauma patients, and to identify the predictors of investigation and change in caregiver upon discharge.

Methods: A 3-year (2017-2019) retrospective analysis of the TQIP databank was performed. Trauma patients who had reported physical abuse were identified; Patients were stratified by age into 3 groups: pediatric (<18 years), adults (18-65 years), and geriatric patients (>65 years). We performed multivariate logistic regression analysis to examine the effects of age, sex, race, ethnicity, and insurance status upon the likelihood of initiating an investigation and caregiver change at discharge.

Results: A total of 26,043 patients were included of which 44.1% were pediatric, 49.9% were adults and 6% were geriatric. Among different age groups reported physical abuse were higher in American Indians, Blacks, Pacific Islanders, Asians, and Whites respectively. Black race (OR = 2.55, 95% CI [1.94 – 3.35]) had strongest predictor of initiating an investigation, where Elderly age and Sex did not show a significant predictive value. Black race (OR = 1.52, 95% CI [1.17 – 1.98]) and geriatric age group were more likely to be discharged to different caregiver whereas patients of Hispanic ethnicity with reported physical abuse (OR = 0.80, 95% CI [0.72 – 0.88]) were less likely to have a change of caregiver at the time of discharge. Insurance status was also a predictor of initiating an investigation (OR = 1.1, 95% CI [1.02 – 1.21]) as well as change in caregiver (OR = 1.2, 95% CI [1.16 – 1.35]).

Conclusion: Among trauma patients, racial disparity exists in reporting, investigating, and changing of the caregiver in cases with reported physical abuse. Further studies are warranted to identify possible underlying causes of disparities in reporting, investigation, and intervention for victims of abuse.

THE EXCLUSIVITY OF RACE AND ETHNICITY IN HISPANIC TRAUMA PATIENTS

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Introduction: Historically, Hispanic populations in trauma have not been appropriately characterized based on the exclusivity of ethnicity and race schema. We examined differences in trauma outcomes between combinations of race and Hispanic ethnicity.

Methods: Retrospective analysis of urban Level-II ACS Trauma Center registry (2010-2019) of 3,253 of 5,829 patients after exclusion for missing demographics and discharge disposition. Race and ethnicity were combined (Race+Eth) and grouped into: Black Non-Hispanic (BNH), Black Hispanic (BH), Other Non-Hispanic (ONH), Other Hispanic (OH), White Hispanic (WH), and White Non-Hispanic (NH). Discharge disposition was grouped into: Discharged home (no support), home with support, rehab or other medical care facility, another hospital, died, and left against medical advice (AMA). Discharge outcomes were compared using logistic regression (LR). Odds ratios (ORs) were calculated for significant variables ($p < 0.05$). WNH was used as the reference variable for all other Race+Eth. Model discrimination was assessed using the Area under the Receiver Operator Curve (AuROC).

Results: LR AuROC was 0.935. OH were less likely than WNH to be discharged home with increased support (OR; 95%CI (0.67, 0.52-0.86)), to be discharged to an increased medical care facility or rehab facility (OR; 95%CI (0.58, 0.42-0.79)), to be discharged to another hospital (OR; 95%CI (0.60, 0.37-0.97)), and to leave AMA (OR; 95%CI (0.60, 0.41-0.89)). No significant differences were found in the discharge disposition or mortality rates when comparing both ONH and WH to WNH.

Conclusions: Trauma outcomes research is incorrectly using the label “Hispanic” as a racial differentiator even though the term reflects an ethnicity that is separate from race. Our study found that the discharge outcomes in Hispanic trauma patients differ based on their perceived race. Those Hispanics who identify racially as “Other” rather than “White” or “Black” are disproportionately negatively impacted. More research into these labels is required to enhance our understanding of trauma outcomes in minority patients.

UNRECOGNIZED BURDEN OF TRAUMATIC INJURIES RELATED TO HOUSING INSECURITY: A PATIENT LEVEL SOCIAL DETERMINANTS OF HEALTH STUDY

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Intro: Social determinants of health (SDOH) are recognized modifiers of patient outcomes in large epidemiologic studies using community level rather than patient level data to assign social risk factors (SRF). Using patient level data, the goal of this study was to analyze the correlation between the SRF, traumatic injuries and outcomes.

Methods: Patient demographics, social work interview data and trauma admission data were combined for the years 2019-2020 at a large urban academic level 1 trauma center. The SRFs identified included housing insecurity (HI), alcohol use, financial security, food vulnerability, employment, insurance, and education level. Correlations between the SRFs, injuries and outcomes were obtained via non-parametric ANOVA analysis and chi-sq where appropriate. Multivariable negative binomial and logistic regressions with backward selection were used to analyze outcomes.

Results: Of 1058 patients, 904 had complete social work evaluations. After controlling for age, ISS, mechanism of injury (MOI), and SRFs, the SRF were not predictive of mortality, discharge location, in hospital falls, delirium, or pneumonia. The one exception was food insecurity being associated with acute respiratory failure (OR 19.17 CI[1.34-274.04]). Length of stay was associated with injury severity score (ISS)($p<0.001$), graduate education ($p=.039$), alcohol use disorder ($p=.0084$), disability ($p=.0122$), and inversely with falls from height ($p=.018$) or standing ($p=.012$) compared to motor crashes. Odds of readmission increased with financial insecurity (OR 5.60 CI[1.34-23.38]). Interpersonal violence was common among those with HI (50.0%, $p<0.001$), and the unemployed (21.27%, $p<0.001$) (Table 1). Insurance provider was also strongly associated with MOI, including 78.25% presenting after fall from standing were on Medicare and 76.09% of assaults were on Medicaid.

Conclusion: Utilizing patient level determination of modifiable determinants of health in trauma patients, SRFs did not affect outcomes in traumatic injuries however there were strong relationships between SRFs, readmissions and mechanism of injury. MOI may identify a population of patients that would benefit from thorough screening for SRFs.

GENDER DISTRIBUTION OF FIRST AND SENIOR AUTHORSHIP ACROSS MOST CITED STUDIES WITHIN THE TOP TEN SURGICAL JOURNALS FROM 2015-2020: CEMENTING WOMEN ACADEMIC SURGERY REPRESENTATION

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Introduction: The aim of this study is to investigate the gender distribution of first and senior authors in the most highly cited original research studies published in the top 10 surgical journals from 2015-2020 in order to identify disparities and changes over time.

Methods: A retrospective study analyzing the gender distribution of first and senior authors in the top 10 most cited studies from the top 10 surgical journals from 2015-2020. The genders of the first and senior authors of each study were assessed using National Provider Identifier (NPI) numbers or pronouns from institutional biographies or news articles.

Results: The genders of 1200 first and senior authors from 600 original research studies were assessed. First author gender distribution consisted of 71.8% men, 22.3% women, 0% non-binary, and 5.8% unknown. Senior author gender distribution was 82.3% men, 14.3% women, 0% non-binary, and 3.3% unknown. Studies published by first authors that are women received more citations than those published by first authors that are men in 2015 (169.1 vs 112.9, $p=0.002$) and 2016 (144.2 vs 101.5, $p=0.011$). There was an increase in first authorship among men from 2015 to 2020 ($p=0.035$).

Conclusion: Men represent a significantly higher proportion of both first and senior authorships in top surgical research and the gap has widened from 2015 to 2020. However, studies written by women first authors received significantly more citations than those written by men.

A MULTICENTER TRIAL OF ACCESS TO REHABILITATIVE CARE FOR ADOLESCENT PATIENTS WITH NEUROTRAUMA

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Introduction: Access to rehabilitative care after neurotrauma may be influenced by many factors, which remain poorly-defined and may be inequitably distributed. Pediatric patients often receive different care (e.g., imaging, operative management) when treated in adult (ATCs) versus pediatric trauma centers (PTCs). Adolescents behave like young adults in terms of risk-taking, but emotional/cognitive immaturity can increase vulnerability to long-term sequelae of brain injury and can complicate physical recovery, return to school, etc. Consequently, neurotrauma rehabilitation vital for optimal recovery likely requires a different balance of physical and emotional support in adolescents versus adults. We hypothesized that the neurorehabilitative care of adolescent trauma patients differs when treated at ATC versus PTC.

Methods: Retrospective review of data from 2 ATCs and 1 PTC in a single trauma system, in which patients age <15 are triaged to the PTC and age ≥15 to ATCs. Data were obtained for all adolescents (age 13-19) with moderate/severe injuries admitted from 2013-2020. Demographics and outcomes were obtained from trauma registries, and individual chart review was performed to record details on rehabilitative care. Statistical analysis used Student's t-test.

Results: 345 ATC and 165 PTC patients were included, of whom 302 (60%) had traumatic brain injury (TBI). PTC had 41% moderate/severe TBI, vs 30% in ATCs (p=0.07). Aside from age (14 vs 17, p<0.01), demographics including insurance status were not different between ATCs and PTCs. In the ATCs, 53% had injuries related to violence, compared with 1.8% of those in PTC. There were significant differences between PTC and ATCs in rehabilitative care including discharge to inpatient rehabilitation (Table).

<u>Mild TBI</u>	<u>ATC (n=137)</u>	<u>PTC (n=62)</u>	<u>p-value</u>
Neurorehab Physician Consultation	4 (3%)	25 (40%)	<0.001
Physical Therapy for Neurologic Concerns	26 (19%)	31 (50%)	<0.001
Speech Therapy for Cognitive Evaluation	7 (5%)	14 (23%)	<0.001
Outpatient Rehab Recommendation/Referral	18 (13%)	52 (84%)	<0.001
<u>Moderate/Severe TBI</u>	<u>ATC (n=60)</u>	<u>PTC (n=43)</u>	<u>p-value</u>
Discharge to Inpatient Rehab	20 (33%)	23 (53%)	0.03
Neurorehab Physician Consultation	9 (15%)	32 (74%)	<0.001
Physical Therapy for Neurologic Concerns	38 (63%)	31 (72%)	0.30
Speech Therapy for Neurologic Concerns	31 (52%)	34 (79%)	0.003

Conclusions: The profile of patients treated at ATCs vs PTCs appears to be different. Rehabilitative care of adolescent TBI patients varies when treated at ATCs vs PTCs. Whether this is a function of available resources, or ATC-vs-PTC philosophical approach, is unclear. Further study is required to determine optimal rehabilitation support of adolescent neurotrauma patients.

AMPLIFYING VOICES: PATIENT PERSPECTIVES ON SUCCESSFUL ELEMENTS OF A HOSPITAL VIOLENCE INTERVENTION PROGRAM

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Introduction: Hospital Based Violence Intervention Programs (HVIPs) are wraparound service programs addressing social determinants of health to reduce recidivism and increase self-efficacy among violently injured patients. While we attempt to draw conclusions about the successful elements of these programs from quantitative data, little is published about what makes a successful HVIP from the patient perspective. The objective of this study is to qualitatively explore these elements through semi-structured interviews with program participants.

Methods: An independent Program Evaluator conducted 12 semi-structured interviews with patients who had completed the program, each averaging 12 minutes. The interviews were coded by 2 reviewers, identifying emergent codes and analyzing each. The data was then organized into categories, domains, or themes.

Results: Thematic saturation was reached within the 12 interviews. Patients frequently expressed lack of interest when first approached, but valued the experience once involved, expressing three salient themes for a successful HVIP. First, patients valued the relationships and connections they created. Second, the program allowed them to plan for their future in ways that they had never been able to before. Finally, the program provided work opportunities that they valued.

Conclusions: Clients are not often interested in HVIP programs when initially approached, in part because they are not willing to change immediately. However, after participating in an HVIP program participants are happy and able to see opportunities and connections they did not have in the past. These elements make HVIP programs successful because it makes participants want to stay in the program instead of going back to join in violent activities.

Table

Theme	Representative Quotes
Making Connections	<p>“my friends are there and did make me like a better person and it’s like I want to keep building to myself so”</p> <p>“I would say socializing and being in the community and making new friends and connections.”</p>
Planning for the future	<p>“I see things in a different perspective than I used to. Well it just enhanced that for me cause yeah I am to myself but my mind is pretty open. I am intelligent and stuff, that just helped expand it so yeah”</p> <p>“I would say being in a program would really open your mind to a whole bunch of opportunities”</p>
Work Opportunities	<p>“But it was really enjoyable like I still got to do the interview which I thought was pretty cool. And it was more personalized to me and I really really liked that. I really enjoyed it. It helped me figure out what I [am] more interested in career-wise.”</p>

CONTRAST EXTRAVASATION AS A RISK FACTOR FOR MASSIVE TRANSFUSION IN PEDIATRIC BLUNT LIVER AND SPLEEN INJURY: MULTICENTER RETROSPECTIVE STUDY IN JAPAN

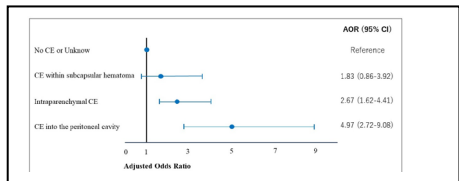
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Introduction: There are scarce data to guide clinicians in predicting risk for massive transfusion (MT) in pediatric trauma. Although contrast extravasation (CE) was added to the liver/spleen injury scale 2018 revision, little is known about its association with massive transfusion. Therefore, we aimed to assess whether the grade of CE was associated with MT requirements following pediatric blunt liver and/or splenic injuries (BLSI).

Methods: This is a multicenter, retrospective cohort study sponsored by the Japanese Association for Surgery of Trauma. We included pediatric patients (≤ 16 years old) sustaining BLSI from 2008-2019. MT was defined as transfusion of all blood products ≥ 40 mL/kg within the first 24 hours of admission. The associations between CE and MT were assessed using a multivariable logistic regression analysis with cluster-adjusted-robust standard errors to calculate the adjusted odds ratio (AOR).

Results: A total of 1,407 children from 83 institutions were included for analysis. The median age was 9 [IQR 6-13], 67% were male, median ISS was 10 [6–19], and in-hospital mortality was 1.5%. Of those, 199 patients (14%) received MT. On initial CT scan, CE within subcapsular hematoma was seen in 54 patients (3.8%), intraparenchymal CE was seen in 101 patients (7.2%), CE into the peritoneal cavity was seen in 85 patients (6.0%) among the overall cohort. After adjusting for age, sex, age-adjusted shock index, injury severity, laboratory and other imaging factors, intraparenchymal CE and CE into the peritoneal cavity were significantly associated with the need for MT (AOR: 2.67; 95% CI, 1.62-4.41 and AOR, 4.97; 95% CI, 2.72-9.08, respectively both $p < 0.001$).

Conclusion: Higher grade CE on initial CT scan was independently associated with a greater probability of receiving MT in pediatric BLSI. Our results suggest that the grade of CE may help clinicians to plan blood transfusion strategies.



DETERMINING THE RISK OF SERIOUS VIOLENT INJURY IN ADOLESCENTS: DIFFERING RISK, SIMILAR OUTCOME?

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Background: Serious youth violence causes significant long-term harm to both individuals and communities and puts burden on trauma care systems. Violence reduction caseworkers aim to identify young people at risk, address unmet needs and prevent future harm. Deprivation and adversity can increase the risk of violence exposure. There has not yet been a formal evaluation of whether the violence reduction service identifies those at risk. The aims of this study were to investigate these violence-related risks and evaluate their association with re-attendance to hospital.

Methods: Retrospective evaluation of in-hospital violence reduction service data for young people attending a London Major Trauma Centre between 2015-2019 with weapon-enabled violent injuries. Unsupervised hierarchical clustering was performed to identify risk cohorts. Re-attendance was defined as returning to hospital with violent injuries after the first presentation, up to March 2021.

Results: 708 of 1974 (36%) patients were seen by violence reduction caseworkers and 334 had at least one risk factor formally documented. The three most recorded risks were a previous violent experience (89.9%), a previous criminal conviction (39.9%), and reported mental health issues (16.3%). The hierarchical cluster model created two clusters of 176 and 158 patients. The patients in Cluster 1 were more likely to live in the family home (99.4% to 69.6%, $p<0.001$), be in education (46% to 27.2%, $p<0.001$), and be categorized as low risk by caseworkers (11.4% to 7.6%, $p=0.268$). The patients in Cluster 2 were more likely to have previous convictions (58.9% to 34.7%, $p<0.001$), a history of substance abuse (51.9% to 32.4%, $p<0.001$), be known to children's services (22.2% to 5.7%, $p<0.001$) and have a learning difficulty (21.5% to 1.1%, $p<0.001$). Despite the model indicating that Cluster 2 had patients with more classical identifiers of risk, both clusters exhibited a similar level of re-attendance (11.4% to 10.8%).

Conclusions: Patients attending hospital with violent injury have often experienced prior adversity, but these should not be the sole determinants of future risk of violence. There may be hidden risks that have yet to be identified, and this needs to be built into violence reduction strategy.

MENTAL HEALTH DISORDERS AND DRUG USE INCREASE EMERGENCY DEPARTMENT RETURN VISITS AFTER TRAUMATIC INJURY

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Introduction: Return visits to the Emergency Department (ED) after hospital discharge for traumatic injury are frequent and potentially preventable. This study aimed to evaluate how substance use and mental health disorders affect the rate of ED readmission after injury.

Methods: A retrospective study of adult trauma admissions from June 1, 2015 to December 31, 2021 at an academic Level 1 trauma center was conducted. Patient demographics, alcohol use, drug use, and mental health disorders were assessed. Rates of return to ED were evaluated with a negative binomial log regression adjusted by time from first trauma admission to end of study.

Results: 10,710 trauma patients were included with a mean age of 48.4, with a standard deviation of 23.7, and 64.6% (n=6,919) were males. 16.4% (n=1,761) screened positive for alcohol use, 46.6% (n=4,990) for drug use, 22.6% (n=2,419) for polysubstance drug use, and 12.1% (n=1,294) for any mental health disorder. Multivariate analysis showed a significant positive association with ED return visits and alcohol use ($p<0.001$; Rate Ratio (RR)=1.26; 95%CI=1.16-1.36), polysubstance drug use ($p<0.001$; RR=1.92; 95%CI=1.79-2.06) and mental health disorders ($p<0.001$; RR=2.64; 95%CI=2.43-2.86).

Conclusion: Alcohol use, polysubstance drug use, and mental health disorders are associated with high rates of ED return visits by 26%, 92% and 164%, respectively. This highlights areas where appropriate referrals and support may be beneficial to address ED return visits after discharge from hospital for traumatic injuries.

MISSED OPPORTUNITIES: SUBSTANCE USE IN ADOLESCENT TRAUMA PATIENTS

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Purpose: The adolescent population is known to have increased risk-taking behaviors including substance use. To evaluate substance use in this population, toxicology testing is universally ordered in all trauma patients presenting at our center. We hypothesized a high rate of substance use among traumatically injured adolescent trauma patients.

Methods: A single-institution retrospective review of trauma patients aged 16-20 years old from May 2018-July 2021 was completed. A total of 1002 visits met inclusion criteria. Variables including demographics, injury characteristics, procedural data, urine and drug toxicology results, social work intervention and discharge status were analyzed via Chi-square and Fisher's exact tests.

Results: The majority of patients were male (72.6%), black (81.8%), and had penetrating injuries (57.5%). 86.2% were screened for alcohol and/or substances; of those, 6.2% were positive for alcohol and 12.4% were positive for illicit substances. Those that tested positive for alcohol were more likely to experience blunt trauma 61.1% vs 42.6% ($p=0.03$). Patients that self-reported alcohol use had a higher re-injury rate, 72.3% vs 48.1% ($p=0.004$). Substance use had no effect on follow-up or hospital-based social work interventions [48.7% vs 45.9% ($p=0.96$) and 28.6% vs 25.7% ($p=0.15$), respectively]. Any social work intervention was positively correlated with clinic follow-up 31.9% vs 20.2% ($p<0.001$).

Conclusion: In this series, nearly 1 out of 5 adolescent trauma patients screened positive for either alcohol or illicit substances. 13.8% were not screened and nearly three-quarters who were positive did not receive any social work intervention. There is a missed opportunity to provide these patients with substance use education and counseling. Further studies are needed to determine if universal screening and diligent social work interventions help to correct adolescent alcohol and substance use and prevent trauma re-injury.

NATIONWIDE ANALYSIS OF BIOMECHANICS OF MOTOR VEHICLE COLLISIONS INVOLVING PASSENGER VEHICLES AND ASSOCIATED OUTCOMES: TOWARDS IMPROVING VEHICLE SAFETY STANDARDS AND REGULATIONS

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Background: Motor vehicle collisions (MVCs) pose significant mortality and economic burden on the United States. Biomechanics research may guide future vehicle innovation. The objective of this study is to investigate the biomechanics of two-vehicle MVCs involving passenger vehicles (PV) to evaluate associated injury patterns and outcomes including mortality.

Methods: Retrospective cohort study of cases from the Crash Injury Research Engineering Network database was performed to evaluate the biomechanics (angle of impact, impact velocity, seat position, seatbelt use, and airbag deployment) of two-vehicle MVCs involving at least one PV from 2005-2015.

Results: Out of 629 MVCs evaluated, lateral collisions were most common (49.5%), followed by head-on (41.3%) and rear-end (9.2%) collisions. Seatbelt use was associated with shorter ICU stay (10.9 days vs. 19.1 days, $p=0.036$) and mortality (Cramer's $V=0.224$, $p<0.001$), but a greater average number of injuries (10.2 injuries vs. 8.6 injuries, $p=0.011$). Restrained occupants suffering abdominal injury had higher average body mass index than those with head ($p<0.001$) or thoracic ($p=0.030$) injury.

Conclusion: Passenger vehicles are commonly involved in MVCs nationwide and efforts are needed to prevent occupant injuries and fatalities. Incorporation of energy-absorbing material into common points of contact within the vehicle interior may decrease the severity of these injuries. Seatbelt use remains a protective factor against MVC-fatalities, but is associated with abdominal injuries in occupants with higher BMIs, and should be a focus of further innovation.

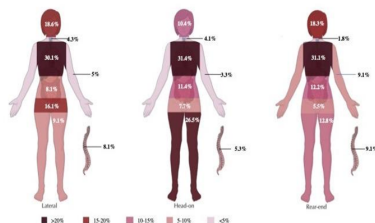


Figure 1. Distribution of Regional Injuries Sustained by Collision Type. The thorax was the most injured body region in all collision types. Thoracic injuries among lateral, head-on, and rear-end collisions amounted to 30.1%, 31.4%, and 31.1%, respectively. Head injuries were the second most common injury and amounted to 18.6% and 18.3% in lateral and rear-end collisions, respectively. In contrast, lower extremity injuries were the second most affected body region in head-on collisions (11.4%), whereas they comprised 8.1% and 12.2% among lateral and rear-end collisions, respectively.

SCHOOL CLOSURE POLICIES CORRELATE WITH ADOLESCENT FIREARM INJURY DURING COVID-19

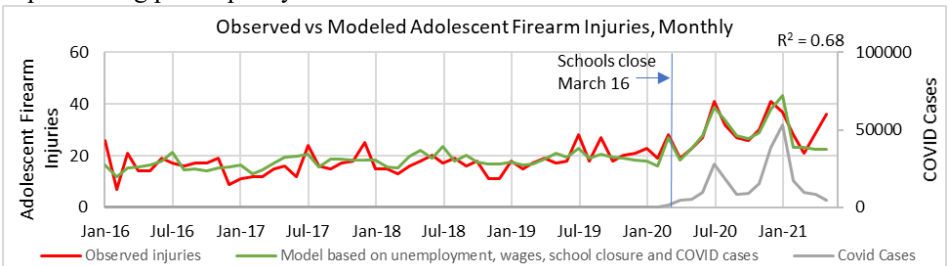
John N. Bliton, MD; Randall G. Duran, BS; Alexis D. Smith, MD; Richard Sola, Jr., MD; Sofia Chaudhary, MD; Kiesha Fraser Doh, MD; Deepika Koganti, MD; Goeto Dantes, MD; Roberto Hernandez Irizarry, MD; Janice M. Bonsu, MD, MPH; Tommy T. Welch, PhD; Roland Richard, PhD, MPH; Randi N. Smith, MD
Emory University

Introduction: Mitigation measures, including school closures, were enacted to protect the public’s health from COVID-19. Adolescents are uniquely vulnerable to public policy changes since many depend on schools for physical, mental, and/or nutritional support. This study explores the statistical relationships between school closures and adolescent firearm injuries (AFI) during the pandemic.

Methods: Data were drawn from a collaborative registry of 4 trauma centers in Atlanta, GA (2 adult + 2 pediatric). Firearm injuries affecting adolescents aged 11-21 years from 1/1/2016 to 6/30/2021 were evaluated. Local economic and COVID data were obtained from the Bureau of Labor Statistics and the GA Department of Health. Time series analysis was performed using Dickey-Fuller testing. Linear models of AFI were created based on COVID cases, school closure, unemployment, and wage changes.

Results: There were 1,330 AFI at Atlanta trauma centers during the study period. The mean age was 18.1 years and most were male (88%) and Black (91%). A significant spike in injuries was observed during Spring 2020. A season-adjusted time series of AFI was found to be non-stationary ($p=0.60$). The correlation between monthly injuries and school closures was 0.58 ($P<0.001$). The strongest independent contributors to the model were school closure and COVID cases (ΔR^2 0.087 and 0.090).

Conclusion: AFI increased during the COVID pandemic. This rise in violence is statistically attributable in part to school closures after adjustment for COVID cases, unemployment, and seasonal variation. These findings reinforce the need to consider the direct implications on public health and adolescent safety when implementing public policy.



TRENDS IN MASS SHOOTINGS IN THE UNITED STATES (US): AN AMERICAN EPIDEMIC WITHIN THE PANDEMIC

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University of California, Irvine

Introduction: In the past fifty years, ~ 30% of all mass shooting perpetrators were Americans, with recent data suggesting worsening of the American firearm epidemic in the wake of the COVID-19 pandemic. Thus, this study aimed to examine the trends in mass shootings in the United States (US) over time, including the recent pandemic period.

Methods: Mass shooting is defined by the Federal Bureau of Investigation as ≥ 4 persons shot or killed in a single incident, not including the shooter. Retrospective mass shooting data (1/2013 – 12/2021) were collected from the Gun Violence Archive. A scatterplot was constructed showing predicted (extrapolated from 2013-2019) versus actual total mass shootings in 2020 and 2021 in the US. Additionally, all 50 states were categorized as either “strong gun law” (top 25) or “weak gun law” (bottom 25) states using the Giffords Law Center Annual Gun Law Scorecard. Multivariate linear regressions were performed to determine the trends in mass shootings overtime associated with gun law strength.

Results: On scatterplot, mass shooting incidents, injuries and deaths in 2020 and 2021 significantly exceeded extrapolations made from the previous 7 years. When comparing 2019 to 2020, stronger gun laws were associated with decreased monthly mass shooting deaths (USC B: -0.058, 95% CI: (-0.096, -0.019), $p=0.004$). Furthermore, for these same strong gun law states, there was a decrease in monthly mass shooting deaths when comparing 2019 to 2021 (USC B: -0.057, 95% CI: (-0.096, -0.018), $p=0.005$) as well as when comparing 2020 to 2021 (USC B: -0.058, 95% CI: (-0.092, -0.024), $p=0.001$).

Conclusions: The number of mass shootings in the US has steadily increased over time, with a further spike in 2020 and 2021 during the COVID-19 pandemic that surpassed extrapolated estimates. In addition, stronger gun laws appear to be associated with fewer monthly mass shooting-related deaths during the pandemic time period. Hence, firearm-related legislation may be able to, at least partially, curtail the acute worsening of this substantial “American problem” of mass shootings.



SESSION IX:
POSTER SESSION II

Thursday, September 22, 2022

12:00 PM - 1:00 PM

Location: Riverside East

GROUP EIGHT (POSTERS 66-74)

NEUROLOGICAL TRAUMA

Charles Adams Jr., MD and Caroline Park, MD

GROUP NINE (POSTERS 75-84)

ORGAN-BASED TRAUMA I

Nicole Stassenl, MD and Dennis Kim, MD

GROUP TEN (POSTERS 85-95)

ORGAN-BASED TRAUMA II

Tejal Brahmbhatt, MD and Michel Aboutanos, MD

GROUP ELEVEN (POSTERS 96-105)

SHOCK/TRANSFUSIONS I

Jasmeet Paul, MD and Lillian Kao, MD

GROUP TWELVE (POSTERS 106-115)

SHOCK/TRANSFUSION II

Joseph Rappold, MD and A. Peter Ekeh, MD

GROUP THIRTEEN (POSTERS 116-125)

**TRAUMA SYSTEMS, HEALTH ECONOMICS,
AND EPIDEMIOLOGY I**

Amy Liepert, MD and Lillian Kao, MD

GROUP FOURTEEN (POSTERS 126-135)

**TRAUMA SYSTEMS, HEALTH ECONOMICS,
AND EPIDEMIOLOGY II**

Navpreet Dhillon, MD and Mayur Patel, MD, MPH

AMANTADINE USE IN ACUTE TRAUMATIC BRAIN INJURY: A PRELIMINARY ANALYSIS OF THE CONSCIOUS STUDY

Brett Tracy, MD; Kelly Nahum, DO; Jeffry Nahmias, MD; Kaushik Mukherjee, MD; Anushka Paladugu, MS; Kimberly Sperwer, DO; Stephanie Doris, MD; Rondi Gelbard MD
Ohio State University

INTRODUCTION: Amantadine use after traumatic brain injury (TBI) has been shown to improve cognitive outcomes in the post-acute setting. However, research on amantadine during the initial hospitalization and post-injury period is lacking. We sought to evaluate the impact of amantadine use on patients with severe TBI in the acute setting and hypothesized that amantadine would be associated with more severe TBIs yet correlate with improved 30-day outcomes.

METHODS: We performed a prospective, observational study of patients ≥ 18 years with severe TBI (Glasgow Coma Scale (GCS) ≤ 8 at 4 Level-I trauma centers between 2020-2022. Patients with penetrating trauma, pre-injury amantadine use, or a cognitive disability were excluded. TBI data collected included abbreviated injury score (AIS) head, Marshall classification, and propranolol use. Patients were grouped according to whether they received amantadine. The primary outcome was 30-day risk of non-favorable discharge disposition (death, hospice, skilled nursing facility, long term acute care hospital), which we determined using multivariable Cox proportional hazards regression (with additional censoring for patients expiring ≤ 48 hours from admission). Secondary outcomes included hospital length of stay (LOS), ICU LOS, ventilator days, and Disability Rating Scale (DRS) scores.

RESULTS: There were 72 patients in the cohort; 39% (n=28) received amantadine. There was no difference in age, sex, admission GCS score, AIS head, or incidence of craniotomy and/or craniectomy (all $p > .05$) between groups. Amantadine patients were more likely to receive propranolol (79% vs 36%, $p < .001$). Median hospital LOS (32 vs 9.5 d, $p < .0001$), ICU LOS (16.5 vs 5.5 d, $p < .0001$), and ventilator days (16 vs 4 d, $p < .001$) were longer for amantadine patients. Median time to amantadine initiation was 9 (4-15.3) days and median duration of inpatient therapy was 24.5 (9.5-31.5) days. For the 57 patients surviving to 1 week, DRS scores on day 7 were worse for amantadine patients (25 vs 21, $p < .01$). However, on regression analysis adjusting for age, DRS score, AIS head, Marshall classification, and propranolol use, patients receiving amantadine had a lower risk of non-favorable discharge disposition (aHR 0.1, 95% CI 0.03-0.33, $p < .001$).

CONCLUSION: In the acute setting, severe TBI patients receiving amantadine had worse DRS scores and longer hospitalizations. However, the 30-day risk of a non-favorable discharge disposition was significantly lower for patients receiving amantadine. Future analyses with a larger patient sample are warranted to evaluate change in cognition throughout the initial hospital stay.

BODY MASS INDEX AND PHARMACOLOGIC VENOUS THROMBOEMBOLISM PROPHYLAXIS IN SEVERE TRAUMATIC BRAIN INJURY

Dina M. Filiberto, MD, MS; Saskya Byerly, MD; Emily K. Lenart, DO; Peter E. Fischer, MD, MS; Andrew J. Kerwin, MD
University of Tennessee-Memphis

Background: Patients with traumatic brain injuries (TBI) are at risk for developing venous thromboembolic (VTE) complications. Previous work suggests venous thromboembolism prophylaxis with low molecular weight heparin (LMWH) is protective compared to unfractionated heparin (UH) in trauma patients. The relationship between body mass index (BMI) and VTE in patients with TBI is not well described in the literature. The purpose of this study was to evaluate the role of BMI and type of pharmacological VTE prophylaxis in patients who develop VTE with severe TBI.

Methods: Patients with a severe TBI (identified by using ICD-10 codes and head AIS > 3) who received LMWH or UH for VTE prophylaxis were queried from the 2019 American College of Surgeons Trauma Quality Improvement Program. Demographics, injury characteristics, timing of VTE prophylaxis, BMI (<18.5kg/m², 18.5 - 24.9kg/m², 25 – 29.9 kg/m², and >30 kg/m²), and verification level of the trauma center were collected from the database. Outcome measures include VTE, mortality, and neurosurgical interventions. Multivariable logistic regression (MLR) analysis was performed to determine predictors of VTE.

Results: Of the 39,520 patients with TBI included in the study, 25,671 (64.96%) received LMWH and 13,849 (35.94%) received UH. Overall mortality was 5.24%. Patients diagnosed with VTE were more likely to undergo neurosurgical interventions: external ventriculostomy drain placement (1.1% vs 0.36%, $p=0.0007$), intracranial pressure monitor placement (4.99% vs 1.56%, $p<0.0001$), and craniectomy/craniotomy (3.21% vs 1.31%, $p<0.0001$), compared to those without VTE. MLR found patients with a BMI 25 – 29.9 kg/m² (OR 1.71; 95% CI 1.130-2.472, $p=0.010$) and a BMI >30 kg/m² (OR 2.226; 95% CI 1.505 – 3.292, $p<0.0001$) were independent predictors of VTE. For every hour delay in initiation to VTE prophylaxis, patients were 0.2% more likely to develop VTE (OR 1.002; 95% CI 1.002 – 1.003, $p<0.0001$). Patients treated with UH (OR 1.085; 95% CI 1.058 – 1.112, $p<0.0001$) were more likely to develop VTE, regardless of BMI and time to initiation of prophylaxis, compared to patients treated with LMWH.

Conclusions: In patients with severe TBI, higher BMI and delay in VTE prophylaxis initiation was associated with increased risk of VTE. LMWH had a protective association with VTE, compared to UH.

BRAIN INJURY GUIDELINE CLASSIFICATION AS A DECISION TOOL FOR ANTICOAGULATION REVERSAL IN TBI

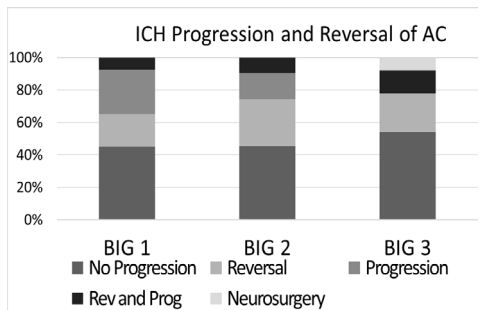
Benedict Capacio, MD; Alexandra Rooney, MPH; Kathryn Schaffer, MPH; Richard Calvo, PhD; Beth Sise, JD, RN; Andrea Krzyzaniak, MA; Michael Sise, MD; Vishal Bansal, MD; Walter Biffl, MD; Matthew Martin, MD
Scripps Mercy Hospital

Introduction: Anticoagulation (AC) in trauma is a risk factor for intracranial hemorrhage (ICH), neurosurgical intervention (NSI), and death. Although AC reversal is often given, there are no evidence-based guidelines to aid this decision. The Brain Injury Guideline (BIG) stratifies patients into 3 risk groups but excluded AC from low risk tiers. We analyzed a modified BIG score for risk prediction and as a decision aid for selective AC reversal.

Methods: AC patients ≥ 55 yr with traumatic ICH from two centers were stratified into BIG 1-3 risk groups using modified BIG criteria with AC excluded as a factor. ICH progression, need for NSI, death, and worsened discharge status was compared between groups using univariate and multivariate models.

Results: 221 patients were included, 23%, 29% and 48% were classified as BIG1, BIG2 and BIG3, respectively. The rate of ICH progression was 38%, 26%, and 55% for BIG1, 2, and 3 respectively (Figure). Among BIG1 patients who progressed, 26% had immediate AC reversal (IR) versus 74% with no reversal (NR, $p=NS$), and the majority of progressions were minor. Similarly, ICH progression was not different between IR and NR in BIG2. BIG3 patients were twice as likely to have progression of ICH versus BIG1 patients ($p<0.05$), and significantly more likely to receive IR (59% vs 28% in BIG1; $p<0.01$). No patient in BIG1/BIG2 required NSI, and there were no deaths related to ICH in the BIG1 group. The BIG category was an independent predictor of the need for NSI, but AC reversal was not independently associated.

Conclusions: Although rates of ICH progression in all BIG categories were higher than reported rates for non-AC patients, the BIG category reliably identified patients at risk for NSI and adverse events. BIG1 and select BIG2 patients may not benefit from AC reversal, and the BIG category could be used to guide the decision to administer or withhold anticoagulation reversal agents.



COMORBIDITIES AND HEMORRHAGE CHARACTERISTICS PREDICTING MORTALITY IN ADULT PATIENTS WITH MILD TRAUMATIC INTRACRANIAL HEMORRHAGE

Jeffrey Brown, BS; Puja Patel, DO; Tara Stansbury, MD; Mark Broadwin, MD; Matthew Painter, MD; Mark Cipolle, MD, PhD; Kamal Shah, MD
Lehigh Valley Health Network

Introduction: Patients suffering from traumatic intracranial hemorrhage (tICH) are routinely transferred from presenting hospitals to level 1 and 2 trauma centers, regardless of extent of neurological deficits. The purpose of this project is to identify imaging characteristics of tICH and comorbidities associated with mortality.

Methods: A retrospective cohort study was performed on adult patients admitted or transferred to a level 1 trauma center from October 2015 to September 2019 with Glasgow Coma Score (GCS) 13-15 and tICH on initial computed tomography head (CTH). Categorical Data were compared with Chi-square or Fisher's Exact Test and continuous data with Mann-Whitney U test. Multivariate analysis was performed to determine risk factors for in-hospital mortality and at 60 days, and then used to create a logistic regression analysis. A p-value of 0.05 was considered statistically significant.

Results: 1542 patients that met inclusion criteria were analyzed. 97 (6.3%) died within 60 days, 29 in hospital (29.9%) and another 68 (70.1%) within 60 days. Patients who suffered in-hospital or 60-day mortality had higher Injury Severity Score (ISS) (16.1/16.6 vs 11.8/11.7, $p=0.001$), and higher rates of congestive heart failure (CHF), myocardial infarction (MI), dementia, advance directives, and functional dependence ($p<0.05$). They were more likely to use anticoagulation and require reversal, undergo transfer to another facility, and have poor GCS at arrival (14.8/14.8 vs 14.5/14.5) and at 24 hours (14.7/14.7 vs 13.3/12.9) ($p<0.05$). In-hospital mortality was higher in acute subdural hemorrhage (SDH) and intraventricular hemorrhage (IVH), while 60-day mortality was increased in all morphologies except subarachnoid hemorrhage (SAH) ($p<0.05$). Linear regression analysis showed MI ($p=0.023$), advance directive status ($p=0.001$), ISS ($p=0.044$), platelet transfusion ($p=0.036$), prothrombin complex concentrate (PCC) administration (0.016), and GCS at 24 hours ($p=0.001$) to be predictive of in-hospital mortality. 60-day mortality was predicted by previous spinal cord injury ($p=0.001$), serum creatinine >2 mg ($p=0.016$), advance directive status ($p=0.008$), ISS ($p=0.012$), platelet transfusion ($p=0.004$), GCS at 24 hours ($p=0.001$), operation performed ($p=0.004$), and intraparenchymal hemorrhage (IPH) size ($p=0.008$).

Conclusions: The comorbidities and CTH characteristics above are indicative of higher risk of in-hospital and 60-day mortality in adults suffering from isolated mild tICH. Discussions of goals of care with mild tICH patients surrounding mortality may be informed by using these metrics and to help predict who may require further therapy.

EFFECT OF MARIJUANA (THC) ON PATIENT OUTCOMES WITH TRAUMATIC BRAIN INJURY

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Riverside Community Hospital

Background: Marijuana use in the United States has been steadily increasing among the trauma population as more states have moved to legalize its recreational and medicinal uses. Previous studies have shown conflicting outcomes in adult patients with positive tetrahydrocannabinol (THC) screen who sustained traumatic brain injury (TBI). We investigated the relationship between marijuana use and outcomes using a large multicenter dataset.

Materials and methods: A retrospective multi-institutional study of patients seen between January 2016 and December 2019 was performed to assess adult patients (>18 years) with TBI who were screened for THC and data regarding outcomes at discharge. Patients were divided into two groups; THC positive and THC negative groups. The primary outcome was mortality and discharge disposition. Secondary outcomes included ICU and hospital length of stay.

Results: A total of 14,970 patients met the inclusion criteria. THC positive patients were younger, and more involved in penetrating trauma. THC positive patients had lower mortality rates at discharge than the THC negative (9.17% vs 10.58%, p-value <0.01). However, upon controlling for confounding factors, THC status was not found to be an independent predictor of mortality at discharge. Logistic regression analysis also showed no significant difference in ICU length of stay or hospital length of stay between the two groups (p-value 0.027 vs 0.262).

Conclusions: Positive THC screens did not increase the likelihood of mortality at discharge or have a significant increase in ICU or hospital length of stay. Our results indicate no survival benefit for TBI patients with THC use.

KEY CT FINDINGS FOR TRAUMA SURGEONS TO RAPIDLY PREDICT EARLY NEED FOR NEUROSURGICAL INTERVENTION OR DEATH FROM TRAUMATIC BRAIN INJURY

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University of Tennessee Health Science Center

Introduction: Management of moderate & severe traumatic brain injury (TBI) depends on rapid identification of patients who require immediate intervention to avoid secondary brain injury or death. This study evaluated if a simple schema for quickly interpreting CT head (CTH) imaging by trauma surgeons & trainees could be validated to predict need for neurosurgical intervention (NSI) or death from TBI (MORT) in 24 hours in TBI patients.

Methods: This was a retrospective review of TBI patients presenting to our Level 1 trauma center in 2020 with blunt mechanism and GCS <13; patients without CTH were excluded. Primary independent variables were presence of 7 normal findings on CTH (CSF around brainstem at foramen magnum, open fourth ventricle, CSF around quadrigeminal plate within superior cistern, CSF around cerebral peduncles within interpeduncular cistern, absence of midline shift, visible sulci & gyri, gray-white differentiation). A trauma surgeon & a trainee separately evaluated each patient's CTH, scoring the 7 specific findings as Normal or Abnormal. The primary outcome was need for NSI/MORT in 24 hours due to TBI. Kappa statistics, receiver operating curves (ROCs), and χ^2 tests were used to analyze data.

Results: 444 patients formed the study population; 69 received NSI and 28 died within 24 hours. Kappa statistics for the 7 findings ranged from 0.237 (gray-white differentiation) to 0.801 (midline shift). Trainees interpreted 66.2% of scans as normal vs attendings 72.5%; trainees' interpretations were more accurate, with areas under the ROC curve of 0.848 vs 0.793 for attendings. By trainees' interpretation, 5.8% of patients without abnormal findings had NSI/MORT versus 52.0% of patients with at least one abnormal finding ($p<0.001$); by attending interpretation, 8.7% without abnormal findings had NSI/MORT vs 54.9% with at least one abnormal finding ($p<0.001$).

Conclusions: Any single abnormal finding in this schema significantly predicted a large increase in NSI/MORT in 24 hours in TBI patients. This schema may be used to quickly predict need for intervention and expedite operative and critical care management of moderate & severe TBI.

PREHOSPITAL VITAL SIGNS FOR USE AS PREDICTORS OF ORGAN DONATION POTENTIAL AFTER GUNSHOT WOUNDS TO THE HEAD

Kristen Nordham, BA; Ayman Ali, BS; Scott Ninokawa, BS; Danielle Tatum, PhD; John T. Simpson, MD; Juan Duchesne, MD, MPH; Kristen Nordham, BA
Tulane University School of Medicine

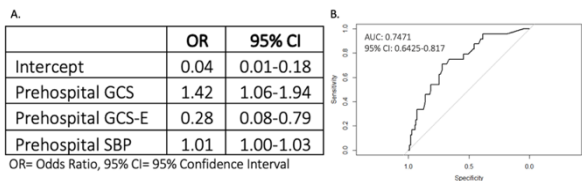
Background: Gunshot wounds to the head (GSWH) have a lower rate of organ donation than the general population. As GSWH patients deteriorate rapidly, vital signs at first contact with medical services may help predict injury progression that is not appreciable after transport to the hospital. We hypothesize that prehospital (PH) vital signs have utility in early identification of organ donor potential.

Methods: Retrospective analysis included all adult trauma patients who presented to a Level 1 trauma center with a GSWH and had signs of life on-scene and at the emergency department (ED) before expiring between 2012-2020. Vitals compared include Glasgow Coma Score (GCS), systolic blood pressure (SBP), and respiratory rate (RR). Logistic regression analysis identified PH vital signs predictive of organ donor potential. Receiver operating characteristic (ROC) curve analysis assessed the predictive accuracy of these factors.

Results: Of 187 subjects, 31 (16.6%) donated organs. Compared to non-donors, donors had significantly higher median PH GCS (4 vs 3, $p=0.02$), SBP (148 vs 115, $p=0.001$), MAP (109 vs 98, $p=0.04$), and RR (19 vs 12, $p=0.01$). There were no significant differences in ED vitals between groups. Logistic regression analysis showed increased PH GCS and increased PH SBP to be predictive of organ donation, while increased PH GCS-Eye was associated with decreased odds of organ donation(A). ROC analysis based on the classification of PH GCS, SBP, and GCS-E showed area under the curve (AUC)=0.75 (95% CI:0.65-0.82) (B).

Conclusion: Screening PH vital signs may help screen GSWH patients for organ donation potential and increase timely referral for donor workup.

A. Significant predictors of organ donation from regression analysis
B. ROC based on prehospital GCS, GCS-E, and SBP identified by logistic regression



THE IMPACT OF HEALTH CARE INSURANCE ON OUTCOMES FOLLOWING TRAUMATIC BRAIN INJURY

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Loyola University Chicago

Introduction: According to a 2020 report by the United States Census Bureau, roughly 8.6% of the population lacks health care coverage. Increasing evidence suggests that insurance status plays a role in outcomes after traumatic injury. However, in the setting of traumatic brain injury (TBI), its impact remains poorly understood.

Methods: The American College of Surgeons Trauma Quality Programs Participant Use File (ACS-TQP-PUF) database was queried from 2017-2019. All patients sustaining an isolated TBI were identified. Isolated TBI was defined as 1) Head Abbreviated Injury Scale (AIS) >3 and 2) AIS <3 in all other anatomical regions. Patients dead on arrival, with Head AIS =6, or with any missing data were excluded from analysis. Demographics, Injury Severity Score (ISS), Glasgow Coma Scale (GCS), and outcomes were compared between those with and without insurance. χ^2 - and Student's t-tests were used for univariate comparisons. Multivariate regressions were used to identify independent risk factors for mortality. Analyses were conducted using RStudio (version 1.4.1717).

Results: A total of 92,940 patients met inclusion criteria, of which 83,967 (90.3%) were insured. When compared to their uninsured counterparts, insured TBI patients were older (56.80 + 24.64 vs 39.58 + 17.33, $p < 0.001$) with a greater proportion of females (37.0% vs 20.7%, $p < 0.001$). Insured patients were more severely injured (ISS >16 50.5% vs 48.8%) and had longer lengths of stay in both the intensive care unit (2.96 + 5.04 vs 2.77 + 5.64, $p = 0.002$) and hospital (6.72 days + 9.38 vs 6.32 days + 10.61, $p = 0.001$). However, they experienced less mortality (8.4% vs 12.5%, $p < 0.001$). When controlling for confounding variables, lack of insurance significantly increased the likelihood of mortality. This effect was most noticeable in patients with Head AIS score = 4 (OR 1.31, 95% CI [1.06-1.61]; $p = 0.013$) and =5 (1.91, [1.69-2.16]; $p < 0.001$).

Conclusions: These results suggest that insurance coverage is independently associated with improved survival in the setting of isolated, moderate to severe TBI.

USE OF NATIONAL INSTITUTE FOR HEALTH AND CARE EXCELLENCE (NICE) HEAD INJURY GUIDELINES AMONG PATIENTS WITH DELAYED PRESENTATION AFTER HEAD TRAUMA CAN LEAD TO MISSED TRAUMATIC BRAIN INJURY

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NYU Langone

INTRODUCTION: Traumatic Brain Injury (TBI) accounted for almost 3 million emergency department visits, hospitalisations and deaths in the United States in 2014. National Institute for Health and Care Excellence (NICE) guidelines, originally developed using data from patients presenting within 24 hours of head trauma, are often used to determine the need for computed tomography (CT) of the head even in patients presenting after 24 hours of head trauma. We aimed to investigate the proportion of overall CT scans done for head trauma at our centre that were performed in late presenters (>24 hours after head trauma), determine and compare the incidence of intracranial pathology in patients with early (<24 hours) versus late presentation (>24 hours), and determine the sensitivity of NICE guidelines for TBI in these two sub-populations.

METHOD: We conducted a retrospective chart review at a tertiary care centre in Karachi. All adults (>16 years) who underwent a CT scan of the head for head trauma over 5 years were included. Data on age, sex, primary diagnosis, co-morbid conditions, mechanism-of-injury, duration (in hours) from head trauma to presentation, site and extent of injury (Injury Severity Scale), duration of hospital stay, number and details of surgical procedures performed, CT scan findings, other injuries, and mortality were collected. Means were compared using Independent sample T-test while categorical variables were compared with chi-square tests. Multivariate logistic regression analyses, adjusting for potential confounders, were performed to determine the predictors of TBI.

RESULTS: We found 2009 patients that met the study eligibility criteria; seven of these were excluded as a result of incomplete medical records. Thus, the final statistical analyses included 2002 head trauma patients. Overall, in both early and late presenters, there was evidence of traumatic injury in 52 % of cases, while the overall mortality rate was 2.3%. Almost one-third (32.2%) of the included patients underwent CT after 24 hours of head trauma. There was evidence of traumatic injury in 46.7% of early presenters and 63% of late presenters. The sensitivity of NICE guidelines for presence of traumatic intracranial injury was found to be 93% for early presenters and 83% for late presenters.

CONCLUSION: Patients presenting to the emergency department after 24 hours of head trauma constitute a sizable proportion of the overall head trauma population. The sensitivity of NICE guidelines for head injury among late presenters is lower and may lead to missed intracranial injuries if imaging is not performed.

ARTERIAL ACCESS COMPLICATIONS FOLLOWING PERCUTANEOUS FEMORAL ACCESS FOR REBOA IN 24 HOUR SURVIVORS

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Introduction: With use of resuscitative endovascular balloon occlusion of the aorta (REBOA) comes the potential for arterial access site complications (AC) and limb ischemic sequelae. We aimed to determine the prevalence of vascular AC and associated clinical and technical factors.

Methods: A retrospective cohort analysis of 24-hour survivors undergoing percutaneous REBOA via the femoral artery in the AAST AORTA registry between Oct 2013 and Sep 2021 was performed. The primary outcome was AC defined as at least one of the following: hematoma, pseudoaneurysm, arteriovenous fistula, arterial stenosis, or use of patch angioplasty for arterial closure. Associated clinical and procedural variables were examined. Data were analyzed using Fisher exact test, Mann-Whitney-U tests, and linear regression.

Results: There were 34 (7%) cases with AC among 485 meeting inclusion criteria. Hematoma (40%) was most common followed by pseudoaneurysm (26%), and patch angioplasty (21%). No differences in demographics or injury/shock severity were noted between cases with and without AC. REBOA outside the ER was associated with AC (AC, 44% vs no AC, 27%; $p=0.04$) while the use of ultrasound (US) was protective (AC, 35% vs no AC, 51%; $p=0.05$). The AC rate in US cases was 12/242 (5%) vs 22/240 (9.2%) without US. Arterial sheath size > 7 Fr was not associated with AC. US use increased over time ($R^2=0.94$, $p<0.001$) with a stable rate of AC ($R^2=0.78$, $p=0.61$). AC were associated with limb ischemia (AC, 15% vs no AC, 4%; $p=0.006$) and arterial bypass procedures (AC 3% vs no AC 0%; $p<0.001$) but amputation was uncommon (AC, 3% vs no AC, 0.4%; $p=0.07$).

Conclusion: Percutaneous femoral REBOA had a 7% AC rate which was stable over time. AC are associated with limb ischemia but need for surgical intervention and/or amputation are rare. The use of US-guided access appears to be protective against AC and is recommended for use in all percutaneous femoral REBOA procedures.

ASSESSING ENDOVASCULAR CANDIDACY IN SUBCLAVIAN AND AXILLARY ARTERY TRAUMA: 11-YEAR ANALYSIS OF OPEN AND ENDOVASCULAR AXILLOSUBCLAVIAN INTERVENTIONS AT A LEVEL-1 TRAUMA CENTER

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Introduction: Endovascular stenting (ES) is a less invasive treatment for traumatic axillosubclavian injuries (ASI). The portion of patients that are endovascular candidates is currently unknown. Common pre-requisites for ES include hemodynamic stability and pre-operative CTA-imaging. We reviewed our institutions experience with ASI with a focus on factors influencing endovascular candidacy.

Methods: Single-center retrospective review of patients with ASI requiring repair at a Level-1 center from 2010-2021. Patients that underwent open repairs were classified as potential “endovascular candidates” if they met the following criteria: 1) Hemodynamic stability (systolic >90mmHg) in the trauma bay and 2) If pre-operative CTA-imaging was obtained.

Results: 27-patients (n=16 Blunt, n=11 penetrating) underwent operations for ASI. Overall mortality was 11.1%. ES was performed in 29.6%(n=8) and open repair in 70.3%(n=19). 63% (n=17) of patients had no trauma bay hypotension. 18.5%(n=5) of patients had single episode hypotension that resolved with resuscitation - all subsequently received CTAs. 18.5%(n=5) of patients were non-responders. Overall 94% (15/16) of blunt and 55% (6/11) of penetrating patients either received ES or met screening criteria for endovascular candidacy. Majority of ES patients (6/8, 75%) received hybrid repairs involving brachial artery cutdown with stent deployment. Patients operated on in a hybrid-OR suite received ES at higher rates than Non-Hybrid-ORs (4/5, 80% vs 4/22, 18%, p=.017). After excluding non-responders, this finding still persisted (4/5, 80% vs 4/17, 24%, p=.039).

Conclusion: A high portion of blunt and a moderate portion of penetrating patients with traumatic axillosubclavian artery injuries meet screening criteria for endovascular stenting. Operative location may influence repair choice, as hybrid-OR use was associated with a higher portion of patients receiving endovascular stenting.

CONCOMITANT CLAVICLE FRACTURE IN THE RIB FRACTURE PATIENT: SHOULD WE BE FIXING MORE?

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Background: Severity of thoracic trauma is directly correlated with the number of rib fractures, as are incidence of pulmonary complications and severity of pain. While many thoracic trauma patients also sustain clavicle fractures, the impact of this additional fracture on outcomes is not well studied.

Methods: At a single level 1 trauma center, all patients aged 16 and over admitted to the trauma service with acute rib fractures from 1/2018 through 9/2021 were studied. Outcomes of interest included impact of a concomitant clavicle fracture on mortality, ICU length of stay (LOS) and ventilator days.

Results: There were 1862 patients with rib fractures, 157 sustained an additional clavicle fracture (8.4%). Average age was greater in the rib fracture only group (63 vs 58, $p = 0.003$). Patients with clavicle fractures sustained greater number of rib fractures (4.8 vs 4.2, $p = 0.004$), had higher injury severity scores (ISS) (15.2 vs 12.8, $p < 0.001$) and were more likely to trigger a trauma activation (93% vs 82%, $p < 0.001$). There was no difference in mortality, ICU admission or need for intubation; however, patients with a clavicle fracture had significantly longer ICU LOS (6 vs 4.3 days, $p = 0.007$) as well as more days intubated (9.5 vs 5.9 days, $p = 0.02$). When controlling for age, number of rib fractures and ISS, patients with clavicle fractures spent an additional 1.34 days in the ICU ($p = 0.032$) though there was no difference in ventilator days ($p = 0.115$).

Conclusion: The presence of a concomitant clavicle fracture in a rib fracture patient could be a marker of severity of injury or an additional factor contributing to pulmonary compromise as evidenced by longer ICU LOS and trend towards increased ventilator days. Further investigation with a larger population is needed to more definitely explore this trend.

EARLY RESOLUTION OF DEEP VEIN THROMBOSIS: ARE WE OVER-TREATING?

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Background: Deep venous thrombosis (DVT) is a common phenomenon with treatment comprised largely of systemic anticoagulation (AC) for a set duration. Many trauma patients cannot receive this therapy due to concomitant injuries at presentation. Serial duplex ultrasounds (US) can be used to assess evolution of DVTs over time and may guide treatment for high-risk patients. We hypothesized that many trauma-related DVTs resolve during the initial admission and thus may not require long-term AC.

Methods: A retrospective trauma registry review was performed for all patients diagnosed with DVT at our level 1 trauma center from January 2012 through December 2021. Patient demographics, LOS, injury pattern, initial duplex US results, DVT treatment and prophylaxis regimens, and subsequent DVT US results were assessed. Weekly screening duplex US are obtained on all trauma inpatients regardless of prior DVT at our facility.

Results: 392 patients were diagnosed with lower extremity DVT of which 261 (66.5%) received follow-up duplex US. Median time to follow-up duplex US was 6 days. The mean hospital LOS was 20.9 days. Of these 261 patients with follow-up US, 90 patients (34.5%) showed DVT resolution at the time of the first follow-up US (**table 1**), and 141 patients (54.0%) had DVT resolution prior to discharge.

Table 1: First Follow-Up Duplex Results by Treatment Regimen

Treatment	Resolution (n,%)	Regression (n,%)	Stable (n,%)	Progression (n,%)
Therapeutic AC (n=106)	41 (38.7%)	1 (0.9%)	53 (50%)	11 (10.4%)
Prophylactic AC (n=79)	31 (39.2%)	8 (10.1%)	34 (43%)	6 (7.6%)
No AC (n=76)	18 (23.7%)	9 (11.8%)	41 (53.9%)	8 (10.5%)
Total (n=261)	90 (34.5%)	18 (6.9%)	128 (49%)	25 (9.6%)

Conclusion: The rate of DVT resolution is high regardless of inpatient AC dosing in our trauma population with over 50% resolution by discharge based on serial duplex US data. Further prospective studies should determine whether patients at risk of complications from systemic AC can safely receive minimal and effective treatment once diagnosed with DVT.

INFLUENCE OF VENOUS SHUNTING ON LIMB OUTCOMES IN MILITARY LOWER EXTREMITY COMBINED ARTERIAL AND VENOUS INJURIES

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Introduction: Combined arterial and venous lower extremity (LE) injuries present complex management challenges. Temporary arterial shunting is widely accepted, but the effect of vein shunting on limb outcomes is not well studied. This study examines the influence of vein shunting on limb outcomes in military femoropopliteal combined arterial and venous injuries.

Methods: A database of LE vascular injuries from Iraq and Afghanistan casualties from 2004-2012 was queried for cases of combined arterial and venous femoropopliteal injuries. Vein shunted and non-vein shunted groups were identified and pertinent variables statistically compared.

Results: Of 135 arteriovenous injuries, 61 (45%) had the vein injury ligated (5 after shunting), leaving 74 arteriovenous injuries undergoing venous repair (37 grafts (3 synthetic), 34 local repairs, 3 patch venoplasty). The vein was shunted in 16 (22%) of these. The shunt and no shunt cohorts had similar demographics, mechanism (70% blast), and ISS (median 18, IQR 10-26). Tourniquets and fasciotomy were used equally. Venous shunts were used almost exclusively in cases in which the artery was shunted (94% vs 22% no shunt, $P<0.001$) and more commonly in cases with bilateral LE vascular injuries (25% shunt vs 3.4% no shunt, $P=0.01$). Shunted veins more frequently underwent graft (versus local or patch) repair (88% vs 40%, $P<0.001$). Vein shunted limbs had numerically higher median MESS (8, IQR 7-9) than non-shunted limbs (6, 5-7, $P=0.24$) and had a numerically greater incidence of multi-level arterial injury (13% vs 7%, $P=0.47$). Amputation was twice as common in non-shunted (26%) than shunted (13%) limbs ($P=0.33$) but any complication with the arterial repair was more common in shunted (44%) than non-shunted (28%, $P=0.24$) limbs.

Conclusion: In combat casualties with combined arterial and venous femoropopliteal injury, vein shunting was used primarily in severely injured limbs in conjunction with arterial shunts and in injuries ultimately undergoing venous graft reconstruction. Despite greater limb and arterial injury severity, vein shunting resulted in an improved limb salvage rate, though arterial repair complications were more common. Temporary shunting of the venous injury should be considered in cases of severe combined LE vascular injury.

META-ANALYSIS OF SURGICAL FIXATION EFFECTIVENESS FOR MULTIPLE DISPLACED RIB FRACTURES

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Background: Evidence for the treatment of rib fractures without a flail component (non-flail) has not yet been adequately gathered, appraised, and integrated. This study evaluated contemporary evidence for the surgical versus non-surgical treatment of adults with multiple displaced non-flail chest rib fractures.

Methods: A systematic literature review and meta-analysis included studies evaluating patients with surgical fixation of non-flail, multiple displaced rib fractures. Random effects models pooled data for outcomes reported in ≥ 2 studies. The primary outcome was the duration of mechanical ventilation (DMV). Secondary outcomes included post-procedural pain, respiratory complications, mortality, tracheotomy, sepsis, intensive care unit (ICU), and hospital length of stay (LOS). Studies were critically appraised using Johns Hopkins Nursing Evidence-Based Practice guidelines.

Results: Thirty-one studies (n=99,678 patients) evaluating surgical fixation of multiple displaced rib fracture patients were included in the meta-analysis. Compared to non-surgical treatment, surgical fixation resulted in statistically significantly shorter DMV (-1.81 days, 95% CI -3.14 to -0.49 days; $p=0.007$), lower 2-week pain intensity (SMD -3.29, 95% CI -5.05 to -1.53; $p=0.003$), lower risk for atelectasis (RR=0.41, 95% CI=0.25 to 0.67; $p=0.0003$), lower risk for any respiratory complication (RR=0.63, 95% CI=0.43 to 0.92, $p=0.02$), and lower mortality risk (RR=0.41, 95% CI=0.23 to 0.73, $p=0.003$). Statistically significant differences were not observed for: pain three days after intervention (SMD -1.28, 95% CI -3.32 to 0.75; $p=0.22$); pneumonia (RR=0.66, 95% CI=0.40 to 1.08; $p=0.10$), acute respiratory distress syndrome (RR 1.19, 95% CI 0.18 to 7.96; $p=0.85$), tracheotomy (RR 0.66, 95% CI 0.30 to 1.44, $p=0.29$), sepsis (RR=0.75, 95% CI=0.17 to 3.28, $p=0.70$), ICU LOS (MD -1.01, 95% CI=-2.42 to 0.939; $p=0.16$), and hospital LOS (MD-1.52, 95% CI 3.97 to 0.92; $p=0.22$).

Conclusions: Surgical treatment of patients with multiple displaced rib fractures resulted in statistically significantly shorter DMV, less 2-week pain, lower risk of atelectasis and overall respiratory complications, and reduced mortality compared to non-surgical treatment.

QUALITY OVER QUANTITY; THE IMPACT OF FUNCTIONAL STATUS ON OUTCOMES OF RIB FRACTURES IN THE ELDERLY

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Introduction: Rib fractures (rfx) are the most common chest injury in trauma patients aged ≥ 65 years. We sought to determine the current mortality impact of rib fractures on a population at high risk for pulmonary decompensation, geriatric patients with pre-existing pulmonary disease.

Methods: After IRB exemption, a retrospective study of patients presenting between 1/2016 and 4/2020 was performed, querying the registry for age ≥ 65 years with history of COPD after fall with rfx diagnosed by computed tomographic imaging. Charts were reviewed for patient demographics, past medical history, associated injuries, complications, and outcome.

Results: 88 patients were identified. Average age was 79 years (range 65-102) with the mechanism of injury most commonly being ground level fall (83%). Mean number of fractured ribs was 4.4 (range 1-15). Overall mortality was 11% initially and 22% at 6 months. Mortality was statistically increased in patients with advanced directives (38% vs 2%), preadmission residence at Skilled Nursing Facility versus home (43% vs 9%), or in those functionally dependent at admission (33% vs 2%). A linear pattern of increased mortality was not found with increasing rib fractures nor was an increased number of fractures associated with mortality risk on multivariate analysis. Preadmission oxygen usage also did not affect mortality.

Conclusion: Despite pre-existing pulmonary disease in this cohort, rfx mortality in the elderly is lower than accepted historical comparisons and appears to correlate with pre-injury functional status. Such data may assist in prognostic discussions in this population.

Number of Rib Fractures	Number of Patients	Mortality (%)		
		Total	Functionally Independent	Functionally Dependent
1-2	18	0 (0%)	0/13 (0%)	0/5 (0%)
3-4	36	3 (8%)	1/24 (4%)	2/12 (17%) *
5-6	17	4 (24%)	0/12 (0%)	4/5 (80%) *
> 6	17	3 (18%)	0/12 (0%)	3/5 (60%) *

- Statistically significant

SURGICAL STABILIZATION OF RIB FRACTURES: NATIONWIDE TRENDS IN TIMING, OUTCOMES AND EQUITY

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Introduction: Recent evidence suggests that surgical stabilization of rib fractures (SSRF) within 72 hours may be beneficial. We utilized a national database to test the hypothesis that outcomes were improved with SSRF within 72 hours. We also explored the frequency of early surgery and the changing racial demographics of patients undergoing SSRF over time.

Methods: We studied the Trauma Quality Improvement Program Participant Use File from 2016-2019 and included patients with chest AIS 3-5 that underwent SSRF. We evaluated injury specifics, demographics, time to surgery, and outcomes including mortality, LOS, and adverse events. Variables were compared using chi-square and Wilcoxon rank-sum tests.

Results: 5,234 (2.9%) of patients with chest AIS 3-5 underwent SSRF. The time to SSRF reduced yearly and the proportion of patients receiving SSRF within 72 hours increased annually ($p < 0.01$). Association between mortality and early surgery was not observed ($p = 0.6$). However, early SSRF was associated with lower rates of VTE, PNA, unplanned intubation/ICU, and total/ICU LOS ($p < 0.01$). Patients undergoing SSRF were noted to be more racially diverse by year and African Americans and those listed as "self-pay or others" were more often delayed to surgery ($p < 0.03$).

Conclusion: The time to SSRF has decreased over time, and an association between SSRF within 72 hours and fewer complications (excluding mortality) was found. The disparities noted among patients undergoing SSRF should be further examined and addressed accordingly.

	2016	2017	2018	2019	p-value
Median Time in Hours to SSRF from Admission (25th-75th %)	77.8 (45.1-123.2)	72.9 (44.1-119.1)	68.1 (40.1-114.7)	68.6 (41.8-108.2)	<0.001
Patients with SSRF w/in ≤72 Hours, % of total	46.2	49.5	55.3	54.7	<0.001
Latinos Undergoing SSRF, % of total	7.1	10.5	11.4	11.1	<0.001
Afr Am Undergoing SSRF, % of total	6.7	8.7	8.7	9.8	<0.001
"Self-pay or Others," Undergoing SSRF % of total	17.1	15.4	16.7	14.5	0.5

THE CHARACTERISTICS AND RESULTS OF ENDOVASCULAR DEVICES IN TRAUMA (CREDIT) STUDY: MULTI-INSTITUTIONAL RESULTS

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Introduction: Endovascular techniques are increasingly used to repair major traumatic vascular injuries, but most endovascular implants are not designed/approved for trauma-specific indications. No inventory guidelines exist for the devices used in these procedures. We aimed to describe the use and characteristics of endovascular implants used for repair of vascular injuries to allow for better inventory management.

Methods: This CREDiT study is a six-year retrospective cohort analysis of endovascular procedures performed for repair of traumatic arterial injuries at five participating US trauma centers. For each treated vessel, procedural and device details were recorded and outcomes assessed with the aim of defining the range of implants and sizes used for these interventions.

Results: A total of 94 cases were identified; 58 (61%) were descending thoracic aorta, 14 (15%) axillosubclavian, 5 carotid, 4 abdominal aortic, 4 common iliac, 7 femoropopliteal, and 1 renal. Vascular surgeons performed 54% of cases, trauma surgeons 17%, IR/CT Surgery 29%. Systemic heparin was administered in 68% and procedures were performed a median of 9h after arrival (IQR 3-24h). Primary arterial access was femoral in 93% of cases, 49% were bilateral. Brachial/radial access was used primarily in 6 cases, and secondary to femoral in 9. Implant details are listed in **Table (mean, range and n, %)**. Five of 94 implants underwent revision (1 open surgery) at a median of 4d postop (range 2-60d). Two occlusions and 1 stenosis were present at follow-up at a median of 1 month (range 0-72m).

Conclusions: Endovascular reconstruction of injured arteries requires a broad range of implant types, diameters, and lengths which should be readily available in trauma centers. Stent occlusions/stenoses are rare and can typically be managed by endovascular means.

	Thoracic Aorta	Ax/SCA	Carotid	Abd. Aorta	Iliac	FemPop
Self-Expand (n, %)	58 (100)	5 (36)	4 (80)	2 (50)	2 (50)	3 (43)
Vessel Diameter (mm)	23 (14-33)	7.7 (5-14)	6.8 (4-12)	11 (7-13)	13 (12-14)	7 (4-11)
Implant Diameter (mm)	27 (21-34)	7.8 (5-11)	11(6-30)	17 (8-26)	11 (8-12)	6 (6-8)
Implant Length (mm)	98 (20-160)	37 (4-100)	48 (20-100)	69 (38-120)	57 (39-90)	84 (40-150)

DOES IMPLEMENTATION OF A STANDARDIZED BLUNT THORACIC TRAUMA SCORE LEAD TO IMPROVED OUTCOMES?

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Introduction: Blunt thoracic injury (BTI) continues to be a major source of morbidity and mortality. Managing the trauma sustained can be a clinical challenge requiring optimal triage of the patient. Prior studies have demonstrated that a standardized score can predict BTI complications. We implemented a novel standardized score (Blunt Thoracic Score, BTS) incorporating age, number of rib fractures, negative inspiratory force (NIF), vital capacity, pain scale, strength of cough, presence of pulmonary contusions, base deficit and history of COPD or smoking to differentiate which patients could benefit from admission to the intensive care unit (ICU).

Methods: Patients admitted to NYU Langone-Long Island from 2018-2020 with BTI who were assigned a BTS and compared to a random sample of patients from 2014-2017 (prior to implementation of BTS). Those with BTS greater than six were admitted to the ICU. Wilcoxon rank-sum, Chi-Square, and Fisher's exact tests were used for bivariate comparisons as appropriate. Logistic and negative binomial regressions were used for multivariable analyses. Using a receiver operating characteristic curve (ROC) and the area under the curve (AUC), the optimal cut-off was determined to predict the need for ICU admission.

Results: From the pre-BTS period, 39 patients were included in the study, and from the post-BTS period 225 patients identified. Median injury severity score (ISS) in both groups was nine. Pre-BTS ICU, admission rate was 61.5% and post-BTS was 43.1%, $p=.03$. Median (IQR) ICU length of stay (LOS) for pre-BTS was 3 (2-4), and post-BTS was 2 (1-3) days, $p=.01$. Median (IQR) hospital LOS for pre-BTS was 5 (4-7), and post-BTS was 3 (2-6) days, $p<.0001$. $BTS>6$ was associated with a longer hospital LOS (IRR 1.70, 95% CI =1.27-2.28) $p<.0001$. Analysis using the ROC curve and AUC showed that a BTS of 7 was the optimal cutoff (sensitivity .87, specificity .86) for determining the need for ICU admission.

Conclusion: Use of a standardized Blunt Thoracic Score is associated with improved ICU resource allocation and decreased ICU and hospital LOS. Prospective analysis of the Blunt Thoracic Score will allow further refinement and optimal utility for triage of patients suffering blunt thoracic injury.

ANTIPLATELET AND ANTICOAGULATION STRATEGIES AFTER FEMORAL ARTERY REPAIR FOLLOWING TRAUMA: PRACTICE PATTERNS AND RESULTS

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Introduction: There remains very little data regarding the utility of anticoagulation (AC) and/or antiplatelet (AP) therapy after traumatic arterial repair. We hypothesize that the use of AC/AP is highly variable and has questionable impact upon outcomes after peripheral arterial repair.

Methods: The AAST PROOVIT Registry was utilized to query femoral arterial injuries requiring surgical intervention. Post-operative AC/AP strategies were examined and the rates of thrombosis/ amputation for each strategy compared.

Results: From March 2013 – Sept 2021, 223 open femoral artery repairs were identified [Primary repair 29.2% (65/223); Autologous interposition or bypass 56.1% (125/223); Synthetic graft interposition or bypass 14.8% (33/223)]. Post-operative AC alone was utilized in 25.6% (57/223); [LMWH 16.1% (36/223); IV heparin 7.6% (17/223); Oral warfarin 0.4% (1/223); Subcutaneous heparin 0.9% (2/223)]. AP therapy was utilized in 17.5% (39/223) [ASA 17.0% (38/223); Plavix + ASA 0.4% (1/223)]. When categorizing these modalities as AC alone, AP alone, or combined regimen, there was no significant difference in adverse outcomes when compared to the group with no recorded AC/ AP ($p=0.43$). Adverse outcomes were defined as thrombosis and/ or amputation. Repair thrombosis and/or amputation occurred in 20 out of 223 instances for a composite complication rate of 4.5% (20/223). Antiplatelet alone yielded a 5.1% (2/39) rate of complication whereas anticoagulation alone showed a rate 12.3% (7/57). The combined regimen rate was 6.7% (6/90) while the group without documented AC/AP showed a rate of 13.5% (5/37).

The addition of antiplatelet therapy to anticoagulation medication did not confer any significant benefit with regards to avoiding thrombosis or amputation ($p = 0.95$). Similarly there was no significant difference in adverse outcome with the addition of anticoagulation to antiplatelet regimen ($p=0.92$).

Conclusion: AC/AP strategies after traumatic femoral artery repair vary widely with no demonstrable benefit to any employed strategy. The addition of antiplatelet or anticoagulation agents does not appear to confer benefit for these injuries when utilizing the presently available data.

Strategy	Total= 223	Thrombosis	Amputation	Total Thrombosis + Amputation
Anticoagulation	25.6% (57/223)	8.8% (5/57)	7% (4/57)	12.3% (7/57)
Antiplatelet	17.5% (39/223)	2.3% (1/39)	2.3% (1/39)	5.1% (2/39)
Anticoagulation + Antiplatelet	40.3% (90/223)	5.6% (5/90)	3.3% (3/90)	6.7% (6/90)
Neither	16.6% (37/223)	0% (0/37)	13.6% (5/37)	13.5% (5/37)

AORTIC OCCLUSION IN THE OPERATING ROOM: RESUSCITATIVE ENDOVASCULAR BALLOON OCCLUSION OF THE AORTA (REBOA) VS. OPEN AORTIC CLAMPING

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Introduction: The use of temporary aortic occlusion (AO) in the operating room is a potentially life-saving intervention that is designed to optimize perfusion to the heart and brain while hemorrhage is controlled within the abdomen itself. Traditionally, this maneuver was achieved during emergent laparotomy via supra-celiac aortic clamping. In recent years, however, the use of REBOA in the operating room for temporary aortic control prior to laparotomy has been introduced. We hypothesize that this newer practice may better avoid the fluctuations in hemodynamics known to occur with emergent entry into an abdominal cavity with uncontrolled bleeding.

Methods: The American Association for the Surgery of Trauma (AAST) Aortic Occlusion for Resuscitation in Trauma and Acute Care Surgery (AORTA) database was used to identify patients undergoing Zone 1 REBOA or open abdominal aortic clamping in the operating room from January 2014 to January 2022. Demographics, injury characteristics, required procedures and outcomes were compared between the two groups using SPSS statistical software.

Results: Over the study period, 161 AO meeting criteria were identified, with 114 Zone 1 REBOAs and 47 open AOs. Blunt mechanisms accounted for 50% of injuries, with a mean admission SBP of 94 mm Hg and a mean ISS of 33. In comparing REBOA to open AO, there were no differences in demographics, presentation physiology, overall injury severity or body region abbreviated injury scores (AIS). The overall mean SBP at time of AO was 73 mm Hg and did not vary between the two groups. Resuscitative requirements were not significantly different between REBOA and open abdominal AO and there was no difference in highest lactate, lowest hemoglobin or highest INR values. There were no significant differences in overall complications, lengths of stay or mortality (45% REBOA vs. 47% Open, $p = 0.797$). Patients undergo REBOA, however, were significantly more likely to have an observed improvement in hemodynamics with AO (86.8% vs. 74.5%, $p = 0.017$) and were more likely to achieve durable hemodynamic stability (77.2% vs. 53.2%, $p = 0.001$) than open occlusion counterparts.

Conclusion: At centers participating in the AAST AORTA database, Zone 1 REBOA is now used more commonly than traditional open abdominal aortic clamping after entry. REBOA appears to be comparable to open AO across most discernable outcomes but is superior to open clamping at improving initial hemodynamics and in supporting durable hemodynamic stability during attempts at definitive hemorrhage control.

EARLY FIXATION OF PELVIC FRACTURE IMPROVES LENGTH OF STAY BUT NOT FUNCTIONAL OUTCOMES

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Introduction: Pelvic trauma is a common occurrence following significant force impact and can often lead to life-threatening complications that require prompt intervention. Data comparing the timing of pelvic fracture fixation on functional outcomes is limited. We hypothesized that early fixation is associated with improved clinical outcomes compared to delayed fixation.

Methods: A retrospective chart review was performed of all adult trauma patients admitted to an urban Level 1 Trauma Center who underwent open reduction and internal fixation of a pelvic fracture. Primary outcomes included ability to ambulate and ability to perform at least one transfer independently at the time of discharge. Secondary outcomes included hospitalization-associated complications. Early pelvic fixation was defined as <48 hours following presentation.

Results: A total of 291 patients presented with 210 acetabular and 81 pelvic ring fractures. Of these, 30.5% (n=64) of acetabular fractures and 38.3% (n=31) of pelvic ring fractures underwent early fixation. Univariate analysis showed that there was no significant difference in functional outcome between early and late fixation for either fracture type. When put into a multivariate model adjusting for age, injury burden, and hospital factors, timing of pelvic fixation again was not a predictor of mobility outcomes. There was no statistically significant difference in complication rates between those who underwent early vs late pelvic fixation. Early fixation, however, was associated with a shorter length of stay for patients with pelvic ring fractures and a lower rate of discharge to rehabilitation or nursing facilities for both fracture types.

Conclusion: While early pelvic fixation does not appear to play a role in short term mobility outcomes or hospital-associated complications for patients with pelvic fractures, our findings suggest early fixation should be considered whenever feasible to reduce hospital LOS and increase home discharge rates for patients.

ENOXAPARIN PRIOR TO FEMUR SURGERY DOES NOT AFFECT BLEEDING: A MULTICENTER PRAGMATIC PILOT STUDY

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BACKGROUND: Controversy exists regarding holding prophylactic enoxaparin doses immediately prior to ORIF of femur shaft fracture due to concerns that operative bleeding risk outweighs the VTE prevention benefit. The objective of this study was to determine the incidence of bleeding complications in trauma patients undergoing femur ORIF based on receipt/non-receipt of enoxaparin within 24 hours prior to surgery.

METHODS: Adult patients undergoing ORIF of closed, near-isolated unilateral femur fractures (2017-19) at Level I/II Centers were enrolled and data retrospectively collected via trauma registry and manual chart review. Patients were grouped by if they received enoxaparin within 24 hours pre-op (ENX+) or not (ENX-) and compared on pre-to-post-op Hb change, EBL, and intra-op pRBC use via univariate analysis ($\alpha=.05$).

RESULTS: Groups did not differ on demographics (Table). For ENX+, median time from last enoxaparin dose to surgery was 12.5 hrs [IQR:9,17]. ENX- patients went to the OR significantly sooner than ENX+ (13.5 v 21.5 hrs, $p<.001$). Comparing ENX- to ENX+, there were no significant differences in pre-op Hb levels (12.8 v 12.5), Hb change (-2.5 v -2.3), EBL (128 v 137), or intra-op pRBC use (0.5% v 0.0%), $p>.05$ for all comparisons. There was no significant difference in DVT or PE occurrence.

CONCLUSION: This pilot study suggests that pre-op administration of enoxaparin in femur fracture patients is safe, feasible and not associated with bleeding complications. These findings warrant verification in a prospective trial.

VARIABLE		ENX - n=415	ENX + n=46	p
Male	n, (%)	213 (51.3%)	28 (60.9%)	.22
Age	Mean (SD)	47.6 (23.4)	41.8 (22.2)	.12
ISS	Mean (SD)	10.3 (2.40)	10.7 (2.2)	.02
BMI	Mean (SD)	28.3 (11.6)	28.9 (8.4)	.49
Time to OR (hr)	Mean (SD)	13.5 (8.0)	21.5 (9.1)	<0.001
Hb pre-op (lowest)	Mean (SD)	12.8 (1.8)	12.5 (2.2)	.29
Hb Change	Mean (SD)	- 2.5 (1.4)	-2.3 (1.6)	.25
EBL (cc)	Mean (SD)	128 (105.2)	137 (91.6)	.38
Intra-op pRBC	n, (%)	2 (0.5%)	0 (0.0%)	.81
DVT	n, (%)	1 (0.2%)	1 (2.2%)	.19
PE	n, (%)	2 (0.5%)	1 (2.2%)	.27

ERECTOR SPINAE BLOCKS DECREASE EARLY OPIOID REQUIREMENTS IN NON-OPERATIVE RIB FRACTURE PATIENTS

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Introduction: Erector spinae plane (ESP) block is a novel regional anesthetic utilized with increasing frequency as an adjunct to multimodal pain regimens (MMPR). The impact of ESP is yet to be determined in non-operative rib fractures. We hypothesized that the addition of ESP block to an MMPR in rib fracture patients would increase incentive spirometry (IS) volume, decrease numeric pain scores (NPS), and decrease opioid consumption.

Methods: A retrospective cohort study from Mar 2020 to Aug 2021 at an ACS verified Level I trauma center was performed. Adult patients (> 18 years), blunt mechanism, and a minimum of 3 rib fractures were included. Patients requiring major thoracic procedures, concomitant major abdominal or extremity injuries (AIS \geq 2), pregnancy, and incarceration were excluded. IS, NPS, and opioid consumption during the initial hospitalization were recorded. Patients received MMPR alone or MMPR and a single shot bupivacaine ESP block, and these groups were compared.

Results: 148 patients (74 in ESP, 74 MMPR alone) were included in the analysis. There were no significant differences between groups in gender, BMI, ISS or chest AIS, but the ESP block patients were older (median [IQR]: 61.1(50.7-75.1) vs 52.9 (41.1-68.8) $p=0.02$) and had more ribs fractured (median [IQR]: 5[4-7] vs. 4[3-6]; $p=0.03$). Opioid consumption was lower in the ESP group on the day following the block (median [IQR]: 7.5[0-15] vs. 15[3.7-45], $p=0.002$). There were no differences in IS and NPS between the two groups.

Conclusion: The addition of a single shot ESP block to MMPR in rib fracture patients decreased opioid consumption in the first 24 hours. Further study is needed to determine if continuous infusion catheters have a more durable effect on opioid consumption or respiratory performance in these patients. However, an ESP block should be considered a viable adjunct for non-operative management of rib fractures.

IS CLINICAL EVALUATION OBSOLETE IN THE EVALUATION OF PENETRATING THORACIC TRAUMA IN THE ERA OF IMAGING?

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Introduction: Despite the advances in imaging technology in trauma, clinical evaluation has a powerful role on the initial assessment of many trauma scenarios. Especially those with potentially unstable hemodynamic injuries. We therefore, analyzed the role of topographic evaluation and hemodynamic stability in discovering specific injuries in a trauma center with a high volume of penetrating thoracic trauma (PTT).

Methods: Prospective register of PTT patients treated during 2017. Subjects were classified according to the location of the wounds as periclavicular, precordial, thoracoabdominal, transmediastinal, and excluded topographic regions (ETR) (meaning outside the predefined regions described). Unstable patients were operated on. Further studies and procedures were dictated by topographic location (TL). Associations between TL, hypotension and injured organs are presented as OR (95% confidence interval).

Results: We included 824 patients, 773 male (93.8%). Median interquartile range (IQR) age was 25 (20 - 33) years. Wounding mechanisms were stab wounds in 532 (64.6%), and fire arms wounds in 292 (35.4%). Entrance wound location was periclavicular in 109 cases (13.2%), precordial in 213 (25.9%), thoracoabdominal in 396 (48.1%), transmediastinal in 47 (5.7%), and ETR in 513 (62.3%). There were entrances in multiple areas in 364 patients (44.2%). Injuries located in the lungs in 458 subjects (55.8%), the diaphragm in 59 (87.2%), the heart in 44 (5.3%), minor vessels in 36 (4.4%), and major vessels in 17 (2.1%). Periclavicular entrances associated with major vascular injury, OR 10.2 (3.4 - 32.2), precordial location with cardiac injury OR 48.3 (15.1 - 245.5), and thoracoabdominal with diaphragmatic injury OR 9.1 (4.03 - 24.0). Sixty-five patients had hypotension at admission. It was associated with a cardiac or vascular wound, OR 9.5 (5.7 - 15.9). A thoracotomy was performed in 93 cases (11.3%). Hypotension associated with it, OR 13.0 (7.2 - 23.5).

Conclusion: In patients with penetrating thoracic trauma, hypotension at admission and topographic location of the wounds are powerful tools to guide decisions regarding surgical indication, surgical access, and complementary studies.

NONOPERATIVE MANAGEMENT OF TRAUMATIC HEMOPERICARDIUM IN PENETRATING PRECORDIAL TRAUMA.

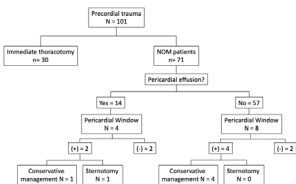
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Introduction: A nonoperative management (NOM) protocol of precordial penetrating trauma (PPT) was implemented in our hospital. We describe the results after three years of the protocol inception.

Methods: Patients ≥ 15 years with PPT were prospectively registered. Unstable or tamponed subjects were operated on immediately. Stable patients were followed clinically, monitored, and evaluated serially with transthoracic ultrasound (US). Surgery was indicated if unstable or tamponade appeared. PW was performed in cases of clinical doubt.

Demographics, trauma mechanism, clinical presentation, trauma indexes, US results, surgical interventions/findings, and mortality were recorded. Continuous variables are presented as median and interquartile range (IQR).

Results: One hundred-one patients were registered. A resuscitative or emergent thoracotomy was performed in 30. The remaining 71 were included in the NOM protocol. Median (IQR) age was 29 (23 - 41) years; 56 (98.2%) were male, and 34 (47.8%) suffered gunshot wounds. The Median (IQR) of RTS, ISS, and NISS were 7.84 (7.84 - 7.84), 11 (10 - 19), and 14 (10 - 27), respectively. Fluid was detected in the pericardium in 14 (19.7%). In 13 in the first examination. Demographics and trauma severity were similar between the US (+) and US (-) groups.



Twelve PW were performed. Eight in the US (-) group (14.0%), and 4 in the US (+) patients (28.6%). The approach for the PW was transdiaphragmatic in 8 cases, thoracoscopic in three, and transthoracic in one.

The PW was positive in 6 cases. It was managed successfully by drainage, lavage, and observation in five. A sternotomy was performed in one patient

to confirm a contusion of the right ventricle.

Among the 14 patients with a US diagnosed hemopericardium, 10 (71.4%) did not undergo surgery. A thoracotomy or sternotomy was avoided in 13 (92.9%). Five out of 6 positive PW were managed conservatively.

Two deaths not related to the thoracic trauma occurred in the (-) US patients. None patient in the (+) US died.

Conclusion: The (NOM) protocol of precordial penetrating trauma (PPT) avoided most PW and thoracotomies/sternotomies without compromising the safety of the patients.

SPINE IMMOBILIZATION LIMITS MAXIMUM INSPIRATORY EFFORT

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Objectives: Maximum incentive spirometry results correlate with respiratory complications following blunt thoracic trauma and are used as a triage tool for patients with rib fractures. Patients with thoracic trauma often require spine immobilization through use of cervical collar and/or logroll precautions. We hypothesized that the presence of a cervical collar and spinal precautions would reduce maximum inspiratory effort.

Methods: This prospective study included 40 uninjured volunteers. Demographic data, including age, height, weight, and respiratory comorbidities were obtained. The predicted maximum inspiratory effort was determined for each participant prior to the experiment using the provided chart. Each participant was tasked to perform maximum inspiratory effort, as measured by spirometry, in four different positions: supine \pm cervical collar, and upright \pm cervical collar. The order in which the subjects performed these values was randomized. The primary outcome variable was spirometry as a percent of predicted volume. The volumes at each position were compared with a paired T-test.

Results: The average age the participants was 25.8 years old and 53% were male. Mean spirometry value in upright position without collar (URWO) was 104% ($\pm 20\%$) of predicted, upright with cervical collar (URW) 93% ($\pm 21\%$), supine without cervical collar (SUWO) 97% ($\pm 23\%$), supine with cervical collar (SUW) was 91% ($\pm 22\%$). When compared to no spinal precautions (UWO), SUWO resulted in a 7% reduction ($p < 0.001$), URW 11% reduction ($p < 0.001$), and SUW 13% reduction ($p < 0.001$).

Conclusion: Maximum incentive spirometry was significantly decreased with spine immobilization in uninjured volunteers. This study highlights the importance of incorporating the presence of a cervical collar and spinal precautions into triage algorithms that use spirometry to predict risk of respiratory complications after thoracic trauma.

SURGICAL RIB FIXATION IN OBESE PATIENTS WITH ISOLATED FLAIL CHEST IMPROVES OUTCOMES: A MATCHED COHORT STUDY

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Introduction: The role of surgical rib fixation (RF) in obese patients is not clear, due to both technical challenges and perceived increased perioperative risk. This study compared outcomes after RF and nonoperative management (NOM) in obesity.

Methods: Adults (BMI>30) with isolated flail chest from the Trauma Quality Improvement Program (TQIP) Database (2016-2018). Patients with RF were propensity score matched 1:2 with NOM. Multivariate regression identified independent factors predicting mortality, prolonged mechanical ventilation, and prolonged ICU stay.

Results: RF was performed in 367/1809 obese patients with flail chest. After matching with 734 NOM, RF was associated with lower mortality rate (1.4% vs. 3.7%; $p<0.05$) and fewer ventilator days (9.2 days vs. 11.5 days; $p<0.05$). On multivariate analysis, RF was associated with improved survival (OR 0.27; $p<0.05$), and early RF (≤ 72 hours) was associated with lower odds of prolonged ICU stay (>7 days) (OR 0.28; $p<0.05$) and prolonged mechanical ventilation (>7 days) (OR 0.28; $p<0.05$).

Conclusion: RF for isolated flail chest is associated with improved outcomes in obese patients. Earlier implementation decreases the odds of prolonged ventilator use and ICU stay.

ULTRA-PORTABLE ULTRASOUND FOR INPATIENT MANAGEMENT OF CHEST TUBES IN TRAUMA: A PROSPECTIVE FEASIBILITY TRIAL (UPUS)

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Background: Bedside ultrasound (US) has shown promising results in the assessment of recurrent pneumothoraces (PTXs) after thoracostomy tube (TT) removal. Advancements in US technology have allowed for ultra-portable, hand-held ultrasound (UPUS) devices to be both affordable and capable of high-quality images. We hypothesized UPUS is feasible, acceptable to patients, and not inferior to standard chest x-ray (CXR) in the assessment of PTX after TT removal.

Methods: This is a single-center, prospective study of all adult trauma patients requiring TTs at a level 1 trauma center. Patients were excluded if they were unable to provide consent for participation. UPUS examinations were performed by two clinically trained researchers using the Butterfly iQ+™ ultrasound. Images were obtained daily while the TT was in place and 1-6 hours following TT removal. Ultrasound results were compared to post-TT removal CXR results. Significant PTX was defined as lack of lung sliding in ≥ 2 intercostal spaces on UPUS, and/or radiology read of a PTX on CXR other than “small”, “trace”, or “tiny”. Examiners were blinded to CXR findings.

Results: A total of 32 patients were enrolled with 59% (N=19) developing a post-TT removal PTX on either CXR or UPUS. Two post-TT removal PTX required reintervention. UPUS and CXR findings were concordant in 20 patients (62.5%). Twelve patients had discordant findings, 10 of whom (80%) had a PTX on CXR that was not identified on UPUS. None of these PTX were significant or required reintervention. UPUS identified two PTX (one significant) that were not seen on CXR. UPUS successfully identified both PTX requiring reintervention. On completion survey 86.67% of patients indicated a preference of UPUS over CXR with the majority (84%) of patients citing comfort (vs. 41% with CXR) and radiation concerns (65% of patients) as driving factors.

Conclusion: UPUS successfully identified all clinically significant post-TT removal PTX and appears to be a diagnostically acceptable alternative to CXR. If UPUS alone had been used to evaluate for post-TT PTX, 30% of patients could have avoided additional hospital days and/or repeat imaging.

EPIDURAL ANALGESIA IN PATIENTS WITH ISOLATED RIB FRACTURES THE 24-HOUR EFFECT ON PAIN AND PULMONARY FUNCTION

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Introduction: Epidural catheter placement is used as part of the multimodal approach in the management of rib fractures. The literature supports improved outcomes with the use of epidural analgesia; however, the specific mechanism and timing of effect remains to be determined. We sought to elucidate the effects of epidural analgesia in patients with isolated rib fractures in the first 24 hours after epidural placement.

Methods: A retrospective review of patients with isolated rib fractures and epidural catheter placement admitted to a rural ACS Level 1 trauma center between January 1- December 31, 2021, was conducted. Verbal pain, visual analog pain scale, vital capacity/incentive spirometry, cough and peak flow data was collected 24 hours before and after initiation of epidural analgesia was retrieved. Patients that underwent rib fixation 24 hours before or after epidural placement were excluded to eliminate the surgery as a confounding variable. Demographic and outcome data were also collected and analyzed.

Results: Fifty patients met inclusion criteria with a median age of 72, 40% female, average ISS of 10 ± 3 , Chest AIS 3 ± 0.3 , GCS 15 ± 0.1 , mean number of ribs fractured was 5.1 ± 2.4 , six (12%) had a flail chest. Average HLOS 10.5 ± 3.9 , ICU LOS 5.5 ± 4.5 . Sixteen patients (32%) had rib fixation procedures, 28 (56%) had chest tubes. One patient developed a PE (2%).

Table I. Pain and pulmonary function before and after epidural placement

Variables	Before Epidural Placement	After Epidural	P values
Average total PIC score \pm SD, median	$7 \pm 2, 7$	$8.4 \pm 1.5, 9$	0.0002
Average verbal pain score \pm SD, median	$5.7 \pm 2.8, 6$	$3.2 \pm 2.2, 2.5$	< 0.0001
Average Wong-Baker \pm SD, median	$5.2 \pm 2.4, 6$	$3 \pm 2.1, 2$	0.0001
Average Subjective cough \pm SD, median	$2.3 \pm 0.5, 2$	$2.5 \pm 0.5, 3$	0.05
Met incentive spirometry goal	26(52%)	29(58%)	0.49
Average Vital Capacity \pm SD, median	$1034 \pm 532, 1050$	$1274 \pm 673, 1250$	0.06
Average Peak Flow \pm SD, median	$118 \pm 100.7, 100$	$160 \pm 85.8, 150$	0.11

Conclusions: In patients with isolated rib fractures epidural placement had significant improvement in subjective pain measurements scores by both Wong-Baker and verbal scores, as well as improvements in PIC (Pain, Inspiration, Cough) scores. There was a trend toward improvement in objective measurements of respiratory function (vital capacity and peak flow) although, not statistically different. Epidural catheter placement may be more helpful with subjective measurements of pain than objective pulmonary function measures. Further study is needed to examine the benefits of epidural placement in isolated rib fractures.

A MICROFLUIDIC STUDY ON THE INTERPLAY OF RED BLOOD CELL (RBC) STORAGE DURATION AND INFLAMMATORY STIMULI

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Introduction: Red blood cell (RBC) aging in the blood bank is characterized by biochemical and morphological changes affecting efficacy in shock states. Sphingosine 1-phosphate (S1-P) from RBCs and endothelium are important in endothelial barrier integrity and function. RBC adherence to the microvasculature may also impede flow and lead to disturbances in perfusion and inflammatory responses. Inflammatory conditions also impact S1-P signaling pathways. Storage duration effects on RBC S1-P concentration and endothelial barrier interactions under flow conditions are unknown. This was studied using a microfluidic flow platform.

Methods: Blood samples were obtained from healthy volunteers and RBC segments from the hospital blood bank. RBC groups included fresh, blood bank storage < 14 days and storage > 21 days. Human umbilical vein endothelial cell (HUVEC) monolayers were established in microfluidic flow devices. Cell monolayers were perfused with media containing tumor necrosis factor (TNF) or media alone followed by perfusion with RBC samples. In other experiments S1-P was added to RBC groups at equal concentrations prior to perfusion of HUVEC monolayers. RBC membrane S1-P content was determined by a fluorescent assay. Endothelial glycocalyx integrity was indexed by thickness and shedding of syndecan-1 (syn-1). Endothelial permeability was indexed by measuring the fluorescence intensity of the interaction of biotinylated fibronectin and FITC-avidin.

Results: Mean \pm SD, N = 4 for each group.

		RBC adherence	Syn-1 (pg/ml)	Glycocalyx Thickness (Fluorescence intensity)	Endothelial Permeability (Fluorescence intensity)
HUVEC control	Fresh RBC	60 \pm 12	28.6 \pm 3.4#	265.2 \pm 9.1#	51 \pm 12#
	< 14 RBC	84 \pm 10*	41.8 \pm 2.1*#	253.4 \pm 8.6#	55 \pm 15#
	> 21 RBC	185 \pm 26*	56.9 \pm 4.4*#	241.7 \pm 6.1#	62 \pm 18#
HUVEC + TNF (media only)		-----	98.7 \pm 7.9	129.4 \pm 6.3	235 \pm 35
HUVEC + TNF	Fresh RBC	98 \pm 18*	76.9 \pm 6.6*#	143.2 \pm 8.7*#	175 \pm 20*#
	< 14 RBC	148 \pm 20*	86.9 \pm 7.2*	134.9 \pm 6.1*	195 \pm 35*
	> 21 RBC	305 \pm 33*	106.2 \pm 7.6*	113.4 \pm 5.2*#	255 \pm 33*

*p<0.05 vs. Fresh RBC (no TNF), #p<0.05 vs. HUVEC + TNF alone

S1-P fluorescence intensity values in fresh RBC, < 14-day RBC and > 21-day stored RBC were 201.3 \pm 14, 133.7 \pm 15* and 95.5 \pm 20*#, respectively (*p<0.05 vs. fresh RBC, #p<0.05 vs. <14 day RBC). Adding S1-P to RBC in the different groups abrogated the negative effects noted on the endothelium and glycocalyx related to RBC storage duration.

Conclusion: RBC vascular adhesion was related to storage duration and inflammatory conditions. This was associated with endothelial glycocalyx degradation and endothelial permeability. RBC S1-P content was inversely related to storage duration and had barrier protective effects. Nanotechnology using S1-P donors may modulate transfusion exacerbation of shock induced microvascular dysfunction.

A PROSPECTIVE EVALUATION OF PLATELET MITOCHONDRIAL BIOENERGETICS IN A BLUNT TRAUMA COHORT

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Introduction: Platelets are dependent on mitochondria for energy production and activation, and mitochondrial bioenergetic defects can lead to aberrant function. Altered platelet bioenergetics have been shown to correlate with patient outcomes in disease states such as pulmonary hypertension and sepsis. Platelet dysfunction is a hallmark of trauma-induced coagulopathy. However, abnormal platelet activation and agonist response are observed in minimally-injured patients – a finding of unclear clinical significance. Platelet mitochondrial bioenergetics have not been prospectively studied in a trauma population and may better identify true platelet lesion.

Methods: The local Institutional Review Board approved this study. Whole blood and clinical data was obtained at presentation from 24 adult blunt trauma patients who met trauma leveling criteria. Platelet mitochondrial bioenergetics were assayed using Seahorse XF extracellular flux analysis, platelet activation was measured by flow cytometry, and plasma cytokine levels were evaluated by immunosorbent assay. 8 healthy volunteers served as controls. Parametric analyses were performed with $\alpha=0.05$.

Results: Median age was 49.5 years, with 67% males. Admitted subjects had a median injury severity score (ISS) of 9. Trauma patients had significantly higher mean levels of IL-6 (30.86 vs 0.00 pg/mL, $p=0.03$), MCP-1 (202.8 vs 46.09 pg/mL, $p=0.004$), and platelet activation (6.76 vs 1.29%, $p<0.001$) compared to controls. There was a nonsignificant trend towards decreased mean basal oxygen consumption rate in trauma patients (156.9 vs 201.1 pmol/min/ 10^6 cells, $p=0.067$). No significant differences were observed between the trauma and control groups in proton leak (45.24 vs 44.78 pmol/min/ 10^6 cells, $p=0.95$), maximal oxygen consumption (350.7 vs 304.8 pmol/min/ 10^6 cells, $p=0.31$), non-mitochondrial respiration (23.9 vs 26.6 pmol/min/ 10^6 cells, $p=0.51$), extracellular acidification rate (23.71 vs 29.36 mpH/min/ 10^6 cells, $p=0.067$), or reactive oxygen species generation (0.043 vs 0.046 pmol/min/ 50×10^6 cells). Analysis of the above variables as a function of ISS showed no differences.

Conclusion: Despite significant increases in acute-phase cytokines and baseline platelet activation in trauma subjects, platelet bioenergetic parameters were relatively unchanged in this blunt trauma cohort.

EFFECTS OF HYPOCALCEMIA ON HEMORRHAGIC SHOCK IN SEVERELY INJURED TRAUMA PATIENTS

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Background: Calcium is essential to various physiologic processes. It has been proposed that the “lethal triad” (i.e., hypothermia, acidosis, and coagulopathy) be altered to include hypocalcemia (hypoCa) and thus referred to as the “lethal diamond.” HypoCa in trauma has been attributed chelation of calcium ions by citrate blood preservatives, but new evidence suggests the traumatic injury itself may independently result in hypoCa that is further exacerbated by blood transfusion. We hypothesize that there is an independent association of hypoCa with increased blood product requirements and mortality.

Methods: We conducted a retrospective study of 1981 severely injured adult trauma patients. Data was collected from a trauma registry from January 2016 to December 2019. Ionized calcium (iCa) levels were obtained from arrival blood draws. Subjects were categorized into two groups by a threshold iCa level of 1.00 mmol/L and compared. Logistic regression analysis was performed to identify independent predictors of mortality at various time points.

Results: Groups were well matched in terms of demographics. The severe hypoCa (iCa <1.00 mmol/L) group showed an increased overall ($p=0.001$), 4-hr ($p=0.007$), and 24-hr mortality ($p=0.003$). There was no difference in prehospital transfusion volumes between the groups ($p=0.25$). Severe hypoCa was associated with more blood products transfused at 4 hours ($p <0.001$), 24 hours ($p <0.001$), and overall hospital length of stay ($p <0.001$). Subgroup analysis was performed on transfused patients comparing resuscitation with whole blood (WB, $n=159$) resuscitation and component therapy (CT, $n=692$). There was no difference in prehospital transfusion volume between the two subgroups. Patients receiving WB were associated with higher iCa ($p=0.01$) and lower transfusion volumes overall and at both early time points (4-hour, 24-hour, $p <0.05$), but no observed difference in mortality or in-hospital outcomes. Logistic regression analysis showed increased odds of early (4-hour) mortality with hypoCa (OR 2.67, 95% CI 1.03, 6.91, $p = 0.04$).

Conclusions: This study supports previous literature showing the association of hypoCa and traumatic injury. We showed that severe hypoCa was associated with increased early and overall mortality and larger blood product requirements without a difference in prehospital blood products amongst these groups. Additionally, hypoCa was found to be an independent predictor of early mortality. These results support the need for future prospective trials assessing the role of hypoCa in trauma and effects of empiric calcium replacement on outcomes and mortality.

EMERGENCY DEPARTMENT REBOA TO STABILIZE PATIENTS FOR CT SCAN PRIOR TO DEFINITIVE HEMORRHAGE CONTROL: AN EMERGING PRACTICE

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Introduction: Resuscitative Endovascular Balloon Occlusion of the Aorta (REBOA) has emerged as a resuscitative tool of modern trauma care at select centers. Over the past several years, practice using these devices has continued to evolve - including the emerging practice of utilizing REBOA to facilitate emergent CT imaging prior to definitive hemorrhage control. Outcomes of these practices, however, have not been previously described in a multi-institutional fashion. We hypothesize that REBOA is increasingly being utilized to facilitate advanced imaging en route to hemorrhage control, and that utilization of this practice in appropriately selected patients does not increase adverse outcomes.

Methods: The AAST AORTA database, amended to include greater granularity regarding intent of REBOA use and patient disposition after use in 2020, was queried to identify patients surviving to move out of the ED after REBOA. Specific focus was then given to those patients proceeding from the ED to CT scan as their initial destination, with details of REBOA use and subsequent outcomes analyzed.

Results: From March 2020 to January 2021, 189 REBOA patients survived to move for the ED to another destination in the hospital. Of these, 24% from 9 different ACS level 1 trauma centers went first to the CT scanner. The reported intent of CT was to identify unclear presence or source / location of hemorrhage in 64% or to image other body areas (e.g. head CT) prior to operation or angiography (24%). Mean age of CT first patients was 37.1 62% were male, mean ISS was 33 and blunt mechanism accounted for 82% (37). Mean admission SBP was 80 mm Hg (\pm 30) and mean SBP at the time of aortic occlusion was 58 mm Hg (\pm 31). REBOA was deployed in Zone 1 for 51%, Zone 2 2.2%, Zone 3 47%. Hemodynamics improved with REBOA in 87% with SBP rising to > 90 mm Hg in 89%. Hemodynamic stability was achieved in 73%. Among occlusion types, total occlusion was most commonly utilized at 89% [Intermittent occlusion 2%; partial occlusion 4%, NOS 4%]. Median balloon occlusion time required was 53.5 minutes (IQR 58). Balloon deflation was ultimately achieved in 76%. After CT scan, patients proceeded to a variety of definitive hemorrhage control interventions, including exploratory laparotomy (44%), embolization of liver/spleen (4%), pelvic embolization (22%), pelvic external fixation (11%) and thoracotomy (4%). Mortality occurred in 56% of patients going first to CT, compared to 51% for all REBOA patients surviving beyond the ED. Complications occurring among survivors of the CT first strategy included AKI (7%), ALI/ARDS (11%), Sepsis/Septic Shock (4%), MODS (4%) and one amputation as a direct result of complication of initial vascular access obtained in the ED (2%).

Conclusion: Initially introduced as a tool to salvage patients who would otherwise not survive delivery to definitive hemorrhage control environments, REBOA practice has continued to evolve. In contemporary practice at multiple level 1 trauma centers, approximately 25% of REBOA patients undergo CT scan immediately following REBOA in order to reportedly assist in hemorrhage source identification and planning or to identify injury in other body regions prior to delivery to OR or IR. Additional research is required to define the appropriate role of this emerging practice.

FLUID RESUSCITATION IN BURN PATIENTS: A RETROSPECTIVE ANALYSIS ON METHAMPHETAMINE'S ROLE IN PLASMA EXTRAVASATION

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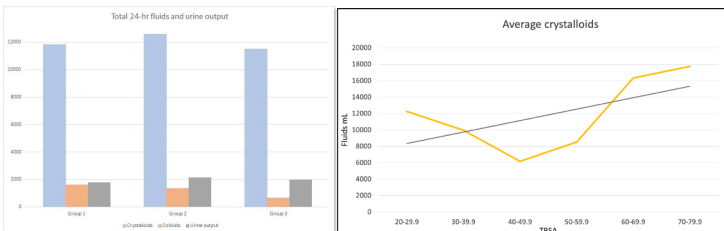
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Introduction: Acute care specialists are faced by the dysregulated inflammatory cascade which require fluid resuscitation. Activation of 5-hydroxytryptamine (5-HT) receptors have been associated with an increase in fluid extravasation. Methamphetamine (METH) is a class II stimulant that stimulates certain 5-HT receptors. METH-induced sensitization has shown upregulation of 5-HT2 receptors and increased release of 5-HT. We posit that these cases will require more intensive resuscitation given their increased serotonin levels.

Methods: Study personnel compared fluid resuscitation in the first 24 hours since burn injury of METH-positive and METH-negative burn patients with a TBSA > 20%. Patients more than 24 hours removed from injury were excluded. A total of 178 patients were selected. 20 patients were METH-positive (Group 1; positive drug screen). 67 patients were METH-negative (Group 2; negative drug screen). 91 patients were deemed METH-negative (Group 3; denial of drug use). Groups were further sequestered into TBSA quartiles. Statistical analysis was done via ANOVA.

Results: Group 1 demonstrated higher average colloids administered than Groups 2-3 (p=.001). 1st, 3rd, and 4th TBSA quartiles of Group 1 showed significance when compared to Groups 2-3 (p=.068, p=.085, p=.085). METH also showed some influence in crystalloids in the 4th TBSA quartile (p=.061).

Conclusion: Given the significance of increased colloid resuscitation for METH-positive patients compared to METH-negative patients, METH may play an indirect role in vascular permeability and fluid expulsion. This is important as colloids are utilized in later stages of resuscitation protocols. Further research on METH's role on fluid imbalances may prove useful for treatment of trauma patients.



OUTCOMES AND SURVIVABILITY IN ADULT TRAUMA PATIENTS UNDERGOING ULTRA-MASSIVE TRANSFUSION

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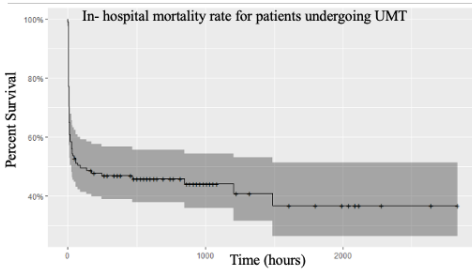
Background: The objective of this study was to determine our institutional efficacy of ultra-massive transfusion (UMT) and to analyze factors associated with outcomes and survivability.

Methods: A retrospective analysis of adult trauma patients undergoing UMT at a Level I trauma center from March 2018-December 2020 was conducted using trauma registry and blood bank databases. UMT was defined as ≥ 20 units of red blood cell products in 24hrs. Patient demographics, clinical presentation, transfused blood products, complications, and outcomes were compared between trauma patients who survived UMT and those who did not.

Results: Over the study period, there were 14,291 trauma activations. 830 patients required massive transfusion protocol, of which, 123 (14.8%), met criteria for UMT. The in-hospital mortality rate was 56.1% and median survival time was 91.0 hours for those undergoing UMT. There were no significant differences in gender, age, race or pre-existing comorbidities between surviving and deceased patients. The patients who died were more clinically unstable at presentation, with lower mean SBP (81.50 vs 99.41, $p=0.031$), HR (81.23 vs 125.2, $p<0.001$), and GCS (6.14 vs 10.48, $p<0.001$), respectively. The deceased cohort received more total blood products (91.20 vs 70.83, $p=0.007$) with significantly higher rates of pRBCs (42.28 vs 37.70, $p=0.044$) and FFP (37.14 vs 25.72, $p<0.001$).

Discussion: For trauma patients undergoing UMT, higher rates of transfusion did not correlate with higher rates of survival, but rather indicated prolonged time to hemorrhage control. With blood as a limited resource, it is prudent to identify which patients will benefit most from this therapy.

Figure 1.0: Kaplan Meir survival curve for adult trauma patients undergoing ultra-massive transfusion (UMT)



OUTCOMES OF PATIENTS ENROLLED IN THE PROPPR TRIAL ON BASIS OF GESTALT AND ABC SCORE

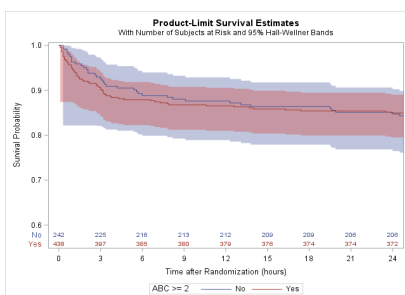
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Introduction: The Pragmatic Randomized Optimal Platelet and Plasma Ratios (PROPPR) trial enrolled patients predicted to require large volume transfusion, based on Assessment of Blood Consumption Score ($ABC \geq 2$) or physician gestalt (PG). We compared characteristics and outcomes of patients enrolled with an $ABC \geq 2$ versus those enrolled by PG.

Methods: Post-hoc analysis of the PROPPR trial by method of predicting transfusion need. Outcomes included proximate (1-hour, 3-hour, 6-hour, 12-hour, and 18-hour), 24-hour, and 30-day mortality, group assignment, time to hemostasis, adverse events, operative procedures, and transfusion requirements.

Results: Of the 680 PROPPR patients, 438 (64%) had $ABC \geq 2$, and 242 were enrolled by PG, with equal ISS and treatment arm distribution between the two groups. The ABC group had more black patients (137 (31%) vs. 50 (21%); $p=0.003$), was younger (median age 30 vs. 44 years, $p<.0001$), and included more patients with penetrating injuries (278 (63%) vs. 55 (23%); $p<.0001$), hypotension (median SBP 95mmHg vs. 111mmHg, $p<.0001$), tachycardia (median HR 124 vs. 100, $p<.0001$), and higher GCS (median 14 vs. 13, $p=0.0452$). Those who died in the ABC group had a faster median time to death (268 minutes vs. 855 minutes, $p=0.0176$), but there were no significant differences in mortality, cause of death, adverse events, operative procedures, or transfusion requirements between the two groups.

Conclusion: The lack of outcomes differences between the two groups suggests that both an $ABC \geq 2$ and physician gestalt are clinically useful for identifying severely injured patients and predicting massive transfusion.



PREHOSPITAL PREDICTORS OF MASSIVE TRANSFUSION PROTOCOL AMONG TRAUMA PATIENTS TRANSPORTED FROM THE SCENE VIA FLIGHT EMS

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Background: In trauma patients at high risk of critical bleeding, timely resuscitation with blood products via massive transfusion protocol (MTP) improves survival. Factors measured during prehospital transport are important tools used by the receiving hospital for early preparation of blood products, including shock index (SI), TXA administration, and extremity injuries. Factors predictive of MTP in the subgroup of patients transported via flight EMS have not been previously examined.

Methods: This was a retrospective study on 212 adult (age ≥ 18 years) trauma patients transported via flight EMS directly from the scene to six level I-III trauma centers between 3/1/2019 and 1/31/2021; 34 patients without documented transport vital signs were excluded. Demographics, injury cause and severity, receiving trauma level, transport blood products, transport TXA, and transport vitals were collected on all patients. Independent associations with MTP were evaluated using adjusted logistic regression analyses.

Results: The majority of patients had a motor vehicle-related cause of injury (66%), and most (87%) were transported from the scene to a level I trauma center, with a median transport time of 19 minutes. Sixteen patients (8%) had MTP initiated at the receiving facility. Transport factors univariately associated with MTP were a cut/pierce cause of injury ($P=0.05$), receipt of whole blood ($P<0.01$), PRBCs ($P=0.02$), or TXA ($P=0.02$) during transport, abnormal HR (≤ 60 or ≥ 120 ; $P<0.01$), abnormal SBP (≤ 90 ; $P<0.01$), abnormal GCS (<13 ; $P<0.01$), and abnormal SI (≥ 0.9 ; $P<0.01$). In adjusted analyses, receipt of transport whole blood (OR=8.52; $P<0.01$), abnormal SBP (OR=8.07; $P<0.01$), and abnormal GCS (OR=8.38; $P<0.01$) were associated with MTP. The adjusted logistic model containing these three variables was very highly accurate at predicting the outcome of MTP (c-statistic: 0.92).

Conclusions: Three factors—receipt of whole blood during transport, $SBP \leq 90$, and $GCS < 13$ —were strongly predictive of MTP in this trauma population transported via flight EMS. The combination of these three factors has not been identified previously and can be of vital importance to flight EMS personnel when identifying patients for whom MTP should be initiated immediately upon hospital arrival, potentially allowing for earlier preparation of blood products at the receiving facility.

REBOA AFTER PENETRATING INTRATHORACIC INJURY: AN AORTA REGISTRY ANALYSIS

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Background: Use of resuscitative endovascular balloon occlusion of the aorta (REBOA) for noncompressible torso hemorrhage (NCTH) has shown promise for stabilizing NCTH patients. Currently, there is a gap in evidence on the benefits of REBOA use in the management of penetrating intrathoracic injury. We sought to evaluate the role of REBOA use for penetrating chest trauma.

Methods: This was a review of the Aortic Occlusion for Resuscitation in Trauma and Acute Care Surgery (AORTA) registry for patients with penetrating chest injuries from 2013 to 2022 who presented with signs of life and chest Abbreviated Injury Score \geq 2. Those with CPR before or at admission were excluded.

Results: A total of 86 patients, 47 RT (55%) and 39 REBOA (45%), met inclusion criteria. There were no differences between RT and REBOA for median injury severity score, initial systolic blood pressure (SBP), or initiation SBP. (**Table**) REBOA patients had longer occlusion time ($p<0.001$), but higher median response SBP ($p=0.01$), and more frequent hemodynamic improvement and stability. Uncontrolled source of bleeding above the occlusion occurred more frequently in the RT group ($p=0.01$). Ten REBOA patients required thoracotomy within the first 24 hours. Mortality was significantly lower in REBOA vs RT patients ($p<0.001$).

Conclusion: Following penetrating intrathoracic injury, hypotensive patients without hemodynamic collapse may benefit from REBOA. Indications for REBOA use in penetrating chest injuries need to be identified and further developed.

Parameter	RT (n=47)	REBOA (n =39)	P-Value
Injury Severity Score, median (IQR)	26 (21-35)	34 (24-42)	0.196
Initial SBP, median (IQR)	110 (80-140)	109 (84-130)	0.862
Initiation SBP, median (IQR)	88 (59-106)	80 (60-100)	0.886
Occlusion Duration, median (IQR)	18 (9-42)	45 (27-75)	<0.001
Response SBP, median (IQR)	99 (58-130)	120 (101-140)	0.014
Hemodynamic Improvement, n (%)	32 (68)	34 (87)	0.037
Hemodynamic Stability, n (%)	16 (34)	28 (72)	<0.001
Uncontrolled bleeding identified above the occlusion, n (%)	28 (60)	12 (31)	0.012
ED Mortality, n (%)	5 (16)	1 (10)	0.670
OR Mortality, n (%)	18 (58)	5 (50)	
ICU Mortality, n (%)	8 (26)	4 (40)	
Overall Mortality, n (%)	31 (66)	10 (26)	<0.001

SONORHEOMETRY VERSUS ROTATIONAL THROMBOELASTOMETRY IN TRAUMA

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Background: Rotational thromboelastometry (ROTEM) is used to rapidly identify trauma-induced coagulopathy (TIC) and direct targeted interventions in hemorrhaging trauma patients. ROTEM performance, however, may be affected by mechanical interference with the forming clot. A novel technology named sonic estimation of elasticity via resonance (SEER) sonorheometry avoids mechanical clot interference, thus potentially increasing diagnostic accuracy. The aim of this study is to compare the performance of SEER with ROTEM in diagnosing TIC, guiding hemostatic resuscitation, and predicting clinical outcomes.

Methods: Samples were collected from adult trauma patients enrolled into a prospective cohort study (ISRCTN12962642) upon admission to a Level 1 Trauma Centre between 2020-2021. Samples were analyzed using SEER, ROTEM and clotting tests. Statistical analysis utilized Spearman correlations and areas under the receiver operating characteristic curve (AUC).

Results: Samples from 221 patients were analyzed. Patients had a median age of 35 years (interquartile range [IQR] 25-49), 86% (190/221) were male, 64% (142/221) suffered blunt injuries, median injury severity score was 16 (IQR 5-28) and 6% (14/221) died within 24hr. Correlations were strong between SEER and ROTEM parameters (all $p < 0.001$): $r = 0.902$ for clot stiffness (CS) and EXTEM A5; $r = 0.849$ for fibrinogen contribution to clot stiffness (FCS) and FIBTEM A5; and $r = 0.726$ for platelet contribution to clot stiffness (PCS) and EXTEM-FIBTEM A5. SEER showed moderate-high discrimination for validated ROTEM cutoffs: CS AUC=0.946 for EXTEM A5 \leq 40mm; FCS AUC=0.923 for FIBTEM A5 \leq 10mm; and PCS AUC=0.870 for EXTEM-FIBTEM A5 \leq 30mm. While CS showed higher discrimination than EXTEM A5 in predicting TIC (INR $>$ 1.2) (AUC 0.831 vs 0.790, $p = 0.038$), the ability of FCS to detect hypofibrinogenemia ($<$ 2g/L) was good, but lower than FIBTEM A5 (AUC 0.792 vs 0.845, $p = 0.027$). There was no difference between SEER and ROTEM in detecting thrombocytopenia ($p = 0.142$) and predicting major hemorrhage ($p = 0.583$) or mortality at 24hr ($p = 0.158$).

Conclusions: SEER is comparable to ROTEM for diagnosing TIC with greater accuracy to detect abnormal clotting time parameters but reduced discrimination for hypofibrinogenemia. Prediction of clinical outcomes was similar between devices.

A DECREASE IN PLATELET COUNT IS ASSOCIATED WITH INCREASED MORTALITY IN HEMORRHAGIC SHOCK

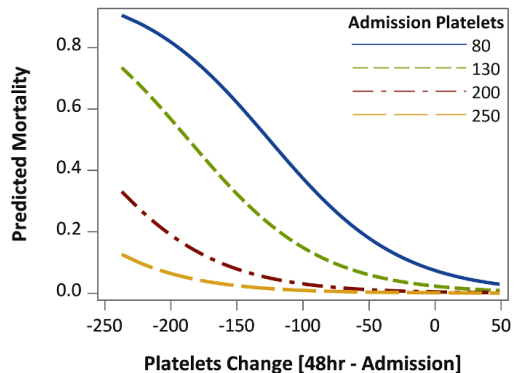
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Introduction: Despite advances in trauma care, the mortality rate after hemorrhagic shock remains high. Excessive platelet aggregation leading to microvascular thrombosis may contribute to multisystem organ failure and death. We hypothesized that a decrease in platelet counts would be observed in patients with higher morbidity and mortality after trauma and hemorrhagic shock.

Methods: A retrospective review of severely injured trauma patients at a single ACS-verified Level 1 Trauma center was conducted. Patients who underwent massive transfusion (≥ 4 units of blood in the first hour or ≥ 10 units in the first 24 hours after injury), had surgical or procedural control of bleeding, and postoperative ICU admission were included. Those who died within 6 hours of presentation were excluded. Demographics, injury mechanism, initial and 48-hour platelet counts and outcomes were analyzed. Means were compared using Wilcoxon tests, and correlations assessed using Spearman's correlations (r_s). Logistic regression was used to assess factors associated with mortality.

Results: From Jan 2018 to Dec 2019, 144 patients met the inclusion criteria. A blunt mechanism was most common (51%), 86% had an ISS ≥ 15 and 60% ISS ≥ 25 , and 33% had Glasgow Coma Scale ≤ 8 . Platelet counts on admission averaged $201 \times 10^9/L$ (range 17-459). 26 patients (18%) died in hospital with 11 in the first 48 hours. Using a model adjusting for ISS and trauma mechanism with admission platelets and 48-hour change in platelets, mortality increased with lower admission platelets (for each $10 \times 10^9/L$ decrease, OR=1.28 95% CI 1.05, 1.55 $P=0.013$). The average change in platelets at 48 hours, $-88 \times 10^9/L$ (SD=90), was associated with increased mortality, OR = 5.89 (CI 1.19, 29.23, $P=0.030$). This model classification accuracy of AUC=0.90.

Conclusion: Patients with an initial low platelet count and those with a decrease platelet count after 48 hours had increased mortality. The exact mechanism of this phenomenon is not understood. Platelet aggregation due to the decreased proteolytic activity of ADAMTS-13 and increased circulation of ultra-large von Willebrand factor may play a role. Future studies examining ADAMTS-13 and microvascular thrombosis are required.



BALANCED RESUSCITATION AND EARLIER MORTALITY ENDPOINTS: A BAYESIAN ANALYSIS OF THE PROPPR TRIAL

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Introduction: The Pragmatic Randomized Optimal Platelet and Plasma Ratios (PROPPR) Trial failed to demonstrate a mortality difference for hemorrhaging patients receiving a balanced (1:1:1) versus a red blood cell heavy (1:1:2) resuscitation at 24-hours and 30-days. Subsequent guidelines recommend utilizing earlier mortality endpoints when assessing hemorrhage-related death to mitigate confounding from later causes of trauma-related death. This study sought to reassess the mortality effects of a balanced resuscitation strategy using Bayesian techniques at earlier time points within the initial resuscitation via a post hoc analysis of the PROPPR Trial.

Methods: Bayesian hierarchical models were created to assess mortality differences at the 1, 3, 6, 12, 18, and 24 hour time periods between study cohorts. Posterior probabilities and Bayes Factors were assessed at each time period.

Results: A 1:1:1 resuscitation displayed at least a 92% probability for mortality benefit at all time periods tested when compared to a 1:1:2 approach and further demonstrated “strong” to “decisive” supporting evidence via each respective Bayes Factor. (Table 1)

Conclusion: Post hoc Bayesian analysis of the PROPPR Trial demonstrates a high probability of mortality reduction with a balanced resuscitation strategy for patients in hemorrhagic shock, especially at more proximal time points during the initial resuscitation. Bayesian approaches should be considered for future studies assessing trauma related outcomes.

DOES AN EARLY, BALANCED RESUSCITATION STRATEGY REDUCE THE NEED FOR CRYOPRECIPITATE TRANSFUSION IN HEMORRHAGIC SHOCK?

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Background: With new forms of fibrinogen replacement becoming available and ongoing studies evaluating early cryoprecipitate transfusion, some centers have recommended including concentrated fibrinogen replacement in massive transfusion protocols (MTP). Given our center's policy of balanced resuscitation (1:1:1), beginning in the prehospital setting, we hypothesized that our rate of hypofibrinogenemia would be low and that fibrinogen replacement should remain an on-demand product, and not part of our MTP.

Methods: All patients presenting to our trauma center 11/17-4/21 were reviewed. We then evaluated all patients who received emergency-release and MTP products. Patients were defined as hypofibrinogenemic (HYPOFIB) if admission fibrinogen <150 or r-TEG angle <60. Univariate analysis sought to define risk factors for presenting with HYPOFIB, while multivariate modeling evaluated their impact on outcome (30-day survival).

Results: Of 29,782 patients entered into the trauma registry, 6,618 level-1 trauma activations, and 1,948 patients receiving emergency release blood and MTP products during this time, <1%, 2%, and 7% were HYPOFIB, respectively. HYPOFIB patients were more likely to be younger, have higher head AIS, and arrive with worse coagulopathy and shock (Table). HYPOFIB had lower survival, shorter time to death, and were more likely to die from head injury. Among HYPOFIB patients, 10% received early cryoprecipitate (0-2 hours). However, there was no difference in survival for those that received early cryoprecipitate (40 vs 47%; $p=0.630$). HYPOFIB patients that died had markedly higher head AIS (5 vs 3) and overall ISS (38 vs 26), but no difference in arrival vitals or evidence of shock.

Conclusion: Early, balanced resuscitation is associated with a low prevalence of admission HYPOFIB. Centers observing higher rates may be using unbalanced ratios for resuscitation and/or delaying the initiation of such ratios. HYPOFIB patients present with a phenotype of severe brain injury, profound shock, and coagulopathy. Routine inclusion of fibrinogen replacement in MTPs does not appear to be warranted at this time.

EARLIER VASOPRESSOR REQUIREMENT AMONG HYPOTENSIVE TRAUMA PATIENTS IS INDEPENDENTLY ASSOCIATED WITH POOR OUTCOMES

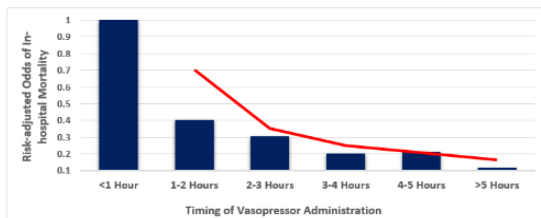
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Background: Early low-dose vasopressin supplementation has shown benefit in the resuscitation of trauma patients. Optimal utilization of any vasopressor agent during early post-injury resuscitation remains unclear, and there is a paucity of data describing the relationship between vasopressor timing (VT) and outcomes. The aim of our study is to assess the current use of vasopressor agents among hypotensive trauma pts and describe the relationship between VT and outcomes.

Methods: Analysis of 2017-2018 ACS-TQIP. All hypotensive adult trauma pts (lowest SBP < 90 mm Hg) with early vasopressors within 6-h of admission were included. Severe head (AIS > 4) and spinal cord injury pts were excluded. VT administration was analyzed. Outcome measures were 24-h & hospital mortality, complications, intensive care unit (ICU) length of stay (LOS) & ventilator use, and 24-h transfusions. Multivariate regression was performed to assess the independent effects of VT on outcomes.

Results: 1,049 hypotensive trauma pts were identified. Mean age was 55y, 70% were male, and 70% were White. Median ISS was 16, 80% had blunt injury, and mean SBP was 61 mmHg. 4-h and median time to first vasopressor administration was 319 min. 24-h mortality was 19%, in-hospital mortality 41%, complication rate 26%, and 4-h and 24-h transfusion median were 5 and 7 respectively. Every 1-h delay in vasopressor administration beyond the first hour was independently associated with lower odds of 24-h (aOR 0.65; p < 0.001), and in-hospital mortality (aOR 0.65; p < 0.001) (**Figure**), complications (aOR 0.77, p = 0.003), and higher odds of longer ICU LOS ($\beta + 2.53$, p = 0.012). There were no associations between early VT administration and ventilator use duration and 24-h PRBC transfusions (p > 0.05).

Conclusion: Earlier vasopressor among hypotensive trauma pts was independently associated with increased mortality and complications. Further research on the utility and optimal VT during the post-injury resuscitative period is warranted, and caution must be used when administering these agents to hypotensive trauma pts in hemorrhagic shock.



END-TIDAL CO₂ AS AN INDICATOR FOR RESUSCITATIVE THORACOTOMY

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Introduction: As the last option during traumatic cardiac arrest, surgeons reserve the use of resuscitative thoracotomy (RT) to those that may benefit. National guidelines use time of pulselessness as the primary determinant for RT, although it is often approximate or inaccurate. Quantitative end-tidal CO₂ (ETCO₂) is an objective measure, rapidly obtainable on arrival, that may improve stratification of patients who could benefit from thoracotomy. We hypothesize that use of ETCO₂ increases survivability to the OR after resuscitative thoracotomy.

Methods: A retrospective cohort study of the Trauma Registry of the American College of Surgeons (TRACS) from 2010-2020 was performed. Inclusion criteria were adult patients undergoing RT at a Level 1 Trauma Center. Demographics and resuscitation characteristics were culled. Patients with RT performed outside the ED were excluded. Primary outcome was survival to the operating room (OR). Univariate and multivariate analysis were performed to evaluate whether quantitative ETCO₂ improved survival over qualitative ETCO₂ and to determine an ETCO₂ threshold for improved survival.

Results: 116 patients were included, 61 (52.8%) had quantitative ETCO₂ measured. Quantitative ETCO₂ patients received more pre-hospital blood transfusions (45.9% vs. 18.2%, $p = 0.001$) and MTP activations (87.9% vs. 69.1%, $p = 0.02$). Survival to OR was higher using quantitative end-tidal CO₂ compared to qualitative measurement (OR 3.12, 95% CI 1.12 to 8.78). There was no significant survival improvement when using ETCO₂ threshold > 15 mm Hg or >20 mm Hg. Overall cohort survival to discharge after RT was 7% and was not different between ETCO₂ groups.

Conclusions: For patients undergoing RT for traumatic cardiac arrest, quantitative ETCO₂ predicted higher survival to the operating room compared to patients with qualitative ETCO₂, however no distinct ETCO₂ threshold was associated with increased odds of survival to OR.

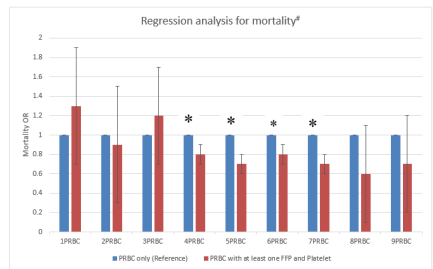
FRESH FROZEN PLASMA AND PLATELETS IS ASSOCIATED WITH BETTER OUTCOMES EVEN IN TRAUMA PATIENTS REQUIRING SUB-MASSIVE TRANSFUSION

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Introduction: Aim of our study was to evaluate if administration of fresh frozen plasma (FFP) and platelets in trauma patients requiring sub-massive transfusion (SMT defined as less than 10 units PRBC within the first 24 hours) effects outcomes.

Methods: 2-year analysis of all adult trauma patients in the TQIP-database. All patients receiving 1-9 units of PRBC within first 24 hours were included. Patients on pre-hospital anticoagulation were excluded. Patients were divided into two groups: those who received PRBC alone (PRBC group) vs. those who received at least one unit of FFP and platelets in addition to PRBC (combined resuscitation or CR group). Primary outcome was hospital mortality, and secondary outcome was in-hospital complications. Multivariable regression analysis and propensity-score matching were used to control for confounders.

Results: Mean age was 48±21 years, 68.5% were male and 74.4% were white. Median ISS was 11[9-17] and 84% had blunt injuries. On regression analysis controlling for age, gender, race, ISS, body region AIS, ED vitals, and admission GCS, patients in the CR had significantly lower mortality in patients who received 4-8 units of blood PRBC, compared to those patients who received PRBC only as demonstrated in Figure 1. Propensity score matching was performed matching the two groups (>3PRBC alone vs. >3CR) for demographics and injuries. CR patients were associated with lower complications overall (18% vs. 29%).



* Significant value (p < 0.05)
* Regression analysis controlling for age, gender, race, ISS, body region AIS, ED vitals, GCS, Temperature, anticoagulant use

Conclusions: Trauma patients requiring more than 3 units of PRBC had lower complications and death if they received FFP and platelets during the resuscitation even in the SMT group.

HIGHER DOSES OF CALCIUM ARE CORRELATED WITH IMPROVED COAGULOPATHY 24-HOURS AFTER INJURY IN TRAUMA PATIENTS RECEIVING MASSIVE TRANSFUSION.

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Introduction: Calcium is a co-factor for clotting factors and important for platelet and fibrinogen stabilization. Between 85% and 94% of trauma patients treated with massive transfusion protocols (MTP) develop hypocalcemia and 71% of those patients develop severe hypocalcemia. The two primary causes of hypocalcemia are phosphate binding and citrate toxicity. It is unknown if there is a linear relationship between the dose of elemental calcium per blood product administered and improved coagulopathy in trauma patients undergoing MTP. This study aims to evaluate if there is a correlation between increased intravenous Calcium administration during MTP and improved coagulation.

Methods: We performed a retrospective analysis of trauma patients at a level 1 trauma center who received MTP over two years (2018- 2020). Doses of intravenous elemental calcium given within 24 hours of admission were collected, and an elemental calcium to blood product ratio (CBR) was calculated for each patient 4 and 24 hours after hospital arrival. Pearson's correlation coefficient was calculated to measure the degree of linear association between CBR and coagulopathy based on rotational thromboelastometry (ROTEM) values.

Results: Patients had a mean age of 44 years, a mean Injury Severity Score (ISS) of 36, a mean lactate of 4.9 and mean arterial pH of 7.32 (N = 1246). Pearson correlation coefficient demonstrated a linear relationships between EXTEM A10, EXTEM A20, EXTEM clotting time (CT), EXTEM Maximum Clot Firmness (MCF), INTEM A10, INTEM MCF and INTEM CT and CBR 4 hours after admission ($r = 0.32$, $r = 0.3$, $r = -0.4$, $r = 0.31$, $R = 0.38$, $r = 0.36$, $r = -0.38$). There was a similar linear relationship between EXTEM A10, EXTEM A 20, EXTEM CT, EXTEM MCF, INTEM A10, INTEM MCF and INTEM CT and CBR 24 hours after admission ($r = 0.27$, $r = 0.24$, $r = -0.4$, $r = 0.28$, $r = 0.34$, $r = 0.33$, $r = -0.5$).

Conclusion: CBR calculated at 4 and 24 hours after arrival were positively correlated with ROTEM values that indicate improved coagulation (A10, A20, MCF) and negatively correlated with ROTEM values that demonstrate worsened coagulation (CT). A higher ratio of calcium to blood products is associated with better clotting 24 hours after hospital arrival, and regular intravenous calcium administration should be a standard component of massive transfusion during trauma.

HOPE IN TRAUMA: A SINGLE INSTITUTION'S EXTERNAL VALIDATION OF THE HYPOTHERMIA OUTCOME PREDICTION AFTER EXTRACORPOREAL LIFE SUPPORT (HOPE) SCORE FOR HYPOTHERMIC CARDIAC ARREST AND A CALL FOR RE-CONSIDERATION IN TRAUMA PATIENTS

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Background: Accidental hypothermia requiring hospitalization is associated with a high complication and mortality rate, particularly when associated with hypothermic cardiac arrest. It is challenging to predict outcomes and survivability following rewarming in such patients. The Hypothermia Outcome Prediction after Extracorporeal Life Support (HOPE) score, which includes sex, age, potassium, CPR duration, and temperature, predicts patient benefit from extracorporeal (EC) rewarming with a high negative predictive value. When created, this score did not include trauma patients, and evidence-based guidelines currently do not exist surrounding the management of hypothermic trauma patients. The objective of this study was to externally validate the HOPE score and evaluate its performance in trauma patients. We hypothesize that the HOPE score will perform differently in trauma patients than uninjured patients and highlight different threshold scores for active internal rewarming measures

Methods: This is a retrospective review of all patients at an urban Level 1 Trauma Center from January 2010 to December 2020 admitted with an initial core body temperature $<35^{\circ}\text{C}$. Patients were identified based on initial emergency department temperature and grouped based upon the rewarming strategy used: external rewarming (including blankets, heating lamps, etc) or active internal rewarming (including rewarming with closed-loop central venous internal warming circuit [Alsius] or EC arteriovenous rewarming). Pairwise comparisons between external versus internal rewarming patients were completed. Pairwise comparisons between EC rewarming survivors and non-survivors were performed. Finally, HOPE scores were calculated for each patient with an AUROC analysis to assess its predictive performance overall and in a trauma patient sub-group.

Results: Overall, 652 patients were included. The median age was 55.0 years, the majority were male (76%), 18% presented after trauma, and with an average initial temperature of 33.5°C . 84% underwent external rewarming versus 16% internal rewarming (11% Alsius, 5% EC). Compared to patients who underwent external rewarming, internal rewarming patients were more likely to be male (89% vs 74%, $p=0.0006$), more hypothermic (27.0°C vs 33.8°C , $p<0.0001$), hypotensive (systolic blood pressure 98 vs 123, $p<0.0001$), and had higher mortality rate (22% vs 11%, $p=0.007$). The EC rewarming subgroup ($n=30$) had an average initial temperature of 23.9°C and 66% presented in cardiac arrest. 27% of the patients had sustained trauma. The mortality rate was 56%, with 41% expiring within the first hour of rewarming. Compared to EC survivors, those who expired after initiation of EC were more coagulopathic (LY30 on thrombelastography of 39.4% vs 0.0%, $p=0.009$), with more profound shock (base deficit of 18.0 vs 13.0 $p=0.04$), and had longer CPR time (45 vs 22 minutes, $p=0.03$). The average HOPE score was 0.67 (0.85 in survivors vs 0.65 in non-survivors, $p=0.02$), with an AUC of 0.73 and Youden's score of 0.75 (sensitivity of 76.5% and specificity of 61.5%). When the HOPE score was calculated in the cohort of trauma patients, the predictive ability increased, with an AUC of 0.99 and Youden's score of 0.75 (sensitivity of 80% and specificity of 66.7%).

Conclusion: This study is the first to examine accidental hypothermia and the HOPE score in trauma patients and highlights the role of trauma surgeons' engagement in the care of patients with profound accidental hypothermia in which the role of invasive rewarming techniques may be lifesaving. This analysis not only validates the HOPE score at our institution but also highlights its superior performance in trauma patients and the need to reconsider a HOPE score cut-off to pursue invasive resuscitation measures in trauma patients.

MACHINE LEARNING TO AID DECISION MAKING IN PATIENTS WHO MAY BENEFIT FROM PREHOSPITAL TRANEXAMIC ACID

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Background: Trauma-induced coagulopathy (TIC) is characterised in part by hyperfibrinolysis. Tranexamic acid (TXA) confers maximum benefit in patients at risk of TIC if given within one hour of injury. Early TXA treatment relies on clinicians identifying patients at risk of TIC, before any viscoelastic assessments can aid decision making. This can be challenging, thus TXA is often given late or not given. A validated Bayesian Network (BN) model that accurately predicts TIC (TIC-BN) using prehospital (PH) variables may help identify patients in whom PH TXA is indicated. The aim was to determine the proportion of patients in each TIC-BN risk strata who received TXA \leq 1hr from injury. Secondary aims were to compare TXA treatment within TIC-BN risk strata among outcome-related subgroups.

Methods: Retrospective study of the UK trauma audit research network database (TARN) between 2015-2019, of patients aged \geq 16 years, who had hemorrhage control intervention or blood transfusion, excluding pregnancies and burns. Patients were risk-stratified using TIC-BN: very low ($<$ 2%), low (2-4%), moderate (4-12%), high (12-33%), and very high ($>$ 33%).

Results: A total of 27,272 patients were included. Median age was 51 years (interquartile range (IQR) 32-71), 68% were male, 86% suffered blunt injury, median injury severity score was 13 (IQR 9-25). Overall, 5571 (20%) patients received TXA \leq 1hr, including 368/3403 (11%) with very low risk of TIC, 494/4764 (10%) low risk, 1805/9408 (19%) medium risk, 2003/8173 (25%) high risk, and 901/1524 (59%) very high risk (χ^2 for trend TXA \leq 1hr vs rest: $p <$ 0.001). The proportion of patients who had TXA \leq 1hr increased as TIC risk increased among outcome-related subgroups: major transfusion (\geq 4U blood products), massive transfusion (\geq 10U), early (\leq 24hr) and late (\leq 28dy) mortality (all $p <$ 0.05). However, of those with medium or higher TIC risk, 53% of all patients, 37% of massive transfusion patients, and 46% of patients who died early, did not receive TXA \leq 1hr.

Conclusions: Eighty percent of the patients for whom TXA is indicated do not receive it within one hour of injury, including over half of those at medium TIC risk or greater. Earlier identification of TXA-eligible patients predicated on accurate machine learning risk prediction using prehospital variables, may allow more tailored treatment for patients at risk of TIC.

HYPOCALCEMIA IN TRAUMA: UNDERDIAGNOSED AND UNDERTREATED WITH SEVERE CONSEQUENCES

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Background: Trauma patients receiving massive transfusion of citrated blood are at increased risk for hypocalcemia. Early identification and correction of hypocalcemia may aid in reversal of trauma-induced coagulopathy. We hypothesize that hypocalcemia is common in this population, is inadequately corrected during non-protocolized resuscitation, and is associated with worse outcomes.

Methods: We completed a retrospective review of trauma patients undergoing massive transfusion protocol activation and receiving one or more blood products within 4 hours of admission at our Level I Trauma Center between 2015 and 2020. Demographics, labs including ionized calcium, blood products received, and outcome measures were collected and grouped into discrete time intervals (0-4hrs, 4-24hrs) for bivariate comparisons and multivariable regression. Hypocalcemia was defined as ionized calcium <0.9 mmol/L.

Results: We enrolled 251 patients (77% male, median age 32 yrs, median ISS 27). Patients received a mean of 14.3 blood products. Hypocalcemia was present in 23% of patients on admission and 38% during the first 24 hours. Hypocalcemia on admission was associated with an increased risk of mortality (OR 1.92, 95% CI 1.03-3.59, $p=0.038$), higher mean ISS (34.1 vs. 28.6, $p=0.02$), and greater mean transfusion requirement in the first 24 hrs (28.2 vs. 11.5 units, $p<0.001$). In the first 4 hours following admission, 37% of patients with hypocalcemia did not receive supplemental calcium.

Conclusions: High rates of hypocalcemia are present in trauma patients before, during and after massive transfusion and are associated with higher ISS, increased blood product use, and mortality. Hypocalcemia results from both severe traumatic injury prior to transfusion as well as inadequate supplementation during massive transfusion. Protocolization of calcium administration for severely injured trauma patients is mandatory prior to and during massive transfusion.

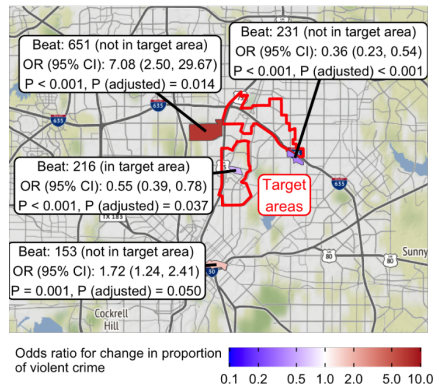
SAFER NEIGHBORHOODS? VIOLENT CRIME AND TRAUMA VOLUME PRE/POST TARGETED POLICE INTERVENTIONS

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Introduction: *Project Safe Neighborhoods: Dallas* (PSND) is part of a national initiative that brings together federal, state, and local stakeholders and law enforcement to reduce violent crime, especially firearm violence, in select communities. The authors' hospital is located centrally in PSND's target areas, and the trauma center's service area fully covers the target areas. This study evaluated PSND's effectiveness by examining if PSND's launch in April 2018 was associated with decreases in (1) violent crime or (2) the rate of patients presenting with firearm and assaultive injuries.

Methods: Data on index violent crime (murder/non-negligent homicide, robbery, and aggravated assault) were obtained from all municipalities in the county (Jan. 2015 – Dec. 2020). Patient volume data were queried from the trauma registry. Nonlinear spatiotemporal models were used to calculate estimated rates and confidence intervals; first derivatives were used to determine periods of significant change. Spatial point pattern tests assessed potential relocation of criminal activity. Given the importance of reducing violent crime, alpha was set at 0.05.

Results: The target areas' violent crime rate never significantly changed, but crime in the non-target area increased significantly during PSND—including a 7-fold increase in one patrol beat just outside of the target areas (see figure). After years of decreases, rates of patients presenting with assault or firearm injuries began significantly increasing and nearly doubled within two years of PSND.



Conclusion: These data suggest PSND was not effective. Criminal activity was not reduced, and it appears to have moved outside the target areas to evade increased scrutiny. Additionally, rates of patients presenting to our hospital with firearm and assaultive injuries increased.

DOLLARS AND SENSE – THE CASE FOR DEDICATED POST-TRAUMA CENTER CARE

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INTRODUCTION: A dedicated Center for Trauma Survivorship (CTS) has been demonstrated to increase adherence with follow-up visits and overall aftercare in severely injured patients discharged from the trauma center. A potential impediment to the universal creation of such centers is the assumed prohibitive financial burden they engender. We hypothesize that a CTS is not costly but a potential positive financial boon, increasing the contribution margin (revenue minus variable costs) and generating absolute revenue for the institution.

METHODS: This pre-and post-cohort study examines the financial impact of patients treated by the CTS. Eligibility criteria for CTS follow up include ≥ 18 years of age, NISS ≥ 16 and ICU stay ≥ 2 days. Patients in the PRE cohort were those treated in the year prior to CTS inception. There were no patients in the PRE cohort that crossed over into CTS care. Financial data was obtained from the hospital's billing and cost accounting systems for the initial trauma center admission as well as all costs and revenues for a one-year time period following discharge. Behavioral health services and direct payments for physician services were not included in this analysis.

RESULTS: There were 182 patients in the PRE and 265 in the CTS cohorts. There were no significant differences in overall demographics, injury pattern, length of stay, or insurance coverage between the PRE and CTS cohorts. The CTS cohort generated 1623 subsequent visits vs. 748 in the PRE cohort. CTS patients underwent more follow-up surgery in their first year of recovery as compared to the PRE cohort (52 vs 19 procedures). The financial impact of the CTS is summarized in the Table below. These data demonstrate a \$7,752 increase in net revenue with a positive contribution margin of \$4,558 for each patient receiving CTS services.

Cohort (dates of trauma admission)	Mean # of subsequent visits	Mean Net Revenue per case	Total Additional Net Revenue	Mean Contribution Margin per visit	Total Add'l Contribution Margin per patient
PRE (7/17-6/18)	4	\$2,963	\$11,852	\$1,397	\$5,588
CTS (7/18-6/20)	6	\$3,269	\$19,604	\$1,691	\$10,146

CONCLUSION: A dedicated CTS not only improves patient retention and increases subsequent necessary procedures but is a positive revenue source for the trauma center. The exclusion of behavioral health services as well as direct health care provider services in this analysis likely underestimates the financial impact of the CTS. These data further support the necessity for a dedicated CTS at all trauma centers as we work to improve outcomes along the continuum of care following severe injury.

EVALUATION OF VENOUS THROMBOEMBOLISM PROPHYLAXIS PRESCRIBING PRACTICES AMONG TRAUMA CENTERS

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Objectives: Venous thromboembolism (VTE) prophylaxis is standard-of-care in the vast majority of trauma patients. The purpose of this study was to characterize current dosing practices and timing of initiation of pharmacologic VTE prophylaxis in trauma patients.

Methods: This was an international, cross-sectional survey of healthcare providers at trauma centers. The survey was sponsored by the AAST and distributed to AAST members. The survey included 35 questions about practitioner demographics, experience, level and location of Trauma Center, and individual/site-specific practices regarding the dosing, selection, and initial timing of pharmacologic VTE prophylaxis in trauma patients.

Results: One hundred eighteen AAST members or associate members representing 98 institutions responded. 94% of respondents were at Level 1 Trauma centers and 58% had > 10 years of experience. While multiple dosing regimens were used, the most common strategy reported was enoxaparin 30mg q12h (68%). The majority of respondents (75%) indicated adjusting the dose in overweight patients. Additionally, 78 (66%) routinely use anti-factor Xa levels to guide dosing. Adherence to guideline-directed VTE prophylaxis (based on EAST or WTA guidelines) was more common at academic institutions compared to non-academic centers (85% vs 63%; $p=0.02$) and if the trauma team included a clinical pharmacist (88% vs. 69%; $p=0.01$). Trauma teams with clinical pharmacists were also more likely to dose adjust VTE prophylaxis for overweight patients (82% vs. 62%; $p=0.02$). Wide variability in initial timing of VTE prophylaxis after traumatic brain injury, solid organ injury, and spinal cord fractures existed across trauma centers.

Conclusions: A high degree of variability exists in prescribing and monitoring practices for the prevention of VTE in trauma patients. Clinical pharmacists may be helpful on trauma teams to optimize dosing and increase prescribing of guideline-concordant VTE prophylaxis.

HIGHER CENTER VOLUME IS SIGNIFICANTLY ASSOCIATED WITH IMPROVED MORTALITY IN TRAUMA PATIENTS WITH SHOCKLEAVE BLANK

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Introduction: Differences in outcomes among centers for injured patients in shock could yield insights to improve performance. We hypothesized that trauma centers treating higher volumes of patients in shock would achieve lower risk-adjusted mortality rates.

Methods: We queried the Pennsylvania Trauma Outcomes Study (2016-2018) for injured patients ≥ 16 years who had an initial SBP of < 90 mmHg. We excluded patients with severe head injury (AIS head ≥ 5) and patients coming from centers with a total shock patient volume of ≤ 10 . We compared risk-adjusted mortality by tertile of center-level shock patient volume using multivariable Cox proportional hazards model incorporating age, injury severity, mechanism, and physiology.

Results: Of 1,975 included patients at 29 centers, 1,041 (52.7%) died. The median annual shock trauma patient volume was 9 for low volume centers, medium 19.5, and high 37. Median ISS score and unadjusted mortality were higher at high volume centers. Time elapsed from arrival to ED to the OR and minutes spent in ED were lower at high volume centers, whereas MTP activation and unexpected survivorship were higher (Table). In adjusted analysis, high volume centers had 24% lower mortality compared to low volume centers (HR 0.76, 95% CI 0.61-0.94, $p=0.013$).

Conclusion: After adjusting for confounders, center-level volume is significantly associated with mortality for patients in shock. Our data suggests that high volume centers may share key practices to improve outcomes at low-volume centers, and trauma centers should be allocated to balance population access with center volume.

	High Volume (n=1,125)	Medium Volume (n=514)	Low Volume (n=283)	p value
Age, median (IQR)	35 (25-58)	51 (30-68)	55 (33-67)	<0.001
Male Sex, n(%)	908 (80.7%)	395 (69.7%)	196 (69.3%)	<0.001
Penetrating Mechanism, n(%)	600 (53.3%)	139 (24.5%)	44 (15.5%)	<0.001
ISS, median (IQR)	22 (14-33)	18 (13-27)	18 (13-26)	<0.001
Massive Transfusion Protocol Activated, n(%)	341 (30.4%)	174 (30.7%)	78 (27.7%)	<0.001
Time spent in ED in minutes, median (IQR)	24 (12-74.5)	49 (17-139)	71 (21-147)	<0.001
Time to OR in minutes, median (IQR)	47 (30-114)	69 (35-275)	76 (49-231)	0.002
Unexpected Survivor*, n(%)	70 (6.2%)	21 (3.7%)	7 (2.5%)	0.009
Mortality	641 (57.0%)	274 (48.3%)	126 (44.5%)	<0.001

IQR, interquartile range; ISS, injury severity score; ED, emergency department; OR, operating room

*Defined as patients with TRISS (Trauma Injury Severity Score) ≤ 0.5 that survived hospitalization

IMPACT OF STATE OPIOID LAWS ON PRESCRIBING IN TRAUMA PATIENTS

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Introduction: Excessive opioid prescribing has culminated in widespread misuse and diversion. Public Act 246, which took effect June 1, 2018, established a policy to address the opioid epidemic in our state. The impact of laws limiting opioid prescribing in trauma patients remains unknown. To determine the relationship between prescribing policy and opioid use in trauma patients, we compared inpatient and outpatient opioid prescribing by oral morphine equivalents (OME) before and after implementation of Public Act 246.

Methods: Adult patients from a Level 1 trauma center were identified who received any oral opioid from 1/1/2016 to 6/30/2021. The exposure was patients admitted after 6/1/2018. Patients who died were excluded. Inpatient OME/day for the 48hrs prior to discharge and the discharge prescription OME/day were calculated. Comparisons of mean inpatient and discharge OME/day pre- and post-law were performed using t-tests. Each cohort was divided into quintiles based on inpatient OME/day. Multivariable risk adjustment accounted for patient/injury factors and inpatient OME use.

Results: 3,748 patients prescribed opioids were included in the study (pre-law n=2,063; post-law n=1,685). Implementation of an opioid prescribing policy was associated with a significant decrease in mean discharge OME/day (34.8±49.5 vs. 16.7±32.3, p<0.001). There were no differences between inpatient OME/day within quintiles pre-post law. Significant differences were observed in discharge OME/day pre-post law (Figure). After adjusting for patient factors, injury type/burden, and inpatient OME use, a -19.2 OME/day (95% CI -21.7 to -16.8, p< 0.001) difference in discharge prescriptions was present post-law implementation.

Conclusions: Risk-adjusted discharge prescriptions for opioids decreased by half after implementation of Public Act 246. Future work is needed to evaluate adequacy of pain relief, refill burden, and changes in long-term opioid use.

NATIONWIDE ANALYSIS OF PROXIMITY OF ACS-VERIFIED AND STATE-DESIGNATED TRAUMA CENTERS TO THE NEAREST HIGHWAY EXIT AND ASSOCIATED MVC-FATALITIES

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Background: Motor vehicle collisions (MVCs) remain a leading cause of trauma-related deaths. The aim of this study is to investigate the relationship between the proximity of ACS-verified and/or state-designated Level 1-4 TCs to the nearest highway exit and MVC-fatalities at the county level nationwide.

Methods: This is a cross-sectional study evaluating the association between distance of TCs to nearest highway exit and MVC-fatalities between the years 2014-2019. MVC-fatalities were obtained from National Highway Traffic Safety Administration (NHTSA). Mapping software was used to determine distance of TC to the nearest highway exit and transport time. ANOVA and linear regression analysis were performed with significance defined as $p < 0.05$.

Results: 2,019 ACS-verified and/or state-designated TCs were included (211 Level (L) 1-TCs, 356 L2-TCs, 491 L3-TCs, 961 L4-TCs). MVC-fatalities were positively correlated with distance of TC to nearest highway exit for counties with TCs located within 5 miles from the nearest highway exit ($r=0.328$, $p < 0.001$). In the 612 counties with a 10% increase in MVC-fatalities from 2014-2019, MVC-fatalities were also positively correlated with distance to the nearest highway exit ($r=0.302$, $p < 0.001$). Counties with more dispersed distributions of TCs were significantly associated with MVC-fatalities (Spearman $\rho=0.456$, 95% CI [0.163,0.675], $p=0.003$).

Conclusions: Shorter distances between trauma centers and the nearest highway exit are associated with fewer MVC-fatalities for counties with TCs within 5 miles of nearest highway exit. Further enhancement of existing highway infrastructure and standardization of EMS transport protocols are needed to address the burden of MVC-fatalities in the United States.

RECENT CHANGES IN PREHOSPITAL INTERVENTIONS IN TRAUMA PATIENTS ARE ASSOCIATED WITH DECREASED MORTALITY

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Introduction: Optimal prehospital management in trauma is hotly debated, with many studies arguing that aggressive prehospital treatment does not improve outcomes. However, no studies have assessed how EMS practices have changed over time in response to new evidence. The aim of this study is to quantify the frequency of prehospital interventions (PHI) performed by EMS over time. We hypothesize that the frequency of PHI has increased.

Methods: We performed a retrospective chart review of adult patients transported by EMS to our ACS verified Level 1 trauma center from January 1, 2014, to December 31, 2020. PHI were manually recorded and changes in their frequency over time were assessed via year-by-year trend analysis and multivariate regression.

Results: 2,501 patients were included, of which 21% were transported by air EMS and 79% were transported by ground EMS. Over the 7-year study period, male gender (74% vs. 79%, $p=0.005$) and age (41 vs. 43, $p=0.02$) increased, while the proportion of blunt trauma (73% vs. 59%, $p<0.001$) decreased. Changes in PHI over time are demonstrated in **Table 1**. ED mortality decreased from 9% to 5% ($p=0.004$) and in-hospital mortality decreased from 18% to 14% ($p=0.001$) over the study period. On multivariate regression adjusting for confounding variables, advanced airway procedures were the only PHI independently associated with increasing in-hospital mortality (Adjusted OR [95% CI] 1.84 [1.1–3.1], $p=0.02$).

Table 1: Changes in Prehospital Interventions Over Time

Interventions That Increased Over Time			Interventions That Decreased Over Time		
Variable	% Increase*	P-value*	Variable	% Decrease*	P-value*
Thoracostomy	↑ 50%	0.003	Fluid Administration	↓ 32%	<0.001
Tourniquet	↑ 175%	<0.001	Advanced Airway	↓ 38%	<0.001
Blood Transfusion	↑ 390%	<0.001	Cervical Spine Collar	↓ 38%	<0.001
Pelvic Stabilization	↑ 700%	<0.001	Backboard	↓ 60%	<0.001

* % Change from beginning to end of study period
+ P-value for trend by regression

Conclusion: PHI in trauma patients have changed significantly over the past six years. These changes were associated with improvements in ED and hospital mortality. PHI for trauma should be further refined to optimize outcomes.

ROUTINE SCREENING RARELY ROUTINE: AN ASSESSMENT OF HOSPITAL VARIABILITY IN ALCOHOL AND DRUG SCREENING IN ADULT TRAUMA PATIENTS

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Introduction: Despite recommendations to screen trauma patients for alcohol and drugs, single-center studies report underscreening. National hospital variability has not been assessed. This study sought to evaluate hospital variability in screening practices.

Methods: This was a retrospective cohort study of adult trauma patients ≥ 18 years in TQIP 2017-2018. Hierarchical multivariable logistic regressions modeled the odds of screening for alcohol and drugs while controlling for patient and hospital variables. Statistically significant high and low-screening outlier hospitals were then identified based on estimated random intercepts and their confidence intervals.

Results: Of 1,290,618 patients at 760 hospitals, 625,691 (48.5%) were screened for alcohol. Only 395,861 (30.7%) were screened for drugs. Hospital alcohol and drug screening rates ranged from 0-100% of patients. Presentation to a trauma center was associated with higher adjusted odds of both alcohol screening (aOR 1.32, 95% CI 1.23-1.41) and drug screening (aOR 1.17, 95% CI 1.09-1.25). However, 38.1% (95% CI 35.7-40.6%) of variance in alcohol screening and 39.5% (95% CI 37.0-42.1%) of variance in drug screening was at the hospital level. After adjusting for patient and hospital variables, we found 265 high outlier hospitals in alcohol screening and 227 in drug screening (Table 1). Of the high outliers in alcohol screening, 213 (80.3%) were trauma centers.

Conclusions: There is significant hospital variability in screening practices for alcohol and drug use among TQIP hospitals.

Table 1: Hospital outliers in alcohol and drug screening

Substance	Hospital Designation (after controlling for patient/hospital variables)	All Hospitals n (%)	Unadjusted Screening Rate % (SD)
Alcohol	High Outliers	265 (41.0)	63.4 (15.1)
	Intermediate	108 (16.7)	39.7 (14.4)
	Low Outliers	274 (42.3)	28.5 (13.3)
Drugs	High Outliers	227 (40.8)	49.7 (14.4)
	Intermediate	83 (14.9)	27.7 (9.0)
	Low Outliers	247 (44.3)	18.6 (6.8)

STOP THE BLEED – NOW WAIT FOR EMS OR GET IN THE CAR AND DRIVE? A SECONDARY ANALYSIS OF AN EAST MCT

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Background: The Stop the Bleed campaign asks that bystanders take an active role in controlling hemorrhage after trauma. However, whether extending the bystanders’ duty to perform private vehicle transport (PVT) results in improved survival is unknown. We hypothesized that in urban penetrating trauma, where pre-hospital procedures have shown to be harmful, PVT would result in improved outcomes compared to transport by advanced life support (ALS) ambulances.

Methods Post-hoc analysis of an EAST multicenter, prospective observational trial was performed on adult patients with penetrating torso or proximal extremity trauma at 25 urban trauma centers. Patients were allocated to PVT or ALS using nearest neighbor propensity score matching. Wilcoxon signed rank or McNemar Test and logistic regression were performed for univariate and multivariate analyses.

Results: Of 1830 total patients, 397 (21.7%) had PVT and 1433 (78.3%) had ALS transport. Propensity matching yielded 778 patients, distributed equally into balanced groups. Patients were primarily male (n = 702, 90.2%), Black (n = 537, 69%), and injured by gunshot wounds (n = 497, 63.9%). ALS transport had significantly higher ED (4.8% vs 1.9%, p = 0.02) and overall mortality (5.4% vs 2.8%, p = 0.02). Logistic regression demonstrated PVT was associated with survival (OR = 0.30, 95% CI 0.10-0.84, p = 0.02). Variables associated with mortality included increasing ISS and thoracic injuries (Table). Complications did not differ between groups.

Conclusion: Immediate PVT in lieu of prehospital procedures (by ALS) may improve outcomes in urban penetrating trauma. Bystander education incorporating PVT in this specific patient population could save lives.

Parameter	Odds Ratio	95% CI	p value
Age in years	1.02	0.98-1.05	0.40
Male	2.95	0.31-27.8	0.34
ISS	1.10	1.07-1.13	0.001
Private vehicle transport	0.30	0.10-0.84	0.02
Thoracic injury	8.39	2.64-36.6	0.001
Abdomen injury	2.10	0.80-5.52	0.13
Pelvis injury	0.92	0.18-4.76	0.92
Extremity injury	1.18	0.47-2.97	0.72

VARIATION IN NON-ADMINISTRATION OF PHARMACOLOGIC VENOUS THROMBOEMBOLISM PROPHYLAXIS IN CLOTT-1

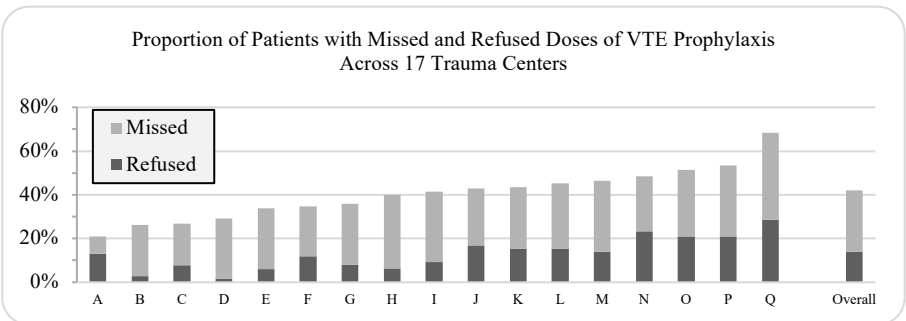
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Introduction: Non-administration of prescribed pharmacologic venous thromboembolism (VTE) prophylaxis is a common quality of care deficit and associated with VTE events. We hypothesized that non-administration of VTE prophylaxis is common and varies widely among trauma centers.

Methods: The Consortium of Leaders in the Study of Traumatic Thromboembolism (CLOTT-1) was a multi-center prospective observational study conducted in 17 US trauma centers. Trauma patient inclusion criteria were: inpatient admission ≥ 48 hours; age 18-40 years; and high risk for VTE. We excluded patients not prescribed pharmacologic VTE prophylaxis. We analyzed overall and institution-specific rates of non-administration and refused doses of pharmacologic VTE prophylaxis. We compared these rates between centers using Chi-squared tests.

Results: Of 6,710 patients prescribed VTE prophylaxis, 2,811 (42%) missed ≥ 1 dose. The proportion of patients who missed ≥ 1 dose differed significantly between trauma centers (p -value <0.001 , range 21.0%-68.4%). 943 (14.1%) patients refused ≥ 1 VTE prophylaxis dose. The proportion who refused also differed across centers (p -value <0.001 , range 2.7%-28.4%). The mean number of doses missed among patients who missed ≥ 1 dose was 2.9 (95% CI 2.8-3.1), and the median was 2 (IQR 1,3). Among 8,158 total doses missed, 2,202 (27%) were missed due to patient refusal.

Conclusion: Non-administration of pharmacologic VTE prophylaxis is common in US trauma patients. Further research is urgently needed to identify the causes of VTE prophylaxis non-administration and implement interventions to reduce this important cause of preventable patient harm.



A LONGER VIEW: PREDICTING THE HIDDEN MORTALITY OF TRAUMA PATIENTS AFTER DISCHARGE

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Introduction: Traditional 30-day trauma mortality statistics likely miss a wave of outpatient deaths in the year after injury. There is currently no effective way to predict this risk, which limits advanced care planning and identification of modifiable risk factors. We hypothesized that clinical and social variables during the index admission can accurately estimate a patient's risk of death in the year after injury.

Methods: Adult trauma patients admitted to our institution from 2010 to 2017 were matched to mortality data in the National Death Index. We excluded deaths prior to discharge and compared survivors and non-survivors using univariable statistics. Using 60% of the study population, we derived a multi-variable logistic regression predicting mortality within the year after injury. The model was validated on the remaining 40%. We generated a receiver operating characteristic (ROC) curve and calculated area under the curve (AUC), accuracy, sensitivity and specificity.

Results: We identified 16,778 patients, of whom 529 (3.2%) died within a year of their injury. Compared with survivors, patients who died were older, mean age 76 vs 49 years ($p < 0.0001$), and had a higher median (IQR) Injury Severity Score (ISS): 10 (5,17) vs 9 (4,17) ($p < 0.0001$). Intensive care unit (ICU) length of stay (LOS) differed as well ($p < 0.0001$): 36% of those who died had an ICU LOS > 2 days vs 18% in those who survived. Median time from injury to death was 53 days and 75% of deaths occurred within 117 days of injury. The ROC curve of our model had an AUC of 0.88. Using a predicted probability cutoff of 0.01, it had an accuracy of 62.3%, sensitivity of 92.6%, and specificity of 61.4% for prediction of death within one year.

Conclusion: These data derive a multi-variable model that accurately predicts a trauma patient's risk of death in the year after injury. It was built and tested using variables available during the index hospital stay, thereby increasing potential clinical utility. These findings describe a broadly applicable tool with the potential to estimate risk of death in the year after injury and warrant multi-center and prospective validation.

ARE CRITICALLY INJURED PATIENTS WITH INSURANCE BEING TRANSPORTED TO NON-TRAUMA CENTERS?

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Introduction: Prior studies have demonstrated that outcomes for critically injured patients are better when they are treated at verified trauma centers (TCs). Based on this information, the Centers for Disease Control and Prevention Field Triage Criteria (CDC FTC) recommend transport of critically injured patients to TCs when defined criteria are met. We evaluated the association of insurance status and the transport of critically injured patients to verified and state-designated TCs.

Methods: We used the 2020 National Emergency Medical Service Information System (NEMSIS) database to create a cohort of critically or emergently injured patients within the National Association of EMS State Officials East region using patient final acuity status designated by EMS. Within this critically injured cohort, we identified a subgroup of patients meeting CDC FTC by EMS (CDC FTC subgroup). Using multivariable logistic regression analyses, we measured the association of insured status, defined as private insurance or Medicare, vs. underinsured status, defined as self-pay, no insurance, or Medicaid, with transport destination (TC vs. non-TC) for both the full cohort and the CDC FTC subgroup.

Results: There were 18,505 patients in the full cohort. Of these, 47.0% (n=8690) were insured and 53.0% (n=9815) were underinsured. Of the insured, 56.8% (n=4932) were taken to a TC vs 78.0% (n=7653) of underinsured patients ($p<0.001$). On logistic regression, insured critically injured patients were 50% less likely to be taken to a TC (OR 0.50, 95% CI 0.44-0.55, $p<0.001$). In the subgroup analysis, of the 5409 patients meeting CDC FTC, 77.0% (n=1507) of those with insurance (n=1956) were transported to a TC vs 89.3% (n=3083) of the underinsured (n=3453, $p<0.001$). On logistic regression, insured patients meeting CDC FTC criteria were 49% less likely to be transported to a TC (OR 0.51, 0.48-0.55, $p<0.001$).

Conclusion: Critically injured insured patients were less likely to be transported to TCs when compared to their underinsured counterparts, even when meeting CDC FTC. These findings suggest that factors unrelated to injury severity, patient physiology, or TC proximity may be affecting field triage decisions.

CHALLENGING DOGMA: IS UNPLANNED ICU ADMISSION IN TRAUMA A FLAWED QUALITY INDICATOR?

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Introduction: Unplanned ICU admission (UP-ICU) is an ACS-TQIP benchmark that has been previously linked to mortality. However, reasons for UP-ICU in trauma patients are diverse and have variable mortality risk. Clinical surveillance and care escalation pathways that lead to UP-ICU may prevent failure-to-rescue (FTR) and indicate high-quality care. We hypothesized that UP-ICU admission prevents mortality from FTR and therefore should not be utilized as a negative quality indicator.

Methods: We performed a retrospective case-controlled study of adult trauma patients admitted to a level 1 trauma center from 2016 to 2020 with a hospital length of stay (LOS) > 24 hours. A matched cohort of control cases was obtained by 1:1 propensity score matching using: age, sex, new injury severity score, revised trauma score, admission base deficit, GCS, traumatic brain injury, need for mechanical ventilation on arrival, initial level of care, injury mechanism, need for operative intervention on admission. The primary outcome was mortality. Secondary outcomes were discharge to a rehabilitation facility (Rehab), LOS, and mortality risk by cause.

Results: We identified 7620 patients, with UP-ICU admission rate of 3.3% (254 patients). UP-ICU group had higher mortality than non-UP-ICU group in unmatched cohort (8.6% vs 2.3%, $p<0.001$). Compared to matched controls, UP-ICU group had equal mortality, but longer LOS and higher Rehab rate (see table). Analysis of UP-ICU group showed that intracranial hemorrhage, arrhythmias, sepsis, and primary respiratory distress accounted for 60% of UP-ICU events and 87% of mortality. However, only respiratory distress was associated with increased mortality (21.5% vs 5.1%, $p<0.001$).

	UP-ICU (N= 254)	Matched Controls (N = 254)	P Value
Mortality	8.6% (22)	8.3% (21)	0.99
Hospital LOS (d)	19 ± 19.6	12 ± 28.6	$p<0.001$
Rehab	54% (126)	40% (92)	$p<0.001$

Conclusion: Propensity-matched analysis of UP-ICU patients show they do not have increased mortality and not all causes had equivalent mortality risk. This suggests that UP-ICU may prevent FTR and should not be viewed as a marker of poor quality of care.

DEDICATED ACUTE CARE SURGERY OPERATING ROOM: THE HALO EFFECT OF COVID

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Introduction: Timing of Acute Care Surgery (ACS) cases is critical to reduce morbidity and optimize patient flow. Lengthy wait times for the operating room are common in centers lacking a daily dedicated room for urgent cases. The COVID pandemic resulted in a decreased volume of scheduled procedures, creating an opportunity to simulate the impact of a dedicated operating room (DOR) for urgent laparoscopic cholecystectomy (LC). We hypothesized there would be more availability for these add-on cases thus decreasing time to operation.

Methods: Patients requiring urgent LC admitted between January 2016-November 2020 were reviewed. Patients were excluded if they had factors prohibiting them from being immediately available to undergo operation (choledocholithiasis and gallstone pancreatitis). A decrease in scheduled procedures occurred between March-April 2020 at our center. This 'COVID' intense time period was compared to other periods to determine if a dedicated ACS room would improve timing of urgent operations in our system.

Results: 1043 patients underwent urgent LC, including 632 who met inclusion criteria. During the COVID period, there was a notable decrease median time from admission to OR from 31.6 hours to 16.97 hours ($p<0.05$) and time from surgical case request to operation from 19.3 to 8.2 hours ($p<0.5$). The attributable difference was found to be secondary to increased availability of OR time. Length of stay decreased from 2.91 to 2.11 ($p=0.09$).

Conclusion: Increased access to the OR due to COVID scheduling restrictions created an opportunity to simulate the impact of a DOR. This study demonstrates the major barrier to patient throughput and LOS for urgent ACS cases is OR access. Having a DOR is an important factor to address quality metrics like LOS.

ERRORS OF OMISSION IN INTERFACILITY TRAUMA TRANSFER COMMUNICATIONS: USE OF A CHECKLIST

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Introduction: Optimal interfacility trauma patient transfer requires initiation of treatment and stabilization at the referring facility (RF) and safe transfer under the direction of a trauma surgeon at a higher-level trauma center (TC). This process is typically effected by physician-to-physician conversation. We hypothesized that these unstructured conversations are prone to omissions and errors, and that a checklist for structured communication may capture opportunities for improvement in these critical “hand-off” communications.

Methods: Trauma surgeons at the state’s highest level trauma center created a “do-confirm” checklist to be followed by the TC when communicating with the RF. This checklist was refined through state-wide meetings with interdisciplinary practitioners, then was prospectively beta-tested during actual physician-to-physician transfer conversations. The resulting 35-point checklist was then used to evaluate sequential archived physician-to-physician transfer conversations over a five-week period in 2017, noting missing checkpoints. Records from the RF and TC were reviewed for patient physiology, imaging, labs and urgent unanticipated interventions performed upon patient arrival at the TC. Data were analyzed by descriptive statistics and Chi-square test.

Results: Audio transcripts and medical records of 41 transferred acute trauma patients were reviewed. Frequently missing or incorrectly communicated elements included c spine clearance for blunt trauma (83%), and anticoagulants (54%). Eighteen patients (44%) had interventions upon arrival to the TC that optimally should have been initiated or completed at the RF. These interventions were reflected by missing checklist communication points including seizure prophylaxis (n=8), spine precautions (n=6), tube placement (n=3), code status (n=2), osmotics (n=1) and hypotension (n=1). Patients requiring unanticipated intervention at the TC were more likely to be ≥ 75 years old or have a neurologic injury (94%, $p < 0.001$).

Conclusion: Omissions are common in unstructured physician-to-physician trauma transfer communications. Use of a checklist may identify opportunities for earlier intervention, particularly in patents who are elderly or have neurologic injury.

MIND THE GAP: RESIDENCY CASE VOLUMES, PROPOSED FELLOWSHIP REQUIREMENTS, AND THE REALITY OF OPERATIVE BURN SURGERY

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INTRODUCTION: Exposure to burn patients and their management has been restricted in the years following ACGME requirements for standard general surgery residency training. This continues to put a strain on the current workforce, especially a third of burn surgeons will be retiring in the next five years. Appropriately targeted training is of paramount importance to ensuring care for future burn patients. The authors hypothesized a) that current surgical residents do not finish residency with sufficient burn case experience to warrant early independence during a burn fellowship year, and b) current proposed fellowship requirements do not reflect a standard year in practice.

METHODS: Three large burn institutions in geographically distinct parts of the country were involved in this study. Available case logs from residents graduating in the last three years were reviewed for cases congruent with those proposed by the American Burn Association (ABA) for a Burn Fellowship. Fellowship case requirements were also compared to case logs of faculty from those three institutions.

RESULTS: A total of 45 resident case logs were evaluated. 11378 CPT codes (253 per resident) were deemed potentially applicable to a career in Burn Surgery. Of these, the majority were patient management (Critical Care (65/resident), Non-operative Trauma (41/resident), Trauma Assessment & Resuscitation (20/resident)). Procedures specific to training in Burn Surgery included: Wound bed preparation & grafting (15/resident), Fasciotomy (2/resident), Amputation (7/resident), Other skin grafting (2/resident). Basic Reconstruction approaches are not tracked by the AGCME; associated tissue rearrangement techniques were extrapolated from Plastic Surgery procedures (8/resident). Laser scar revision, Escharotomy, and Formal Burn Resuscitation could not be identified. Compared to suggested ABA case volumes for fellowship training, over five years residents are exposed to only 25% of cases needed for practice (33/135). Compared to an attending case load at high-volume centers, residents are exposed to only 10-15% of cases performed in a year (33/200-250).

CONCLUSION: Resident exposure to burn specific care is low even at programs with rotations through high volume Burn Centers. While patient management volumes are suggestive of preparation to manage complex critically ill burn patients, procedural volumes are very low. Case number requirements during residency and fellowship should appropriately reflect potential practice.

NIL PER OS IN PATIENTS WITH PROTECTED AIRWAYS: AN UNNECESSARY PRECAUTION?

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Background: The American Society of Anesthesiology recommends fasting in the pre-anesthesia setting to mitigate the risk of perioperative aspiration in healthy patients undergoing elective surgeries. However, critically ill burn patients with large total body surface area (TBSA) involvement require multiple operative interventions, and are at significant risk from diminished nutritional supplementation with nil per os (NPO) orders placed. With a long-standing practice of continuing peri- and intra-operative tube feeding in mechanically ventilated burn patients undergoing non-airway surgeries in the supine or lateral position routine practice, the authors hypothesized that this practice permits near goal tube feeding delivery with minimal risk of aspiration complications.

Methods: A retrospective chart review was conducted of all intubated burn patients over 18 years of age admitted to the Burn ICU that required at least one return to the OR while a protected airway was in place. Data collected included volume of tube feeding delivered in the 24 hours preceding a trip to the operating room, number of returns to the operating room with a protected airway, incidence of pneumonia with time frame & associated organism, and other demographic data. Aspiration complications were primarily defined as pneumonia from a non-burn wound related organism within 48h of surgery.

Results: 116 operative interventions with complete peri-and intraoperative enteral feeding were available for evaluation. Patient included had an average age of 54 ± 20 y and a TBSA of $28 \pm 21\%$; they underwent a range of 1-12 operations while meeting criteria for study. Pneumonia was identified after 19% of operative interventions; of these four were bacteria that could be associated with a gastrointestinal source (*E. coli* x 3, *Klebsiella* x 1), and three had concurrent wound cultures with the bacteria. Delivery of tube feeds was $83 \pm 32\%$ of goal in the peri-operative period in this patient population.

Conclusion: Intraoperative enteral feeding in the burn population is not associated with a high rate of aspiration pneumonia in the setting of a protected airway. Continuing enteral feeding allows for increased caloric delivery to patients with high energy requirements for wound healing during the acute phase of injury.

PREHOSPITAL KETAMINE ADMINISTRATION FOR TRAUMA PATIENTS RESULTS IN MORE ED INTUBATIONS

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Background: The use of ketamine in the prehospital setting has increased with EMS providers. Adverse effects of prehospital ketamine administration have not been well-established in the trauma population. The objective of this study was to evaluate the effects of pre-hospital ketamine on trauma patients presenting to a Level 1 trauma center. This study hypothesized that respiratory depression or oversedation from ketamine would increase the number of ED (Emergency Department) intubations.

Methods: A retrospective chart review of adult trauma patients receiving prehospital ketamine from 2016-2021 was performed. Patients with severe traumatic brain injuries were excluded. A 1:1 propensity match was performed of patients with similar demographics, injury severity, and mechanism of injury who did not receive prehospital ketamine. Univariate analyses were used to compare the groups. The primary outcome was the incidence of intubation in the Emergency Department.

Results: 74 trauma patients who received prehospital ketamine were identified. The average ketamine dose was 39 mg IV and 226.4 mg IM. 35.1% of patients received ketamine for pain while 29.7% received it for agitation. The ED intubation rate was higher in the prehospital ketamine group with 17.6% (n=13/74) requiring intubation as compared with 4.8% (n=3/63) who did not receive ketamine (p=0.03). Patients who required intubation in the ED had higher average doses of both IV/IO (37.7 +/- 4.8 mg vs. 55.0 +/- 24.2 mg) and IM ketamine (196.4 +/- 41.7 mg vs 290.0 +/- 41.3 mg).

Conclusion: This study demonstrated that pre-hospital ketamine increased ED intubations. Further studies are necessary to help refine prehospital protocols studies to allow for more efficacious utilization of pre-hospital ketamine given its increasing popularity.

SURGICAL CRITICAL CARE: IS WORK LIFE EXPECTANCY INCREASING? AN ANALYSIS OF AMERICAN BOARD OF SURGERY RECERTIFICATION RATES ACROSS SUBSPECIALTIES

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Background: The practice of Surgical Critical Care (SCC) has traditionally necessitated additional in-house, extended night and weekend clinical commitments, which can be viewed as less desirable for many surgeons. Therefore, some SCC surgeons elect to focus solely on the practice of General Surgery (GS) rather than continuing practicing both SCC and GS. We hypothesized that surgeons with a practice focused on SCC have a shorter work life span when compared to other sub-specialties and that this will be evident when looking at American Board of Surgery (ABS) recertification rates.

Methods: Deidentified data for all surgeons certified by the ABS in GS, Pediatric Surgery (PS), Vascular Surgery (VS), and SCC were obtained from the ABS after obtaining approval from the IRB and the ABS Research Committee. We compared recertification rates between SCC, VS, and PS since 1994 when it became necessary to complete SCC fellowship training to obtain added qualifications in and to practice SCC. Surgeons with a single sub-specialty certification who obtained initial certification between 1994 and 2009 were included, with four groups created in four-year increments to look for trends over time. ANOVA analyses were used to compare the 10-year recertification rate and the 20-year recertification rate between each sub-specialty and between genders. Only those that obtained initial certification between 1994 and 1997 were analyzed for 20-year recertification.

Results: 3102 surgeons met inclusion criteria, including 1241 (40%) SCC, 387 (12%) PS, and 1474 (47%) VS. Over time, SCC surgeons have increased their 10-year recertification rate from 77% to 90% while PS and VS have persistently high recertification rates >93% ($p < 0.001$ at each timepoint) (Figure 1). There was no difference between genders in 10-year or 20-year recertification rates. Of those who did not recertify in their subspecialty at 10 years, recertification in GS was more prevalent in SCC (137/171 (80%)) than PS (0/9 (0%)) or VS (34/72 (47%)) ($p < 0.001$).

Conclusion: Based on the recertification rates, these results suggest that the time a SCC surgeon remains active in the workforce is increasing overtime. However, it still lags behind those of vascular and pediatric surgery that have remained relatively stable. Unlike PS and VS surgeons, those in the SCC field have a higher recertification rate in GS. This may reflect the inclusion of general surgery as part of their practice, especially with the merge of emergency general surgery, trauma surgery and SCC as part of Acute Care Surgery. Issues of work life balance cannot be distinguished from these data. Further research is warranted.

ONGOING TRANSFUSION MEDICINE FEEDBACK IS ASSOCIATED WITH IMPROVED PLASMA DEFICIT IN INITIAL RESUSCITATION OF HEMORRHAGIC SHOCK

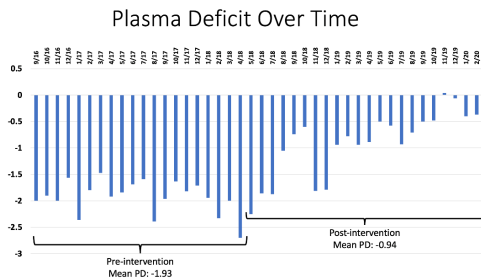
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INTRODUCTION: The implementation of damage control resuscitation with balanced transfusion ratios of packed red blood cells (PRBC), plasma, and platelets in severely injured trauma patients has been associated with improved outcomes. However, despite widespread acceptance of the superiority of this resuscitation strategy, trauma centers still struggle to maintain balanced transfusion ratios in the modern era. We hypothesized that regular monthly feedback on transfusion ratios would lead to improved plasma deficits (PD) in severely injured trauma patients with hemorrhagic shock.

METHODS: This was an ambispective, observational study at a single ACS-verified Level 1 trauma center. As part of a trauma quality improvement project, a transfusion medicine physician began attending the monthly trauma multidisciplinary quality improvement meeting and presented the previous month’s blood product utilization, including ratios. Transfusion data in the post-intervention period (May 2018-January 2020) were collected and compared to the immediate pre-intervention period (September 2016-April 2018). All patients requiring transfusion in the trauma bay or requiring massive transfusion (≥ 4 units of blood in the first hour or ≥ 10 units in the first 24 hours) were included. PD, defined as the difference between transfused pRBC and plasma in the trauma bay over time, was measured. No changes in the massive transfusion protocol or blood availability were made during the study time period.

RESULTS: Compared to the pre-intervention time period, an improved PD was observed in the post-intervention period (PD -1.93 vs 0.94, $p < 0.001$) (Figure).

CONCLUSION: Transfusion medicine physician review of transfusion data, including transfusion ratios, at a monthly trauma quality improvement meeting resulted in significant improvements in balanced resuscitation. Ongoing review of transfusion practices is an important component of a trauma quality improvement program and is associated with improved resuscitation ratios.



SAVE THE DATE



82ND ANNUAL MEETING
SEPTEMBER 20-23, 2023

HILTON ANAHEIM
ANAHEIM, CA

81ST ANNUAL MEETING OF AAST AND CLINICAL CONGRESS OF ACUTE CARE SURGERY

SEPTEMBER 21-SEPTEMBER 24, 2022

ALL TIMES ARE CST

MON. 9/19/2022	FUNCTION	LOCATION
7:30 AM - 4:00 PM	EMERGENCY SURGERY COURSE (ADDITIONAL FEE)	RANDOLPH 3
TUES. 9/20/2022	FUNCTION	LOCATION
7:30 AM - 4:00 PM	EMERGENCY SURGERY COURSE (ADDITIONAL FEE)	RANDOLPH 3
7:30 AM - 4:30 PM	AAST BOARD OF MANAGERS MEETING	MICHIGAN 1
12:00 PM - 7:00 PM	REGISTRATION	GRAND REG DESK
1:00 PM - 5:00 PM	PRE-SESSIONS	LOCATION ON TICKET
3:00 PM - 7:00 PM	SPEAKER READY	GRAND SUITE 5
5:00 PM - 6:00 PM	PRE-SESSION RECEPTION	Randolph, Pre-Function Space
WED. 9/21/2022	FUNCTION	LOCATION
6:00 AM - 6:00 PM	SPEAKER READY	GRAND SUITE 5
6:30 AM - 7:45 AM	COMMITTEE MEETINGS I	SEE MEETING APP
6:30 AM - 7:30 AM	STUDENT/RESIDENT/IN-TRAINING BREAKFAST (PRE-REGISTRATION REQUIRED)	GREAT HALL MN
6:30 AM - 5:15 PM	REGISTRATION	GRAND REG DESK
7:30 AM - 8:30 AM	BREAKFAST	GRAND FOYER
8:00 AM - 8:30 AM	WELCOME	GRAND BALLROOM
8:30 AM - 11:10 AM	SESSION I: PLENARY PAPERS 1-8	GRAND BALLROOM
10:45 AM - 8:00 PM	EXHIBIT HOURS	RIVERSIDE EAST
10:40 AM - 7:30 PM	DONOR LOUNGE	RIVERSIDE EAST
11:10 AM - 11:35 AM	BREAK	RIVERSIDE EAST
11:35 AM - 12:35 PM	SESSION II: PRESIDENTIAL ADDRESS	GRAND BALLROOM
12:35 PM - 1:50 PM	LUNCH SESSIONS	LOCATION ON TICKET
1:15 PM - 1:45 PM	BREAK IN EXHIBIT HALL	RIVERSIDE EAST
1:50 PM - 5:30 PM	SESSION IIIA: PAPERS 9-19	GR BR A-D NORTH
1:50 PM - 5:30 PM	SESSION IIIB: PAPERS 20-30	GRANDBRCSOUTH-G
5:30 PM - 5:45 PM	BREAK	RIVERSIDE EAST
5:45 PM - 6:15 PM	SESSION IV: EXPERT SURGEON LECTURE	GR BR A-D NORTH
6:15 PM - 7:15 PM	SESSION V: POSTER SESSION I	RIVERSIDE EAST
7:15 PM - 8:15 PM	WELCOME RECEPTION	RIVERSIDE EAST
THURS. 9/22/2022	FUNCTION	LOCATION
6:00 AM - 6:00 PM	SPEAKER READY	GRAND SUITE 5
6:15 AM - 7:15 AM	INTERNATIONAL ATTENDEE BREAKFAST (PRE-REGISTRATION REQUIRED)	GREAT HALL MN
6:15 AM - 7:15 AM	COMMITTEE MEETINGS II	SEE MEETING APP
7:00 AM - 8:00 AM	BREAKFAST IN EXHIBIT HALL	RIVERSIDE EAST
7:00 AM - 2:30 PM	EXHIBITS	RIVERSIDE EAST
7:00 AM - 3:00 PM	REGISTRATION	GRAND REG DESK
7:00 AM - 2:10 PM	DONOR LOUNGE	RIVERSIDE EAST
7:30 AM - 9:10 AM	SESSION VI: PAPERS 31-35	GRAND BALLROOM
9:10 AM - 10:10 AM	SESSION VII: PANEL I, "DEFINING AN ACUTE CARE SURGERY FTE"	GRAND BALLROOM
10:10 AM - 10:50 AM	SESSION VIII: SCHOLARSHIP PRESENTATIONS	GRAND BALLROOM
10:50 AM - 11:50 AM	SESSION IX: FITTS LECTURE	GRAND BALLROOM
11:50 AM - 12:00 PM	BREAK - HEAD TO POSTER SESSION	RIVERSIDE EAST
12:00 PM - 1:00 PM	SESSION X: POSTER SESSION II	RIVERSIDE EAST

1:10 PM - 2:10 PM	LUNCH WITH EXHIBITORS (AAST SPONSORED)	RIVERSIDE EAST
1:10 PM - 2:25 PM	LUNCH SESSIONS II	LOCATION ON TICKET
2:30 PM - 6:00 PM	ADD-ON SESSIONS	LOCATION ON TICKET
2:30 PM - 5:30 PM	JTACS EDITORIAL BOARD MEETING (INVITE ONLY)	GRAND HALL I
5:00 PM - 6:00 PM	VIRTUAL JOB FAIR SOCIAL HOUR (OPEN TO ALL)	SEE APP
6:00 PM - 7:30 PM	ASSOCIATE MEMBER HAPPY HOUR (AAST ASSOCIATE MEMBERS ONLY)	SEE APP
6:30 PM - 9:30 PM	TSACO DINNER (INVITE ONLY)	PLAZA BR

FRI. 9/23/2022	FUNCTION	LOCATION
6:00 AM - 6:30 PM	SPEAKER READY	GRAND SUITE 5
6:15 AM - 7:15 AM	COMMITTEE MEETINGS III	SEE MEETING APP
7:00 AM - 8:00 AM	BREAKFAST IN EXHIBIT HALL	RIVERSIDE EAST
7:00 AM - 1:30 PM	EXHIBITS	RIVERSIDE EAST
7:00 AM - 3:00 PM	REGISTRATION	GRAND REG DESK
7:30 AM - 10:30 AM	SESSION XI: PAPERS 36-44	GRAND BALLROOM
10:30 AM - 11:00 AM	BREAK IN EXHIBIT HALL	RIVERSIDE EAST
11:00 AM - 12:00 PM	SESSION XII: PANEL II, "WHEN IT IS ONE OF US"	GRAND BALLROOM
12:00 PM - 1:15 PM	LUNCH SESSIONS III	LOCATION ON TICKET
12:30 - 1:15 PM	BREAK IN EXHIBIT HALL	RIVERSIDE EAST
1:15 PM - 4:55 PM	SESSION XIII A: PAPERS 45-55	GR BR A-D NORTH
1:15 PM - 4:55 PM	SESSION XIII B: PAPERS 56-66	GRANDBRCSOUTH-G
5:00 PM - 6:30 PM	BUSINESS MEETING	GR BR A-D NORTH
7:00 PM - 7:30 PM	RECEPTION	GRANDBRCSOUTH-G
7:30 PM - 11:00 PM	AUCTION AND BANQUET	GRANDBRCSOUTH-G

SAT. 9/24/2022	FUNCTION	LOCATION
7:30 AM - 10:00 AM	REGISTRATION (IF NEEDED)	GRAND REG DESK
7:30 AM - 8:30 AM	BREAKFAST	GRAND F
8:00 AM - 9:18 AM	SESSION XIV: QUICKSHOT SESSION I 1-13	GR BR A-D NORTH
9:18 AM - 9:40 AM	BREAK	GRANDBR FOYER
9:40 AM - 10:58 AM	SESSION XV: QUICKSHOT SESSION II 14-26	GR BR A-D NORTH
11:00 AM	MEETING ADJOURNED	GR BR A-D NORTH

SPEAKER READY TIMES		
TUES. 9/20/2022	3:00 PM - 7:00 PM	GRAND SUITE 5
WED. 9/21/2022	6:00 AM - 6:00 PM	GRAND SUITE 5
THURS. 9/22/2022	6:00 AM - 6:00 PM	GRAND SUITE 5
FRI. 9/23/2022	6:00 AM - 6:30 PM	GRAND SUITE 5

