



DEPARTMENT OF SURGERY

27TH ANNUAL
HELEN & JOHN
SCHILLING LECTURE

SESSION ONE

6:30AM

Welcome — Douglas E. Wood, MD, FACS, FRCSEd, *The Henry N. Harkins Professor and Chair*

6:35AM

Research Symposium Introduction — David R. Flum, MD, MPH, Associate Chair for Research, Professor of Surgery

LONG PRESENTATIONS

6:45AM

Nina Clark, MD, General Surgery R3
“Guideline Concordant Genetic Testing In Patients With Breast, Ovarian, Pancreatic, And Prostate Cancer”..... Page 9

6:57AM

Eustina Kwon, MD, MPH, Research Fellow, UW Department of Bioengineering
“Analysis Of Spatial And Socioeconomic Patterns Of Hirschsprung Disease In Washington State” Page 10

7:09AM

David Drouillard, MD, MS, General Surgery R4
“Management Of Appendicitis During Pregnancy”..... Page 11

7:21AM

Yusha (Katie) Liu, MD, PhD, Plastic Surgery Chief Resident
“Surface EMG-Driven, Smartphone-Integrated Therapeutic Gaming System For Rehabilitation Of Muscle Weakness” Page 12

7:33AM

W. Christian Crannell, MD, Abdominal Transplant Surgery Fellow
“Identical Kidneys Are Discarded at Higher Rates When Labeled As High KDPI” Page 13

SHORT PRESENTATIONS

7:45AM

Kajal Mehta, MD, MPH, Research Resident
“The Implementation Of An Enteral-Based Resuscitation Bundle For Moderate-Sized Burn Injuries In A Resource-Limited Setting”..... Page 14

7:48AM

Rocio Carrera Ceron, MD, CVES Research Fellow
“Post-Operative Symptoms And Quality Of Life After Laparoscopic Paraesophageal Hernia Repair”..... Page 15

7:51AM

Rebecca DeSanti, MD, Plastic Surgery R4
“Perceptions Of Surgical Careers From The Female Medical Student Perspective” Page 16

7:54AM

Aldina Mesic, MPH, PhD(c), NIH Fogarty Scholar
“Spatial Analysis Of Road Crashes On National, Inter-Regional, And Regional Roads From 2005-2020 In Ghana: A Kernel Density Estimation Approach”..... Page 17

7:57AM

Arjune Dhanekula, MD, Cardiothoracic Surgery R3
“Contemporary Short-Term Outcomes In Patients Undergoing Aortic Arch Replacement”..... Page 18

8:00AM

Blake Murphy, MD, Vascular Surgery R1
“Aortic Size Index Accounts For Sex-Specific Differences In Abdominal Aortic Aneurysm Diameter At The Time Of Rupture”..... Page 19

LONG PRESENTATIONS

8:03AM

Benjamin Massenburg, MD, Plastic Surgery R5
“Morphometric Outcomes Of Non-Syndromic Sagittal Synostosis Following Open Middle And Posterior Cranial Vault Expansion”..... Page 20

8:15AM

Joshua Rosen, MD, MHS, Research Resident
“Testing Of A Novel Decision Support Tool For Acute Appendicitis”..... Page 21

8:27AM

Kyle Bilodeau, MD, Research Resident
“Causes Of Red Cell Loss During Extracorporeal Membrane Oxygenation” Page 22

8:39AM

Elina Serrano, MD, MPH, Research Resident
“Inclusion Of Non-English-Speaking Participants In U.S. Randomized Controlled Trials”..... Page 23

8:51AM

Blake Murphy, MD, Vascular Surgery R1 (*presenting on behalf of Bryce French, MD, Vascular Surgery Fellow*)
“Outcome Of Ruptured Abdominal Aortic Aneurysms In Patients Who Underwent Prior Elective Aortic Repair”..... Page 24

9:03AM

SCHILLING DISTINGUISHED FACULTY AWARD—NICOLE GIBRAN, MD / PRESENTED BY DAVID R. FLUM, MD, MPH

9:08AM

BREAK

SESSION TWO

LONG PRESENTATIONS

9:38AM

Laurel Tangalakakis, MD, CVES Clinical Fellow
“Extensive Esopahgeal Mobilization In Pehr: How Protective Is It?”..... Page 25

9:50AM

Johnathan Shih, MD, Plastic Surgery R4
“Payer Type And Disparities In Outpatient Care Following Peripheral Nerve Injury At A Level I Trauma Center”..... Page 26

10:02AM

Griffen Allen, MD, MBe, General Surgery R1
“Lack Of Preoperative Goals Of Care Discussions In Injured Older Adults: A Missed Opportunity To Provide Goal-Concordant Care” Page 27

10:14AM

Mariam N. Hantouli, MD, Postdoctoral Research Fellow
“Management Of Acute Cholecystitis During Pregnancy” Page 28

10:26AM

Frank Yang, MD, Research Resident
“Appendiceal Neoplasm In The Management Of Acute Appendicitis”..... Page 29

SHORT PRESENTATIONS

10:38AM

Editt Taslakian, MD, MS, Plastic Surgery R2
“Development Of A Low-Cost, Smartphone-Compatible Virtual Reality System For Healthcare Applications”..... Page 30

10:41AM

Mike Weykamp, MD, Research Resident
“Trauma Chest Tube Management: Practice, Population, & Outcome Heterogeneity And Development Of The Harborview Protocol”..... Page 31

10:44AM

Amir Ghaffarian, MD, Vascular Surgery R4
“Clinical Outcomes Of A Diagnostic And Management Protocol For Popliteal Artery Entrapment Syndrome At A Large Referral Center”..... Page 32

10:47AM

Deion Sims, BS, Medical Student M3
“Diverticulitis Feels Like A Life Sentence” Page 33

10:50AM

Eustina Kwon, MD, MPH, Research Fellow, UW Department of Bioengineering
“Social Vulnerability Index: A Valuable Tool To Identify Youth At High Risk For Gun-Violence?”..... Page 34

LONG PRESENTATIONS

10:53AM

Katherine Stern, MD, T32 Research Fellow, Translational Research in Trauma and Critical Care Fellowship
“Artificial Intelligence To Anticipate Sepsis In Critically Ill Trauma Patients”..... Page 35

11:05AM

Jake Hemingway, MD, Vascular Surgery Chief Resident
“A Normal Physical Exam Does Not Reliably Exclude Vascular Injury Requiring Repair Following Penetrating Upper Extremity Trauma” Page 36

11:17AM

Irene Zhang, MD, Research Resident
“Postoperative Opioid Prescribing Among Surgeons And The Impact Of A System-Wide Intervention”..... Page 37

11:29AM

Nallely Saldana-Ruiz, MD, MPH, Vascular Surgery Fellow
“Dialysis-Dependent Patients Have Increased Risk Of Myocardial Infarction And Peri-Operative Death Followig Carotid Revascularization”..... Page 38

11:41AM

Jamie Oh, MD, MS, General Surgery R4
“Temperature Sensitivity After Burn Injury: A Burn Model System National Database Hot Topic” Page 39

11:53AM

BREAK

12:23PM

Introduction by Douglas E. Wood, MD, FACS, FRCSEd, *The Henry N. Harkins Professor and Chair*

12:28PM

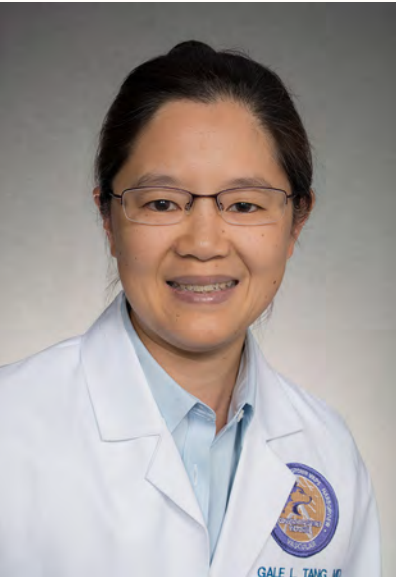
27TH ANNUAL SCHILLING LECTURE | KATHIE-ANN JOSEPH, MD — “ACHIEVING HEALTH EQUITY IN SURGERY”

1:13PM

Lecture Q&A

1:28PM

Lunch and Awards (UW Tower Cafeteria)



Gale Tang, MD

Associate Professor

I am a vascular surgeon-scientist with my clinical work at the VA Puget Sound and my laboratory based at the UW South Lake Union Research Facility. I worked on small animal models of hindlimb ischemia and genes affecting arteriogenesis (collateral artery formation) in the Messina lab during my general surgery residency at UCSF. As faculty, I have continued work on arteriogenesis in hindlimb ischemia examining the role of syndecan-1 and p27 kip1. My research interests currently focus on the vascular response to injury and arteriogenesis in response to ischemia. My work is currently funded via a VA Merit Award looking at the role of adventitial vein cells on neointimal hyperplasia in a nude rat-human greater saphenous vein graft model.



Grant E. O'Keefe, MD, MPH

Professor

I am a general surgeon at Harborview Medical Center and have an active clinical practice and research program. I have focused my research activities on how we can improve outcomes of trauma and critical illness. As a resident, I studied preventable trauma deaths in northern Alberta and developed a database that became the prototype for the Provincial trauma registry. My graduate studies the University of Washington (Master of Public Health; July 1994) focused on understanding complications after trauma. Since then, I have used genomics and other system-wide approaches to understand the biological basis of sepsis and conducted some of the earliest studies on the genetic basis for infectious complications after injury. In recent years, I have linked my clinical interest and role in overseeing nutritional support services at Harborview Medical Center with my interest in translational research to study the metabolomic effects of traumatic injury and various components of artificial nutritional support. This work has generated new knowledge and new collaborations that bring a diversity of research interests to improve outcomes through nutritional care of critically ill patients.

Welcome to the 27th Annual Department of Surgery Research Symposium and Schilling Lecture. Each year this Symposium provides us with an opportune moment to reflect on both the phenomenal quality of research in the Department and the distinguished group of scholars who have joined us as lecturers and visiting faculty over the years. Schilling lecturers represent the best and brightest across the spectrum of clinical and research disciplines in surgery while the Schilling Research Symposium is a forum to bring together faculty, residents, fellows, students, and friends to share the innovative research happening in our Department.

While last year's event was a successful virtual event, we missed some of the opportunities for connection that make this a truly special event. We look forward to seeing the reaction of an audience, those unplanned conversations and of course, the live presentation of research that is at the heart of the Symposium. The annual Schilling Lecture has always been a source of inspiration to residents and faculty alike and leaving our Zoom boxes behind will certainly be a bright spot in 2022.

We are fortunate to welcome Dr. Kathie-Ann Joseph as our Schilling Visiting Professor. Dr. Joseph is an esteemed breast surgical oncologist, Professor of Surgery at NYU Grossman School of Medicine, and Vice Chair for Diversity and Health Equity in Surgery and the Transplant Institute. Dr. Joseph is a dynamic leader in surgery and we look forward to having her with us for the research presentations and for her lecture in the afternoon entitled, "Achieving Health Equity in Surgery."

We will also be honoring this year's Schilling Distinguished Faculty Award recipient, Dr. Nicole Gi-bran and recognizing her remarkable career as a researcher.

The Surgery Research Symposium and Schilling Lecture are made possible by a generous gift from the late Helen Schilling in honor of her husband Dr. John Schilling. The Schillings were deeply committed to teaching, scholarship and research and this event, where residents showcase their research supported by faculty mentors, showcases a great aspect of their legacy. It is with tremendous pride and gratitude that we carry on this tradition and look forward to doing so for years to come.

It is also an important learning opportunity for residents and fellows to refine their scientific presentation skills through presentations, audience Q&A, and feedback from our panel of judges. The Schilling event is a celebration of the passion for research that exists within our Department. Every member of the Department plays a critical role in the success of our research mission and we are grateful for the hard work and dedication of our staff, faculty, and trainees who make events like this possible.

We are pleased that you are joining us and hope that you find the events both informative and inspiring.

Sincerely,

Douglas E. Wood, MD, FACS, FRCSEd
The Henry N. Harkins Professor and Chair
Department of Surgery
University of Washington



Douglas E. Wood,
MD, FACS, FRCSEd
The Henry N. Harkins
Professor and Chair



David R. Flum,
MD, MPH
Associate Chair for
Research, Surgery,
Professor, Surgery, Health
Services, and Pharmacy

David R. Flum, MD, MPH
Associate Chair for Research, Surgery
Professor, Surgery, Health Services, and Pharmacy
Department of Surgery
University of Washington

ABOUT HELEN & JOHN SCHILLING



Helen & John Schilling

The Helen and John Schilling Endowed Lectureship was established by the late Helen Schilling to bring distinguished scholars to the Department of Surgery at the University of Washington, and to enhance the Department’s commitment to the highest standards of patient care, teaching, research and scholarship. It was Mrs. Schilling’s wish that the lectureship be named in honor of her husband, John.

Dr. Schilling devoted his life to academic medicine in a career spanning 50 years. He was born and raised just outside Kansas City, Missouri, and at the age of 15 entered Dartmouth College. After graduating from Dartmouth in 1937, he attended Harvard Medical School as a member of the class of 1941, the last class to graduate before World War II. In the six months before the start of his internship and residency at the Roosevelt Hospital in New York City, he signed on as a ship’s doctor on the schooner Effie M. Morrissey for a scientific expedition to the Arctic sponsored by the U.S. Bureau of Standards. After a number of perilous adventures along the Greenland coast and in the Hudson Straits, he returned to New York and started his training in general surgery. He joined the surgical staff at the University of Rochester in 1945 where he began his life long work on

wound healing. His career at Rochester was interrupted for several months by a stint in the central Pacific (Eniwetok) to participate in the study of flash burns as part of the atom bomb tests and the Manhattan Project. Subsequently he joined the Air Force as a volunteer and set up a surgical department at the new School of Aviation Medicine in San Antonio.

In 1956 Dr. Schilling was invited to be the chief of the first full-time department of surgery in the new medical school at the University of Oklahoma. He was successful in recruiting a number of outstanding junior faculty, many of whom went on to become chairs. In addition to his administrative responsibilities, he maintained an extensive research program in wound healing in collaboration with Dr. Betty White. At the end of 18 years Dr. Schilling and his faculty had trained 75 surgeons from Oklahoma and adjoining states, and had established a department known for its academic accomplishments.

Dr. Schilling came to the University of Washington in 1974 as a senior investigator and, upon the sudden resignation of the chair, was asked to take over the management of the Department of Surgery. Thus began his third chairmanship which lasted eight years until his retirement. His first responsibility was to recruit faculty to fill the many vacancies, a task he achieved after several stormy years. Upon his retirement in 1983, he had recruited 41 new faculty members and graduated a total of 40 chief residents.

His career in academic surgery was marked by a devotion to patient care and teaching, as well as research. But, despite his commitment to the profession, Dr. Schilling still found time to engage in other activities. From his early childhood, he enjoyed the outdoors and had become an expert tennis player, skier, and fly fisherman; he always believed that one’s life work should be punctuated by intervals of travel and recreation.

Helen Schilling shared with her husband both the non-academic as well as the academic side of his life. They first worked together in Rochester and continued their professional association through the years in Oklahoma and Washington. They were married in 1979. Mrs. Schilling had a career in newspaper work and administration after graduating from Oberlin College. This dual background enabled her to be his close associate and administrative assistant for 40 years.

LECTURER—KATHIE-ANN JOSEPH, MD



Kathie-Ann Joseph, MD

Professor of Surgery and Population Health, Vice Chair of Diversity and Health Equity, Co-Director of the Beatrice W. Walters Breast Health Outreach and Navigation Program, and Medical Director KP-3 at NYU Grossman School of Medicine/NYU Langone Health

Dr. Kathie-Ann Joseph is Professor at NYU Langone/NYU Grossman School of Medicine and Professor of Population Health where she holds a dual appointment. She was recently appointed the inaugural Vice Chair for Diversity and Health Equity for the Department of Surgery and the Transplant Institute. In addition, Dr. Joseph is the Clinical Systems Lead for the Institute for Excellence in Health Equity (IEHE). Finally, Dr. Joseph is the inaugural Medical Director of Kimmel Pavilion Unit 3 (KP3) which stands as one of the busiest and most pivotal areas for patient care at NYU Langone. She also continues to serve as the Co-Director of the Beatrice W. Walters Breast Health Outreach and Navigation Program.

For the past 10 years she has served as the Chief of Breast Services at Bellevue Hospital. She has also worked as the Director of the NYC Health + Hospitals Breast Surgery Council. Dr. Joseph is a graduate of Harvard College and received her medical degree and master’s in public health degree from Columbia University Vagelos College of Physicians of Surgeons and Columbia University Mailman School of Public Health respectively. She completed her internship and general surgery residency training at NYU Langone Medical Center and her breast surgical oncology fellowship at Columbia University Medical Center. She is dedicated to improving the care of underserved women and eliminating inequity in health care.





Saman Arbabi, MD, MPH
Professor



Giana H. Davidson, MD, MPH
Associate Professor



Farhood Farjah, MD, MPH
Associate Professor



Sarah Greenberg, MD, MPH
Assistant Professor



Teresa S. Kim, MD
Assistant Professor



Ron V. Maier, MD
Professor



Michael S. Mulligan, MD
Professor & Chief



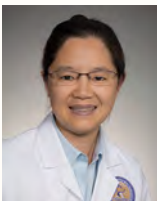
Grant E. O'Keefe, MD, MPH
Professor



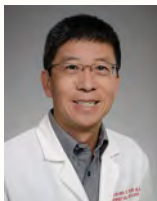
James O. Park, MD
Professor



Venu G. Pillarisetty, MD
Professor



Gale Tang, MD
Associate Professor



Raymond S. Yeung, MD
Professor



Douglas E. Wood, MD, FACS, FRCSEd
The Henry N. Harkins Professor and Chair



David R. Flum, MD, MPH
Associate Chair for Research
Professor of Surgery

DEPARTMENT OF SURGERY
RESEARCH LEADERSHIP

Nicole Gibran, MD
Professor Emeritus



Dr. Gibran is Professor Emeritus in the UW Department of Surgery. She recently retired, in July 2021, after an illustrious career that spanned over 30 years at the University of Washington. Dr. Gibran completed surgical training residency in Boston, and started her career in Seattle by completing a clinical burn fellowship (1991) and a NIH T32 research fellowship (1994). She then joined as faculty in the Division of Trauma, Burn and Critical Care Surgery. She quickly obtained her first major federal grant and continuously received federal research funding over her entire career. She was recognized for her work in multiple ways, most notably through her tenure as chair of the Surgery, Anesthesia, Trauma (SAT) Study Section at the NIH (2005-2007), becoming the first woman to serve as president of the American Burn Association (ABA) in 2012, and rising to the role of UW Associate Dean for Research and Graduate Education in 2018. The following three areas highlight her most significant research contributions in burns:

IMPROVED UNDERSTANDING OF THE GENETICS OF POST-BURN SCARRING

Clinical observations point to a genetic link for increased risk of hypertrophic scarring in certain individuals, including Black, Indigenous and People of Color (BIPOC). For over 10 years, Dr. Gibran led a translational effort to better understand genetic associations with fibroproliferation. Her research strategies ranged from in vitro models, a unique porcine model (using the Red Duroc Pig) that is most relevant to human scarring, and a human observational study that included a Genome Wide Association Study.

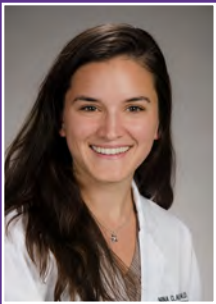
CLINICAL RESPONSES TO INJURY AND QUALITY BENCHMARKS

As a busy clinical surgeon and UW Burn Center Director, Dr Gibran sought to improve all phases of care, from early resuscitation to late scar management. She led this work through retrospective and prospective studies, multi-center industry-sponsored trials, and multi-center federally funded clinical trials such as the Glue Grant “Inflammation and the Response to Injury.” At the national level, she also led efforts to introduce quality benchmarking through development of the Burn Quality Improvement Project and elevated standards for burn center verification during her tenure as chair of the ABA Verification Committee.

LONG-TERM OUTCOMES AFTER BURN INJURY

With improved survival in the era of modern burn care, providers over the past 30 years have increasingly focused on recovery and quality of life after burns. Dr. Gibran’s work in this arena focused on long-term physical and psychological outcomes. Most of this work was through the federally funded Burn Model System Program, a 27-year multicenter effort to understand and improve long-term recovery. Burn Model System research and dissemination efforts serve to facilitate patients’ return to school / work as part of community reintegration.

As a researcher and mentor, Dr. Gibran has elevated the state of burn research – in the UW Department of Surgery and beyond – and challenged a generation of trainees to think more deeply and critically about burn injury and care.



NINA CLARK, MD

Plastic Surgery R3

Research Interests: Surgical outcomes, health services research, surgical critical care, surgical oncology

Faculty Mentor: Meghan Flanagan, MD, MPH

Medical School: University of California, San Francisco

Hometown: Pinckney, MI

Discussant: Sara H. Javid, MD

EUSTINA KWON, MD, MPH

Research Fellow

Research Interests: Health disparities in pediatric colorectal surgery and pediatric trauma

Faculty Mentor: Samuel Rice-Townsend, MD

Medical School: Penn State College of Medicine

Hometown: Newport News, VA



GUIDELINE CONCORDANT GENETIC TESTING IN PATIENTS WITH BREAST, OVARIAN, PANCREATIC, AND PROSTATE CANCER

CLARK NM, ROBERTS EA, FEDORENKO C, SUN Q, DUBARD-GAULT M, HANDFORD C, YUNG R, CHENG H, NORQUIST B, FLANAGAN MR

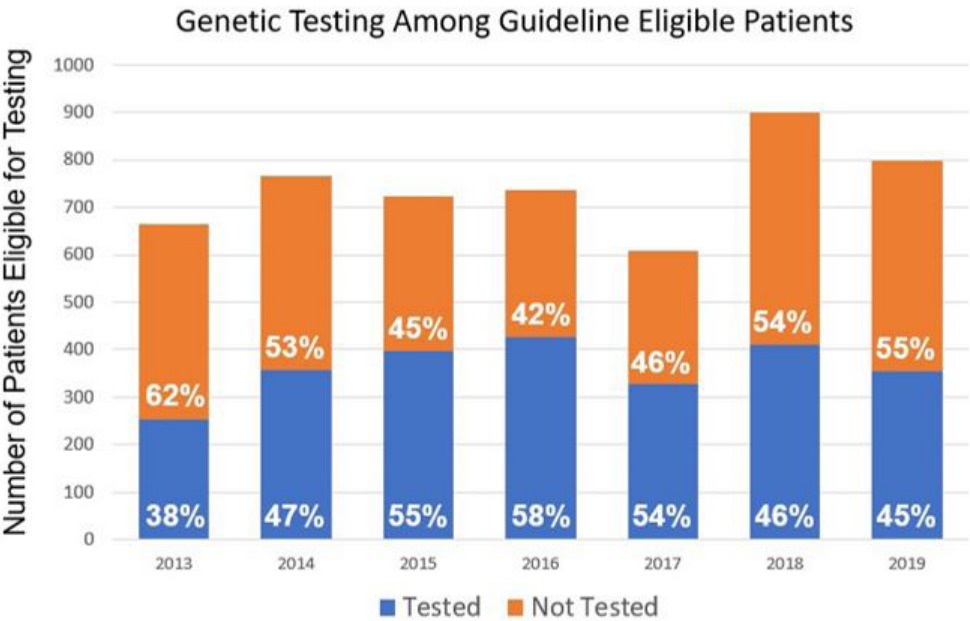
The National Comprehensive Cancer Network recommends genetic testing in patients with potentially hereditary breast, ovarian, prostate and pancreatic cancers (HBOPP). Knowledge of genetic mutations can impact decisions about screening, surgery and systemic treatment. We examined the frequency and factors associated with genetic testing among patients with HBOPP cancer from 1/2013-6/2019.

A retrospective cohort study of 26,321 HBOPP patients was conducted using a linked administrative-cancer database in the Seattle-Puget Sound SEER area. Guideline concordant testing (GCT) was assessed annually according to guideline updates. Frequency of testing according to patient/cancer characteristics was evaluated using Chi-squared tests, and factors associated with receipt of genetic testing were identified using multivariable logistic regression.

17% of HBOPP patients received testing, increasing from 12% in 2013 to 24% in 2019 ($p < 0.001$). Testing was highest in ovarian cancer (39%) and lowest in prostate cancer (4%). Age < 50 , female gender, commercial insurance, urban location, family history of HBOPP cancer, personal history of cancer and triple negative breast cancer (TNBC) were associated with increased testing (all $p < 0.05$). GCT occurred in 49%, increasing from 38% in 2013 to 58% in 2016, then decreasing to 44% in 2019 (Figure). In 2019, GCT was $> 80\%$ in TNBC, male breast cancer, personal history of breast and pancreatic cancer, and breast cancer with family history of prostate cancer; it was lowest for ovarian cancer (47%), pancreatic cancer (17%) and metastatic prostate cancer (6%).

The frequency of genetic testing for HBOPP patients has increased over time, but the proportion of patients undergoing GCT decreased recently, likely due to expanded eligibility criteria. Though GCT is high in breast cancer patients, there are gaps in concordance among patients with other cancers. These findings support expanded provider education and a need to reduce barriers to access. Increased genetic counseling and testing resources for HBOPP patients could reduce testing gaps.

Figure. Guideline eligible patients undergoing testing by year.



ANALYSIS OF SPATIAL AND SOCIOECONOMIC PATTERNS OF HIRSCHSPRUNG DISEASE IN WASHINGTON STATE

KWON EG, SMITH CA, AVANSINO JR, RICE-TOWNSEND SE

Background: Hirschsprung disease (HD) is typically repaired in infancy but can require long-term access to specialized care despite correct surgical intervention. This study aimed to determine if geographic distance from hospitals, socioeconomic status, and demographic factors of HD patients are associated with differences in re-admission rates, incidence of Hirschsprung-associated enterocolitis (HAEC), total hospital charges, or admission length of stay (LOS).

Methods: The Washington State Inpatient Database from the Agency for Healthcare Research and Quality (AHRQ) from 2015-2018 was queried for pediatric patients (0-18y) with the diagnosis of HD. Multivariate analyses were performed using logistic regression and log transformation linear regression models, adjusting for individual patient characteristics.

Results: We identified a total of 255 pediatric patients with the diagnosis of Hirschsprung disease who required inpatient admission. Twenty-four percent of these patients had at least one all-cause 30-day readmission. Compared to patients with Medicaid, those with private insurance were less likely to be readmitted within 30 and 90 days ($RRR = 0.37, 0.36; p < 0.05$). Payor status was not associated with a difference in HAEC, total charges, or LOS. Patients who live more than 50 miles from hospitals were less likely to require hospital admission for HAEC when compared to those who live less than 10 miles ($RRR = 0.34; p < 0.05$). Distance from hospitals was not associated with differences in other outcomes.

Conclusions: Distance from hospitals, payor status, and demographic factors had effects on resource utilization in pediatric patients with Hirschsprung disease in the state of WA. Further studies are needed to identify and address potential disparities leading to these patterns.



DAVID DROULLARD, MD, MS

General Surgery R4

Research Interests: Patient reported outcomes, surgical decision-making, patient engagement, appendicitis, diverticulitis

Faculty Mentor: Giana H. Davidson, MD, MPH

Medical School: Columbia University

Hometown: Minneapolis, MN

Discussant: Zoe E. Parr, MD

YUSHA (KATIE) LIU, MD, PHD

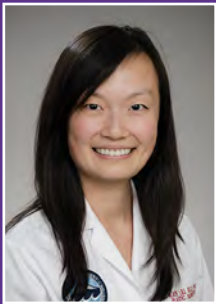
Plastic Surgery Chief Resident

Research Interests: Hand and peripheral nerve surgery

Faculty Mentor: Aaron Bunnell, MD,
UW Department of Rehabilitation Medicine

Medical School: University of Washington School of Medicine

Hometown: Latrobe, PA



MANAGEMENT OF APPENDICITIS DURING PREGNANCY

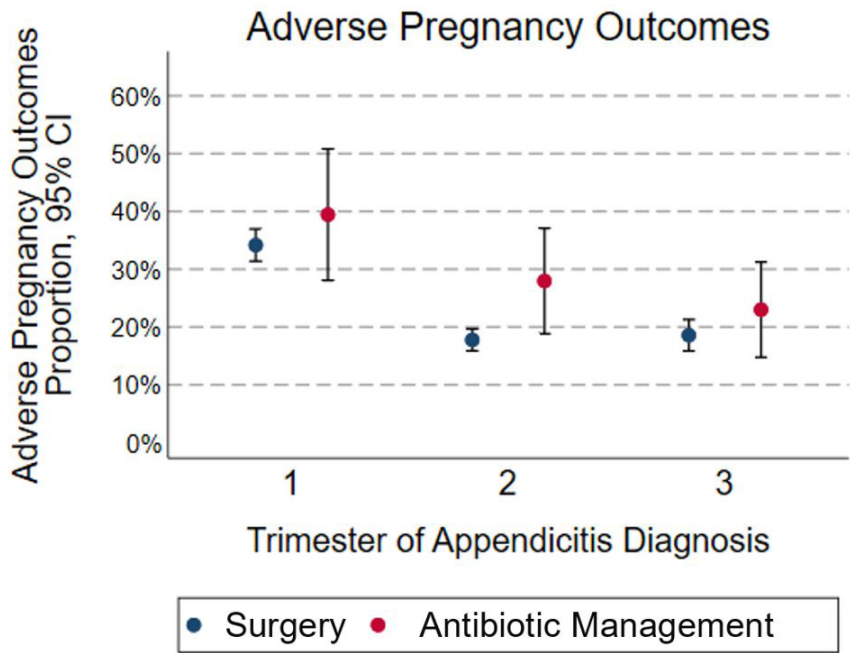
DROULLARD DJ, HANTOULI MN, NASH MG, BENSON LS, KESSLER LG, FLUM DR, DAVIDSON GH

Background: Antibiotic management of appendicitis is increasingly common in adults. However, the frequency of its use for pregnant patients is unclear, as is the associated risk of adverse pregnancy outcomes (APO). We aim to characterize trends in the use of antibiotic management and the incidence of APO after antibiotic management and appendectomy.

Methods: A retrospective cohort study of patients (age 14-55y) with appendicitis during singleton pregnancies using the IBM MarketScan Research Databases (2007-2019), applying an algorithm to determine gestational age from administrative claims. We defined appendicitis, appendectomy within 2 days of diagnosis, and APO (pregnancy loss and preterm birth) using insurance claims, and used multivariable logistic regression to account for differences in patient characteristics and disease severity.

Results: 3,735 patients were diagnosed with appendicitis during pregnancy (mean age 29), of whom 7.1% were initially managed with antibiotics alone. This proportion increased significantly over the study period, from 4.5% in 2007 to 12% in 2019 ($p < 0.001$). APO were similar between those managed with surgery vs. antibiotics in the first and third trimesters, however antibiotic management in the second trimester was associated with a significantly higher incidence of APO (28% vs. 18%, $p = 0.014$). This association remained statistically significant after adjusting for pregnancy risk factors and appendicitis severity (adjusted odds ratio 1.75, 95% confidence interval 1.09-2.81).

Conclusions: Antibiotic management is increasingly used for appendicitis in pregnancy. While this strategy appears to have similar outcomes to surgery for first and third trimester cases, nonoperative management in the second trimester may be associated with greater risk of APO.



SURFACE EMG-DRIVEN, SMARTPHONE-INTEGRATED THERAPEUTIC GAMING SYSTEM FOR REHABILITATION OF MUSCLE WEAKNESS

LIU Y, SILVA RML, BAUDIN JA, MEECE D, MORRIS CH, KIM J, ZISTATIS J, CHANG SR, FRIEDRICH JB, KAO DS, BOONE DA, BUNNELL AE

Background: Severe muscle weakness from causes including peripheral nerve and spinal cord injury, stroke, and traumatic brain injury are debilitating; although therapy is critical for regaining function, patients with profound weakness are unable to perform standard exercises. To address this limitation, we created an innovative system of therapeutic gaming controlled by input from surface electromyography (sEMG), a noninvasive technique that measures electrical signals generated by muscle contractions from electrodes placed on the overlying skin.

Methods: Our initial sEMG prototype consisted of adhesive electrodes and sensor circuit board that plugged into a computer to run a simple video game. Our upgraded sEMG device design features Bluetooth connectivity, stainless steel button electrodes, a water-resistant and sanitizable clamshell housing, and wireless charging and gameplay. This is integrated with a mobile app that not only runs the game, but also allows for calibration of muscle strength and data tracking to monitor progress over time.

Results: In pilot testing of our therapeutic gaming platform, patients with neurological injury ($n=21$) found the system motivating, enjoyable, easy to use, and subjectively felt that its use would speed up their recovery. Even those lacking antigravity muscle strength were able to reliably engage in gameplay.

Conclusions: Surface EMG-driven therapy has tremendous potential particularly in the earliest stages of recovery, as nascent signals from muscle activation are detectable on EMG long before significant limb movement is observed, allowing for earlier initiation of active therapy. Therapeutic gaming also promotes patient engagement, motivation, and adherence to exercises. We have engineered a compact, wearable, Bluetooth-enabled sEMG device and integrated this with a mobile app-based video game compatible with smartphones and tablets. Our novel design will maximize accessibility, with the hope that patients of all ages, socioeconomic statuses, and communities may benefit from this innovative, personalized approach to rehabilitation.

Figure 1. Our custom-designed wireless, wearable sEMG device pairs via Bluetooth to a smartphone to run the therapeutic gaming app.





W. CHRISTIAN CRANNELL, MD

Abdominal Transplant Surgery Fellow

Research Interests: Kidney and liver utilization and graft optimization, surgical education

Faculty Mentor: Catherine Kling, MD

Medical School: University of Vermont

Hometown: Suffern, NY

Discussant: Nicolae Leca, MD

KAJAL MEHTA, MD, MPH

Research Resident

Research Interests: Burn injury prevention and care, quality improvement, global health/global surgery

Faculty Mentor: Barclay Stewart, MD, PhD, MPH

Medical School: UT Southwestern Medical School

Hometown: Lake Jackson, TX



IDENTICAL KIDNEYS ARE DISCARDED AT HIGHER RATES WHEN LABELED AS HIGH KDPI

CRANNELL WC, PERKINS JD, KLING CE

Background: The kidney donor risk index (KDRI) and percentile conversion kidney donor profile index (KDPI) were introduced with the Kidney Allocation System (KAS) to provide a continuous measure of kidney donor quality. Kidneys with a KDPI > 85% (KDPI₈₅) require additional informed consent from the recipient and are colloquially referred to as ‘high KDPI’. The median KDRI and the 85th percentile KDRI (KDRI₈₅) are recalculated annually; consequently, the KDPI₈₅ cutoff changes every year. This study examines changes in KDRI₈₅ over time, determine kidney utilization around the KDPI₈₅ cutoff and explores the “high KDPI” labeling effect. We hypothesize identical KDRI kidneys are utilized differently when above or below the KDPI₈₅ cutoff.

Methods: KDRI to KDPI Mapping Tables from 2012 to 2020 were used to determine the yearly KDRI₈₅ value. OPTN data was used for organ discard and utilization rates for kidneys with KDRI below the KDPI₈₅ cutoff (KDPI_{LOW}) and above (KDPI_{HIGH}).

Results: The KDRI₈₅ varied by year, between 1.768-1.888. Kidney discard rates were significantly lower for KDPI 81-85 kidneys compared with KDPI 86-90 kidneys, by 8.9% (36.2% vs 45.1%, p<0.001). Kidneys with a KDRI between 1.785–1.849 were classified as KDPI_{HIGH} in years 2015-2017 and KDPI_{LOW} in years 2018-2020 (Table 1). The discard rate was 44.9% when labeled as KDPI_{HIGH} and 39.1% when labeled as KDPI_{LOW} (p<0.01). The number of kidneys transplanted per donor decreased from 1.11 for KDPI_{LOW} to 0.94 for KDPI_{HIGH} (p<0.01).

Conclusions: The KDRI₈₅ changes yearly, impacting which kidneys are labeled as KDPI_{HIGH}. Organ discard significantly increases for the 5% of kidneys above the KDRI₈₅ marker compared with below. For identical KDRI kidneys, “high KDPI” label significantly increases discard rates. The high KDPI label and consent process should be removed.

Table 1
The High KDPI Labelling Effect for Identical Kidneys

	2015-2017 (KDPI _{HIGH})	2018-2020 (KDPI _{LOW})	P
Mean KDRI ± SD	1.816 ± 0.019	1.817 ± 0.019	0.67
Donors (n)	694	918	0.01
Kidneys procured (n)	1186	1666	
Kidneys transplanted, n (%)	654 (55.1%)	1015 (60.9%)	0.002
Kidneys discarded, n (%)	532 (44.9%)	651 (39.1%)	
Kidney transplanted per donor (n)	0.94	1.11	<0.001

THE IMPLEMENTATION OF AN ENTERAL-BASED RESUSCITATION BUNDLE FOR MODERATE-SIZED BURN INJURIES IN A RESOURCE-LIMITED SETTING

MEHTA KA, LEE J, YADAV M, MESIC A, SHRESTHA R, POUDEL K, GYAWALI P, PHAM TN, RAI SM, NAKARMI KK, STEWART BT

Introduction: Timely and adequate resuscitation for moderate to severe burn injuries is challenging in many circumstances globally, from low- and middle-income countries (LMICs) to military settings to mass casualty disasters. Burn care experts recommend using enteral-based resuscitation (ER) in these austere settings, however there are no clear protocols or guidelines on how to perform ER in real-world scenarios. We aimed to describe the development and early implementation of an ER bundle in an austere environment.

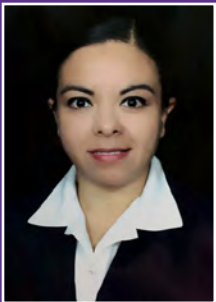
Methods: Within the context of a pilot study of ER versus standard of care intravenous (IV) resuscitation for moderate-sized burn injuries, we applied implementation science strategies (i.e., Expert Recommendations for Implementing Change (ERIC)) to design and implement an ER bundle at a major burn center in Nepal. Semi-structured focus group discussions were conducted with stakeholders to understand facilitators and barriers to developing and using the protocol, with iterative feedback used to adjust the protocol and documentation tools. Responses were analyzed using content analysis. Quantitative measurements were used to examine the acceptance, adherence, accuracy and fidelity of the protocol.

Results: Stakeholders developed an ER protocol with 2-hourly assessments along with corresponding documentation tools. Several initial barriers to adoption were encountered. ERIC strategies utilized to promote intervention uptake included simplification and visualization of the protocol, identification of project champions, development of educational materials for multiple cadres, utilizing chains of command to enable accountability, utilizing institutional branding and ultimately obtaining endorsement by the center’s leadership (Table 1). Post-implementation quantitative review demonstrated 91-99% completion of documentation and 95% adherence to the protocol, demonstrating high fidelity.

Conclusion: Development of a contextually appropriate enteral-based resuscitation bundle in a resource-constrained setting required a multi-faceted approach led by a team of change champions and leaders. The ERIC framework allowed for an iterative approach to prioritize stakeholder engagement and feedback to begin the implementation and of an ER bundle in an LMIC.

Table 1. Expert Recommendations for Implementing Change (ERIC) Strategies for Protocolized, Enterally-based Resuscitation Design and Implementation

Strategy	Activities
Assess readiness	Nursing and hospital staff interviews
Build coalition	Identify champions
Change records system	New documentation system
Conduct education campaign	Formal training sessions with materials
Conduct local consensus discussions	Develop consensus on resuscitation protocols
Conduct ongoing training	Informal small group trainings
Develop educational materials	Posters, case studies, videos
Closed-loop communication	Group chat for shared decision-making
Identify early adopters	Recognize adopters and successes
Promote adaptability	Feedback-based modifications incorporated



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Research Interests: Esophageal and thoracic surgery, motility, surgical outcomes

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REBECCA DESANTI, MD

Plastic Surgery R4

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POST-OPERATIVE SYMPTOMS AND QUALITY OF LIFE AFTER LAPAROSCOPIC PARAESOPHAGEAL HERNIA REPAIR

CARRERA CERON RE, OELSCHLAGER BK, INABA C, TANGALAKIS L, WRIGHT AS

Background: Paraesophageal hernia repair (PEHR) can be challenging and has known high recurrence rate. Biologic mesh has been shown to reduce short-term but not long-term recurrence but the impact of mesh on quality of life and post-operative symptoms is unclear. The aim of this study was to evaluate outcomes of PEHR comparing primary repair (PR) vs. biologic mesh repair (MR), based on quality of life and post-operative symptoms.

Methods: We identified all patients who underwent first-time laparoscopic PEHR between October 2015-October 2019 at our institution who had a minimum postoperative follow-up of 6 months. Mesh was used selectively and at surgeon’s discretion. A standardized symptom questionnaire was administered using a scaled 0 to 10 score for severity, and 0 to 4 for frequency for postoperative symptoms.

Results: 95 patients underwent PEHR during our period of study, including 65 (68%) PR and 30 (32%) MR, without differences in baseline characteristics. Median follow-up was 226 days (7.5 months). We obtained a postoperative upper gastrointestinal (UGI) study in 92% of the PR group and in 97% of the MR group. Radiologic recurrence was statistically higher in the PR compared with MR repair (32% vs. 21%, *p*= 0.04).

There was no significant difference between PR and MR groups in postoperative symptom frequency or severity. We compared the outcomes of patients with a recurrent hernia with those without a recurrence. Every symptom except chest pain was significantly more severe in those with recurrent hernias (table).

Symptom	No Recurrence	Recurrence	<i>p</i> value
Heartburn	1. 1± 2.2	2.5 ± 2.9	0.01
Regurgitation	0.8 ± 1.9	2.3 ± 2.6	0.003
Dysphagia	1.0 ± 2.1	2.3 ± 2.9	0.01
Chest pain	0.9 ± 2.0	1.8 ± 2.9	0.08
Bloating	1.3 ± 2.2	2.6 ± 3.2	0.03
Abdominal pain	1.0 ± 1.9	2.6 ± 3.2	0.004
Diarrhea	1.34 ± 2.2	2.5 ± 3.2	0.03
Values are mean ± SD. *Symptom severity scored by scale 0 –10			

Conclusions: Post-operative GI symptoms rarely caused frequent or daily impact, and there was no difference in these symptoms between primary and MR. These findings demonstrate that mesh reinforcement of the hiatus reduces short-term recurrence and is not a predictor of poor postoperative symptomatic outcomes. Patients without recurrence have better clinical outcomes, indirectly supporting the use of mesh for short-term outcomes.

PERCEPTIONS OF SURGICAL CAREERS FROM THE FEMALE MEDICAL STUDENT PERSPECTIVE

DESANTI RL, LIU Y, HERRIN MA, COLOHAN SM, CALHOUN KE

Background: Over 50% of medical students are women with improved outcomes in patients treated by female surgeons, yet women comprise the minority of surgical residents¹. Surgical mentors have been associated by medical students with choosing a surgical career by fostering an interest in the mentor’s field². We investigated surgery from the female medical student’s perspective to identify and find solutions to perceived career barriers addressed through mentorship.

Methods: 37 female medical students enrolled in a Women in Surgery mentorship program between July 2019 and February 2021 completed an anonymous online survey including demographic information, quantitative survey items, and free text responses.

Results: Mean age was 25 years old, with 9 first, 3 second, 19 third, and 6 fourth year students. 51% were married/in a relationship. None had children prior to/during medical school or were currently pregnant. 97% were considering a surgical career, however, only 65% were likely to choose surgery. 95% agreed women can succeed in surgery, but 89% believe women are treated differently than men in surgery, and 97% believe barriers to achieving success in surgery are different for women. To aid in choosing surgery, 68% believed they would require support through mentorship. Barriers to pursuing surgery most commonly included a relationship/marriage (73%), personal competitiveness based on USMLE scores, grades, and clerkship performance (70%), duration of training (68%), and ability to have a family (68%), followed less commonly by gender-based discrimination from colleagues (54%) or patients/families (38%), and financial concerns (22%). 84% indicated three or more of these concerns.

Conclusions: Female medical students are interested in pursuing surgical careers and believe they can be successful yet desire women mentors to help combat personal, social, and financial concerns. Mentorship programs matching female medical students with women surgeons will help alleviate perceived barriers thus increasing the number of women choosing surgery.



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Cardiothoracic Surgery R3

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Hometown: Detroit, MI

SPATIAL ANALYSIS OF ROAD CRASHES ON NATIONAL,
INTER-REGIONAL, AND REGIONAL ROADS FROM 2005-2020 IN GHANA:
A KERNEL DENSITY ESTIMATION APPROACH

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OPOKU, I (2), OBIRI-YEBOAH, M (7), DONKOR, P (3), STEWART, B (5,)6

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- 2. Building and Roads Research Institute, Kumasi, Ghana
- 3. Department of Surgery, School of Medicine and Dentistry, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana
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- 5. Department of Surgery, University of Washington
- 6. Harborview Injury Prevention and Research Center
- 7. National Road Safety Authority, Accra, Ghana

Abstract: The burden of road traffic injuries (RTIs) and deaths is disproportionately high in Ghana and other low- and middle-income countries (LMICs). Road traffic crashes are the leading cause of death among young people (5-29) in LMICs, and are expected to increase due to road development, a growing number of vulnerable road users (i.e., those without external protection such as pedestrians, cyclists, and motorcyclists), and increasing rates of motorized vehicle ownership. In Ghana, despite the systematic collection of comprehensive road crash data nationally since 2003, spatiotemporal trends in road traffic crashes have not been analyzed. This study addresses this research gap by identifying crash, RTI, and death hotspots on national, inter-regional, and regional roads from 2005-2020. We utilize geo-stamped crash data from police reports (88,385 crashes from 2005-2020) compiled and maintained by the Building and Roads Research Institute. We describe the epidemiology of crashes, RTIs, and deaths across all years (2005-2020), each year, and among two types of road users: vulnerable and non-vulnerable (i.e., those with external protection such as private vehicle and public transport occupants). We use Kernal Density Estimation methods to study the spatial patterns. We describe crash-level, vehicle-level, and individual-level correlates to crashes. Further, we conducted a statistical significance analysis to understand which locations have statistically significant density, which is critical for allocating limited resources. These results will inform interventions aimed at crash prevention and post-crash care which will reduce RTIs and deaths in Ghana.

CONTEMPORARY SHORT-TERM OUTCOMES IN PATIENTS
UNDERGOING AORTIC ARCH REPLACEMENT

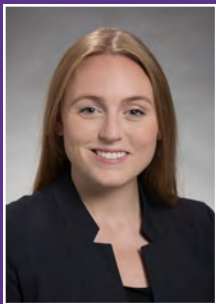
DHANEKULA AS, TABESH A, DEROO SC, BURKE CB

Background: Operative management of aortic arch pathology has long been challenging. Over the years, improved technique and technologies have vastly improved our ability to intervene on the arch, including strategies that span open, endovascular, and hybrid approaches. With many options available for aortic arch repair, it is critical to compare outcomes between each and determine their appropriate clinical indications. Here, we analyze our single-institution short-term outcomes for patients who underwent open replacement of their aortic arch.

Methods: Retrospective cohort study including patients who underwent open arch replacement at the University of Washington from January 2019 until the end of 2021, excluding any acute Type A dissections. Final cohort size was 80 patients.

Results: Of the 80 patients in the cohort, 68 (85%) had arch replacements into zone 2, 7 (8.75%) were into zone 1, 4 (5%) were into zone 3, and 1 patient (1.25%) had a zone 0 replacement with frozen elephant trunk. 44 (53.75%) were re-do sternotomies, and 53 (61.25%) had a frozen elephant trunk placed. The entire cohort had a stroke rate of 6.25% (8 patients), spinal cord ischemia rate of 3.75% (3), and a 30-day mortality rate of 3.8% (5). When excluding re-operative sternotomies, the cohort had a stroke rate of 5.4% (2), spinal cord ischemia rate of 2.7% (1), and a 30-day mortality rate of 2.7% (1).

Conclusion: Open arch replacement is a safe and effective treatment paradigm for patients with arch disease, whether it be acute dissection, chronic dissection, or aneurysmal disease. Even with re-operative sternotomy, CVA rate is below 10% and 30-day mortality is below 5%. These numbers improve further when excluding acute dissection. Thus, even with advancing endovascular strategies to treat the arch, modern open arch replacement remains an important therapeutic option in these patients.



BLAKE MURPHY, MD

Vascular Surgery R1

Research Interests: Disparities in vascular surgery, complex aortic disease, vascular access, quality improvement

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Hometown: Chicago, IL



BENJAMIN MASSENBURG, MD

Plastic Surgery R5

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Hometown: Kula, HI

Discussant: Russell E. Ettinger, MD

AORTIC SIZE INDEX ACCOUNTS FOR SEX-SPECIFIC DIFFERENCES IN ABDOMINAL AORTIC ANEURYSM DIAMETER AT THE TIME OF RUPTURE

MURPHY BE, HEMINGWAY JF, AHMAD M, QUIROGA E, TRAN N, SINGH N, STARNES BW, ZETTERVALL SL

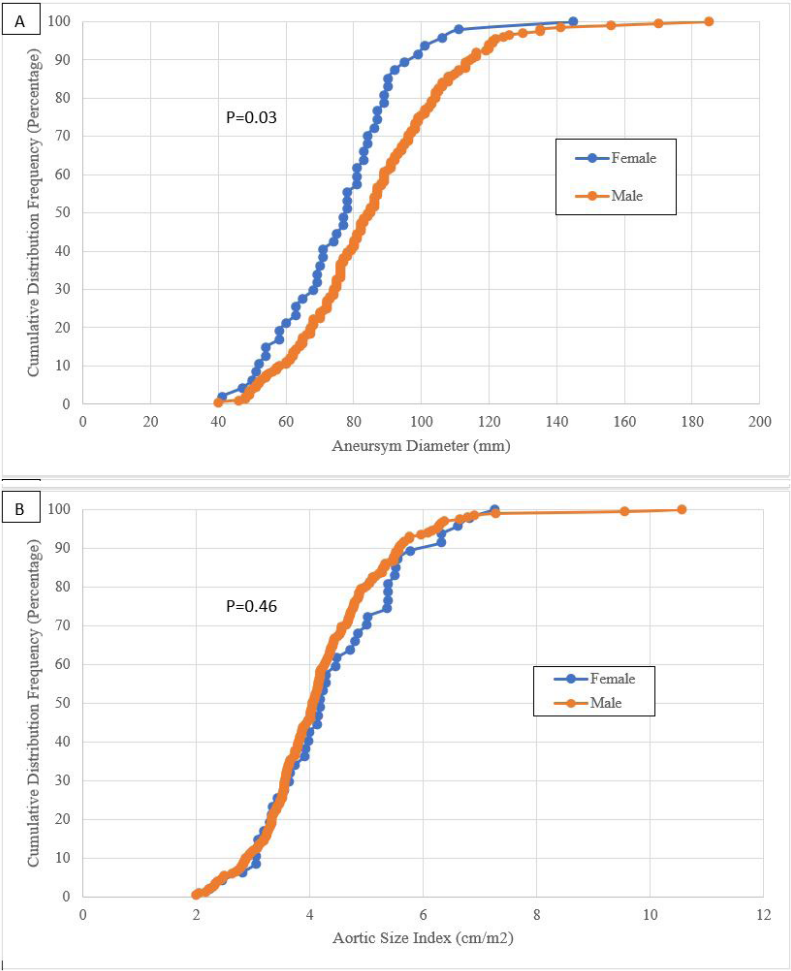
Background: Prior studies examining sex-related differences in outcomes following abdominal aortic aneurysm (AAA) repair suggest worse outcomes among women due to lower rates of endovascular repair (EVAR), anatomic differences, and higher rupture rates despite smaller AAA diameters. While aortic size index (ASI) has been proposed as a surrogate marker of rupture risk in women, no studies have compared sex-specific anatomic variations and outcomes following ruptured AAA (rAAA) repair.

Methods: A retrospective review of all rAAA patients treated at a single academic center between January 2002 and December 2018 was performed. The Dubois and Dubois formula was used to calculate ASI. Sex-specific demographics and outcomes were compared using the Student t-test and Chi-Squared test. Aneurysm diameter distributions and ASI were compared using the Kolmogorov-Smirnov test. Predictors of post-operative morbidity and mortality were assessed with multivariable analysis.

Results: 239 patients met inclusion criteria. Women (n=45, 19%) had higher rates of chronic obstructive pulmonary disease (43% vs. 23%, p=.010) and smaller AAA diameters (Figure 1A, p=.03). ASI was comparable (Figure 1B). Although a similar percentage of women had anatomy suitable for EVAR (53% vs. 66%), women were less likely to undergo EVAR (36% vs. 56%, p=.02). There were no differences in 30-day mortality (27% vs. 28%), post-operative respiratory failure (38% vs. 35%), renal failure (13% vs. 20%), or major adverse cardiac events (7% vs. 10%). Neither ASI (p=.72), nor AAA diameter (p=.77), were predictive of 30-day mortality on multivariable analysis. The differences seen in AAA diameter based on gender (Figure 1A) normalized when ASI was calculated (Figure 1B).

Conclusions: Men and women achieve similar peri-operative outcomes following rAAA repair, despite lower rates of EVAR, with the ASI accounting for sex-specific differences seen in AAA diameter. An aggressive approach to management should be applied to all patients treated with ruptured AAA, regardless of sex.

Figure 1: Distribution of abdominal aortic aneurysm diameter (A) and aortic size index (B), by sex.



MORPHOMETRIC OUTCOMES OF NON-SYNDROMIC SAGITTAL SYNOSTOSIS FOLLOWING OPEN MIDDLE AND POSTERIOR CRANIAL VAULT EXPANSION

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Institutions:

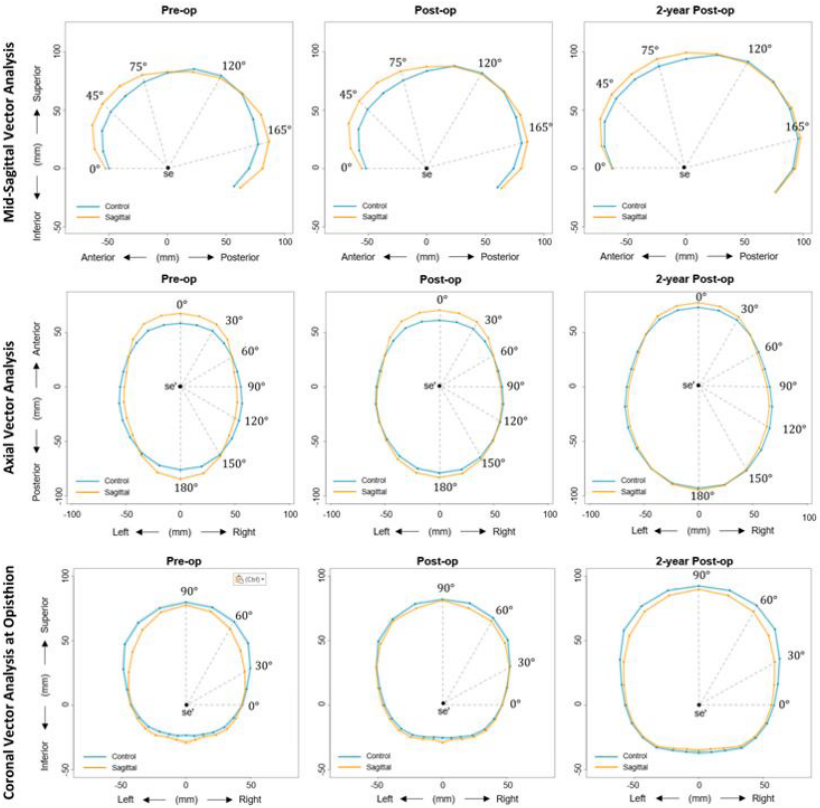
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Purpose: This study aims to quantify the change in three-dimensional skull morphometrics for patients with sagittal synostosis (SS) between presentation, after surgery, and at two-year follow-up.

Methods: CT scans from 91 patients with isolated SS were age, gender, and race matched to 273 controls. We performed vector analysis with logarithmic regressions to model the impact of open middle and posterior cranial vault remodeling on cranial shape and growth.

Results: Anterior cranial volume, bossing angle, and frontal shape were not changed by surgery but normalized without intervention by two years. Bi-parietal narrowing and middle cranial volume was expanded after surgery and maintained at two years. Occipital protuberance was improved after surgery and normalized at two years. Posterior cranial volume was decreased by the occipital remodeling and remained slightly lower than control volumes at two years. Persistent residual deformities at two years included supero-lateral narrowing at the level of opisthion and supero-anterior vertex bulge. Logarithmic models suggested older age at surgery resulted in more scaphocephaly and enlarged posterior cranial vault volumes at two years, without impacting other volume outcomes. Initial preoperative severity score was most predictive of two-year morphometrics.

Conclusion: Initial severity of SS deformity was the best predictor of two-year morphometric outcomes. An anterior vertex bulge can persist and supero-posterior cranial width decreases with time after open surgery, but frontal dysmorphology self-corrects without surgical intervention.





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Research Interests: Surgical outcomes, decision making, trauma, acute care surgery and critical care

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Discussant: Farhood Farjah, MD, MPH

KYLE BILODEAU, MD

Research Resident

Research Interests: Extracorporeal membrane oxygenation, cardiac surgery

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TESTING OF A NOVEL DECISION SUPPORT TOOL FOR ACUTE APPENDICITIS

ROSEN JE, FLUM DR, DAVIDSON GH, LIAO JM

Background: Given mounting evidence that antibiotics are a safe and effective treatment for appendicitis, treatment choices should be based on patients’ preferences and values. We created a novel decision support tool (DST) to facilitate shared decision making for appendicitis. We assessed its’ efficacy at decreasing decisional conflict and encouraging consideration of an alternative treatment.

Methods: An online randomized experiment in at-risk individuals comparing the DST to a standard infographic. Individuals were given a vignette of uncomplicated acute appendicitis. Decisional conflict scale (DCS) scores were measured, and participants were randomized 3:1 to view the DST or infographic. Post-intervention DCS scores and treatment perceptions were measured. The primary outcome was the total DCS score before and after exposure to the DST.

Results: 180 individuals were randomized (132 DST, 48 infographic). Demographic characteristics were balanced between groups. Total DCS scores decreased after viewing the DST (59.0 to 14.6, $p<0.001$) representing movement from a state of high to low decisional conflict. Individuals shown the DST reported higher acceptability (3.7 vs. 3.3 out of 4, $p<0.001$) and perceived the information as more accurate (4.7 vs. 4.4 out of 5, $p=0.005$) and trustworthy (4.5 vs. 4.3 out of 5, $p=0.02$) than the infographic. Total DCS scores were lower in the DST group compared to the infographic, but the difference was not statistically significant (14.6 vs. 18.1, $p=0.41$). Individuals viewing the DST were more likely to agree that antibiotics are safe (98% vs. 79%, $p<0.001$) and would work for them if they had appendicitis (76% vs. 65%, $p=0.01$), while similar proportions felt surgery was safe (97% vs. 92%, $p=0.31$).

Conclusions: The DST decreased decisional conflict, was viewed as trustworthy and unbiased, and encouraged consideration of both treatment strategies. The DST may be an effective tool to facilitate shared decision making between surgeons and patients with acute appendicitis

CAUSES OF RED CELL LOSS DURING EXTRACORPOREAL MEMBRANE OXYGENATION

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Objective: This study estimated red blood cell (RBC) loss rates during pediatric extracorporeal membrane oxygenation (ECMO) due to diagnostic phlebotomy, intravascular hemolysis, bleeding and other causes.

Design: Retrospective, single-center, observational study

Setting: Tertiary care children's hospital

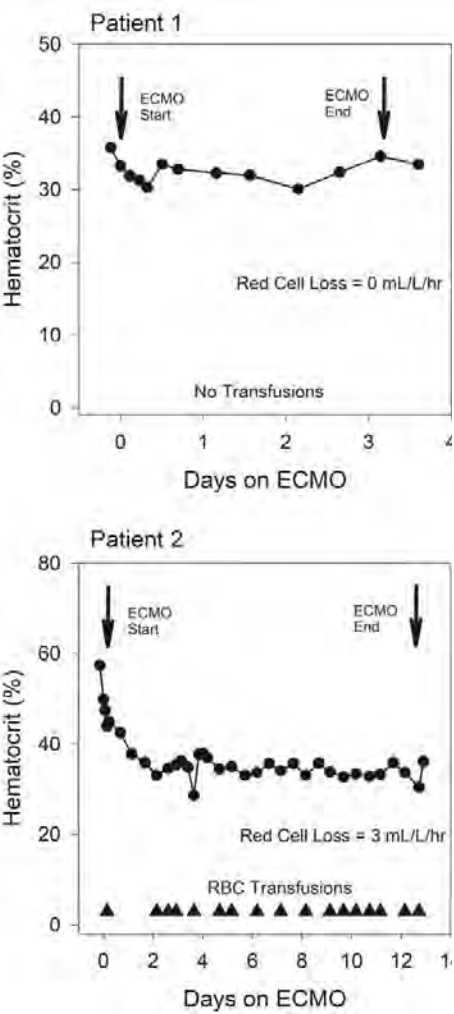
Patients: 91 ECMO patients (age 1d-20y, 33VV, 64VA).

Measurements: An RBC loss index (RLI), equal to mL RBCs lost per liter of patient+circuit volume per hour, was calculated from changes in hematocrit and transfused RBCs. RBC loss due to hemolysis was estimated from plasma hemoglobin and free hemoglobin half-life. RBC extracellular vesicles were measured by flow cytometry.

Main Results: Median RLI on ECMO was 1.9 mL/L/hr, 13-fold higher than normal and equivalent to a 4.6 drop in hematocrit/day. RBC loss was higher in patients that died (2.95 mL/L/hr) versus survived (1.70, $P = 0.0008$). RLI was highly correlated with transfusion rate ($r^2 = 0.71$). Median RBC transfusion rate was 9 mL/kg/day. Transfusion rate measured in mL per kg patient weight underestimated RBC loss in patients with large changes in hematocrit and over-estimated RBC loss in neonates where the circuit volume>patient blood volume. RLI is a more reliable indicator of RBC loss. RLI was 40% higher in patients with bleeding. In non-bleeding patients, intravascular hemolysis represented 16% of total RBC loss and diagnostic phlebotomy 24%, suggesting that ~60% of RBC loss was due to other causes. RBC extracellular vesicle generation, a measure of RBC injury/activation, was increased 7-9-fold during ECMO, indicating sublethal RBC damage during ECMO is occurring and could lead to extravascular clearance of damaged RBCs.

Conclusions: Our study is the first to quantitate total, phlebotomy and intravascular hemolysis RBC loss. In non-bleeding pediatric ECMO patients, phlebotomy and intravascular hemolysis account for only 40% of RBC loss, while the remainder is due to other causes including possible extravascular clearance due to sublethal RBC injury.

Figure 1. Example of red cell loss and transfusion for two patients on ECMO.





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Research Interests: Surgical disparities, the patient experience of individuals with limited English proficiency, trauma outcomes

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Discussant: Rebecca Maine, MD, MPH

BRYCE FRENCH, MD

Vascular Surgery Fellow

Research Interests: Aortic aneurysms, ruptures aneurysms

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INCLUSION OF NON-ENGLISH-SPEAKING PARTICIPANTS
IN U.S. RANDOMIZED CONTROLLED TRIALS

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Abstract: Background: Underrepresentation of diverse research participants limits generalizability of study results, hinders the detection of treatment effect heterogeneity, and prevents some populations from experiencing the benefits of research advancements. Non-English-speaking (NES) patients encounter significant barriers in access to care and have worse clinical outcomes, yet the extent to which this population is represented in randomized controlled trials (RCTs) remains unknown. We aimed to assess the representation of NES populations in U.S. RCTs published in three high-impact clinical journals.

Methods: A systematic review of U.S. RCTs published in The New England Journal of Medicine, The Journal of the American Medical Association, and The Lancet was performed. Two independent reviewers assessed articles for eligibility. Eligible studies underwent a full text review of the manuscript, protocol, supplementary materials, and ClinicalTrials.gov registration.

Results: Among 112 US-conducted RCTs, 10 (9%) studies explicitly included NES participants and 4 (40%) of these reported number of NES participants. Sixteen (14%) studies explicitly required English proficiency in their eligibility criteria and thus excluded NES participants. Sixteen (14%) studies reported provision of translated consent forms, translated research materials, professional interpreters and/or bilingual research staff but did not explicitly report whether NES participants were recruited. Most studies (70 or 63%) did not comment on participant language or efforts to include NES participants. Among 14 (13%) surgical trials, three (21%) studies explicitly included NES and one study (7%) required English proficiency. Six (43%) surgical trials did not comment on participant language.

Conclusion: The majority of RCTs either systematically excluded or failed to report the inclusion of NES individuals. These results highlight the need for standardized language reporting guidelines and intentional efforts from investigators, internal review boards, funding and regulatory agencies, and journals to include NES participants and other underrepresented subpopulations in clinical research.

OUTCOME OF RUPTURED ABDOMINAL AORTIC ANEURYSMS IN
PATIENTS WHO UNDERWENT PRIOR ELECTIVE AORTIC REPAIR

FRENCH, B, KARIM, M, SINGLETON, M

Introduction: Elective aortic aneurysm repair is effective in the prevention of future rupture for the vast majority of patients. Without adequate long-term surveillance and reintervention, sac expansion and rupture are reported despite previous repair. However, limited data is available on the outcomes of these patients following treatment for ruptured AAA. This study aims to assess whether patients undergoing treatment of a rAAA presenting after elective repair have adverse outcomes compared to patients without a prior repair.

Methods: A retrospective study using data from the Vascular Quality Initiative (VQI) from 2011 to 2021 was performed to evaluate patients treated for a rAAA. Outcomes were compared between patients with and without a previous aortic repair. A subgroup analysis was then performed to evaluate the effect of operative approach on outcomes among patients with a prior aortic repair. Adjusted analysis was performed to account for differences in patient populations.

Results: 6,135 patients underwent repair for a rAAA including 4.7% (293) with a previous aortic repair. Thirty-day mortality was similar between those patients with prior aortic repair and those without (41% vs 36%; p=0.10), as were perioperative outcomes (Table 1). These persisted after adjustment. In subgroup analysis, patients who underwent open repair had a higher rate of post-operative renal failure (OR, 4.7; 95% CI, 2.2-7.9), return to the operating room (OR, 2.6; 95% CI, 1.3-4.7) and wound complications (OR, 15.2; 95% CI, 3.9-102.3). Patients undergoing open repair were also less likely to be discharged to home (OR, 2.2; 95% CI, 1.2-4.2) (Table 1).

Conclusion: Prior aortic surgery does not increase morbidity or mortality following treatment for a ruptured AAA. However, morbidity and mortality are increased with open treatment, compared to an endovascular approach in patients with prior aortic surgery. An EVAR first approach to rupture should continue to be utilized for all ruptured aneurysms with regardless of prior operative intervention.

Table 1. Comparison of outcomes in patients who underwent EVAR and open repair for rAAA after an elective repair.

Outcome	Previous Aortic Repair		P-Value	Multivariable Analysis OR (CI)
	Yes Previous Repair (n=293)	No Previous Repair (n=5842)		
30-day mortality	41% (120)	36% (2112)	0.10	1.08 (0.84-1.40)
Postop leg ischemia	5% (13)	5% (300)	0.57	0.75 (0.39-1.31)
Postop MI	10% (28)	11% (632)	0.36	0.75 (0.48-1.12)
Discharged to Rehab Facility	65% (191)	55% (3,232)	<0.01	1.11 (0.84-1.46)
Postop renal failure	29% (82)	23% (1,261)	<0.01	1.25 (0.93-1.68)
Respiratory complications	28% (80)	26% (1433)	0.51	0.95 (0.71-1.26)
Postop bowel ischemia	8% (24)	11% (602)	0.19	0.68 (0.41-1.03)
Wound complications	7% (18)	5% (254)	0.19	1.36 (0.78-2.24)
Return to OR	23% (64)	23% (1300)	0.90	0.96 (0.71-1.29)



LAUREL TANGALAKIS, MD

CVES Research Fellow

Research Interests: Paraesophageal hernia, bariatric surgery

Faculty Mentor: Andrew S. Wright, MD

Medical School: Michigan State University
College of Human Medicine

Hometown: Kalamazoo, MI

Discussant: Roger P. Tatum, MD

JOHNATHAN SHIH, MD

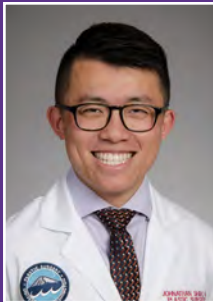
Plastic Surgery R4

Research Interests: Healthcare outcomes

Faculty Mentor: Jeffrey B. Friedrich, MD, MC

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School of Medicine

Hometown: Bakersfield, CA



EXTENSIVE ESOPAHGEAL MOBILIZATION IN PEHR: HOW PROTECTIVE IS IT?

TANGALAKIS LL, WRIGHT AS, CARRERA R, INABA C, OELSCHLAGER BK

Background: Attainment of adequate intra-abdominal esophageal length (3cm) is considered a key step in laparoscopic paraesophageal hernia repair (PEHR) but there is little evidence of how much length is sufficient to minimize recurrence and no consensus about when esophageal lengthening procedures may be required. This study explores how protective esophageal length is against recurrent hiatal hernias (HH).

Methods: We performed extensive mediastinal esophageal mobilization to maximize esophageal length and documented this length in consecutive patients undergoing PEHR at our institution between 2015 and 2019. Recurrence was evaluated by barium esophagram in patients who completed minimum 6-month follow up.

Results: One hundred three of 176 patients (59%) completed 6-month follow-up (median 8.5 months). Most patients (93%) had at least 3cm of intraabdominal esophagus after mobilization. Seventy-four patients (71%) had more than 3cm of esophagus. Of those with <3cm length, two (19%) received a short (2-2.5cm) fundoplication, two (1.9%) had a gastropexy without fundoplication, and four (3.9%) underwent a Collis gastroplasty with fundoplication. The anatomic HH recurrence rate was 24.2% (25/103). There was no difference in average esophageal length between patients with and without recurrence (3.8cm vs. 3.8cm, p=0.93). We compared the extremes and found no difference in recurrence between those with a long (>5cm) versus “short” esophagus (< 3cm) (25% vs 33%, p = 0.69).

Conclusion: With extensive esophageal mobilization we almost always obtain at least 3cm of esophagus, and rarely required a Collis gastroplasty. There does not appear to be any protective influence of attaining >3cm intra-abdominal esophageal length, and therefore the mechanism of recurrence does not appear to depend on this factor.

PAYER TYPE AND DISPARITIES IN OUTPATIENT CARE FOLLOWING PERIPHERAL NERVE INJURY AT A LEVEL I TRAUMA CENTER

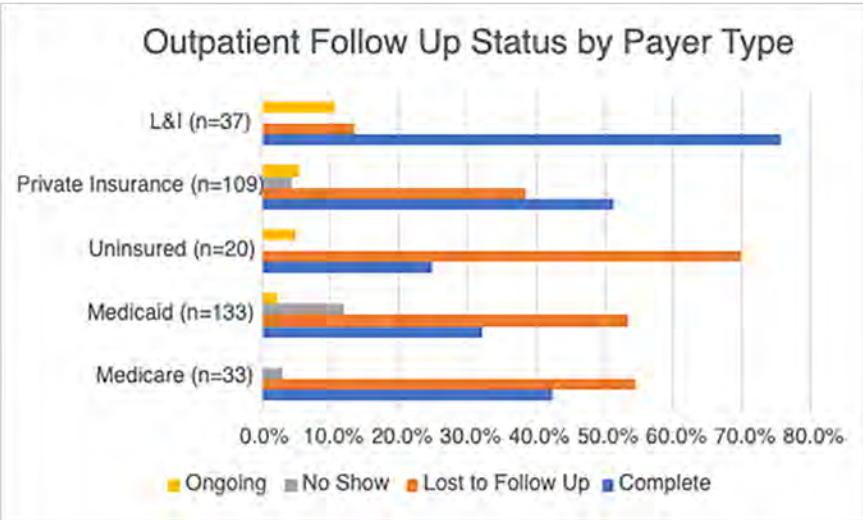
SHIH J, DE RUITER B, SHEN A, LIU YK, NGUYEN AL, DANG T, FRIEDRICH JB

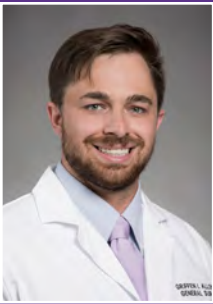
Background: Peripheral nerve injury (PNI) is associated with significant functional disability and healthcare burden. Depending on mechanism and severity, these injuries may require prompt surgical exploration or close, deliberate monitoring for proper electrodiagnosis. In this context, reliable outpatient follow up is critical for the delivery of quality care. In this study, we sought to characterize payer-stratified patterns of outpatient follow up among PNI patients at a level I trauma center.

Methods: The Harborview Medical Center Trauma Registry was queried for patients treated for upper and lower extremity PNIs from 2015-2020. Patients were stratified by payer type and evaluated for outpatient follow up patterns after hospital discharge. Outpatient follow up status for all patients was analyzed and categorized as complete, lost to follow up, no show, or ongoing.

Results: 332 patients were treated for PNIs over the study period. The average age was 42, and 74% of the patients were male. 32.8% of patients had private health insurance, 40.1% had Medicaid, 9.9% had Medicare, 6.0% were insured, and 11.1% were covered under L&I for a work-related injury. Patients covered under L&I completed follow up at the highest rate (75.7%), followed by patients with private insurance (51.4%). Patients who were uninsured and those with Medicaid had the lowest rates of follow up completion (25.0% and 32.4%, respectively). 70% of uninsured patients and 53.4% of patients with Medicaid were lost to follow up before completing electrodiagnostic workup or rehabilitation/therapy. Findings are summarized in Figure I. Common reasons for follow up attrition included distance, lack of transportation, and lack of reliable telecommunication.

Conclusion: There is significant disparity when evaluating access and utilization of outpatient care following peripheral nerve injury. Further research is warranted to evaluate potential interventions at an institutional level to mitigate the socioeconomic, cultural, and geographic barriers faced by at-risk patients.





GRIFFEN ALLEN, MD, MBe

General Surgery R1

Research Interests: Palliative care in surgery, surgical ethics, and surgical outcomes/quality improvement

Faculty Mentor: Kathleen O'Connell, MD, MPH

Medical School: Medical College of Georgia

Hometown: Valdosta, GA

Discussant: Ron Maier, MD

MARIAM N. HANTOULI, MD

Postdoctoral Research Fellow

Research Interests: Clinical outcomes research, patient-centered care, healthcare equity

Faculty Mentors: Giana H. Davidson, MD, MPH and David R. Flum, MD, MPH

Medical School: An-Najah National University

Hometown: Jenin, Palestine



LACK OF PREOPERATIVE GOALS OF CARE DISCUSSIONS IN INJURED OLDER ADULTS: A MISSED OPPORTUNITY TO PROVIDE GOAL-CONCORDANT CARE

ALLEN GI, KAPLAN S, POWELSON EB, O'CONNELL KM

Background: Older adults are at risk for non-beneficial end of life treatments after a severe injury. Preoperative goals of care discussions (GOCD) are essential to providing goal-concordant care to injured older adults.

Methods: This was a case-control study of injured adults 65 years and older who were admitted to Harborview Medical Center (HMC) from January 2015 to December 2020. The cohort of interest included patients who underwent surgical intervention and died during the index hospitalization. Demographics, injury characteristics, and presence of geriatrics/palliative care consultation were compared between patients who had GOCD documented preoperatively versus postoperatively.

Results: During the study period 7426 injured older adults were admitted to HMC. Of the 701 (9.4%) patients who died during the index hospitalization, 207 (29.5%) had undergone operative intervention. Median age was 78 years (IQR 72–830) and 69 (33%) patients were women. 186 (89.9%) patients had a documented GOCD during the admission, 37 (19.9%) occurred preoperatively and 149 (80.1%) occurred postoperatively. Patients with preoperative GOCD had similar injury severity scores 26 (IQR 18-43) vs. 26 (IQR 17-34), $p=0.4$, longer length of stay 14 (IQR 5-29) vs. 8 (IQR 4-14), $p=0.004$, and were more likely to have a geriatrics/palliative care consultation OR 3.0 (95% CI 1.2-8.5) compared to patients with postoperative GOCD. The preoperative GOCD group had more time from admission to first operation 31 hours (IQR 6-65) vs. 13 (IQR 2-36), $p=0.02$, and similar time from last operation to death 139 (IQR 75-333) vs. 134 (IQR 66-288), $p=0.5$ compared to the postoperative GOCD group.

Conclusions: A missed opportunity for preoperative GOCD was identified in 82% of injured older adults who died in the hospital after surgical intervention. Standardization of preoperative GOCD to include templated documentation and multidisciplinary involvement may reduce invasive non-beneficial end of life treatments.

MANAGEMENT OF ACUTE CHOLECYSTITIS DURING PREGNANCY

HANTOULI MN, DROULLARD DJ, NASH MG, BENSON LS, FLUM DR, DAVIDSON GH

Introduction: Management of cholecystitis during pregnancy balances the risk of adverse pregnancy outcomes (APO) (i.e., pregnancy loss and preterm delivery) with surgery. Guidelines recommend cholecystectomy regardless of trimester but the risk of APO across trimesters has not been characterized. We compared the APO between patients presenting with cholecystitis in different trimesters who did/did not receive cholecystectomy.

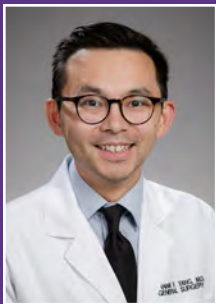
Methods: Retrospective cohort study of cholecystitis during pregnancy using the Truven MarketScan Databases (2007-2019). We defined APO, trimesters (T1, T2, T3) of cholecystitis presentation, and cholecystectomy using outpatient and inpatient claims and a novel algorithm to determine gestational age.

Results: Among 3,277 pregnant patients with cholecystitis, 38.6% underwent cholecystectomy (49.8% of those presenting in T1, 42.9% in T2, and 13.9% in T3). In T1, pregnancy loss occurred in 18.5% (95% CI: 15.8-21.7) of patients having cholecystectomy (N=701) and 23.6% (95% CI: 20.6-27) of those without cholecystectomy (N=707). In T1, preterm delivery occurred in 12.4% (95% CI: 10.1-15.1) of patients having cholecystectomy (N=701) and 11% (95% CI: 8.9-13.6) of those without cholecystectomy (N=707).

In T2, pregnancy loss occurred in 1.6% (95% CI: 0.7-3.3) of patients having cholecystectomy (N=450) and 1.8% (95% CI: 1-3.4) of those without cholecystectomy (N=598). In T2, preterm delivery occurred in 13.6% (95% CI: 10.6-17.2) of patients having cholecystectomy (N=450) and 16.1% (95% CI: 13.3-19.3) of those without cholecystectomy (N=598).

In T3, pregnancy loss did not occur, but preterm delivery occurred in 7% (95% CI: 3.3-13.78) of patients having cholecystectomy (N=114) and 16% (95% CI: 13.3-19.3) of those without cholecystectomy (N=707).

Conclusion: The professional society recommendation for cholecystectomy across trimesters appears to be supported by the observed, lower rates of APO when cholecystectomy was performed. Given these findings, the relative underuse of cholecystectomy in T3 compared to other trimesters warrants further investigation. These findings may help individualize shared decision making across trimesters.



FRANK YANG, MD

Research Resident

Research Interests: Comparative effectiveness research, surgical patient quality of life, cancer diagnostics disparities

Faculty Mentors: David R. Flum, MD, MPH

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Hometown: Carrollton, TX

Discussant: Venu Pillarisetty, MD

EDITT TASLAKIAN, MD, MS

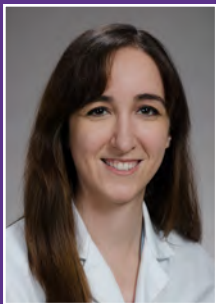
Plastic Surgery R2

Research Interests: Global surgery and access to care, plastic surgery resident education, pediatric plastic surgery, hand surgery

Faculty Mentor: Erin Miller, MD

Medical School: Mayo Clinic Alix School of Medicine

Hometown: Glendale, CA



APPENDICEAL NEOPLASM IN THE MANAGEMENT OF ACUTE APPENDICITIS
THE CODA COLLABORATIVE

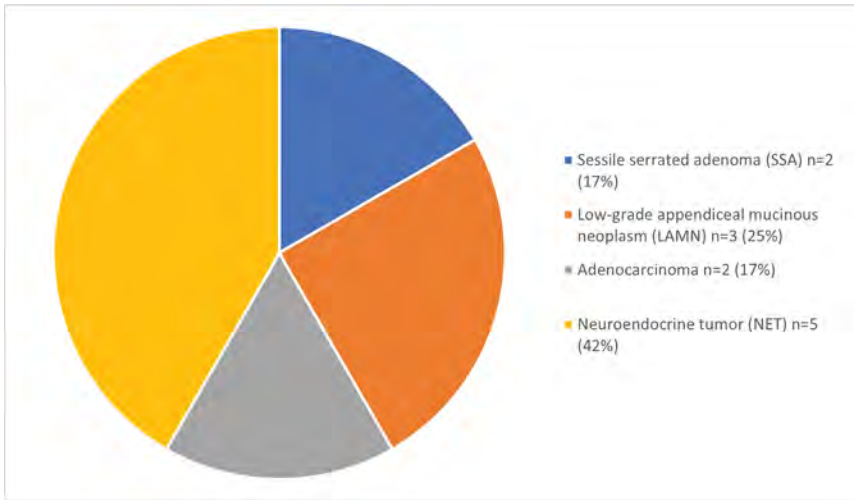
Background: Antibiotics for acute appendicitis is a safe and effective alternative to appendectomy. Uncertainty remains surrounding the impact of missed appendiceal neoplasm. Among participants of CODA, we aimed to determine the accuracy of CT for appendiceal neoplasm, and to describe the staging and timing of those with neoplasm.

Methods: We performed a planned, secondary analysis of participants of CODA, a randomized trial with two parallel observational cohort studies conducted at 25 sites 2016-2020. We describe demographic, radiographic, clinical, and pathologic characteristics among those with appendiceal neoplasm. We used descriptive statistics to calculate neoplasm prevalence and PPV/NPV of CT imaging.

Results: Among 8168 screened patients (mean-age 38.5y, 53% male), CT concerning for neoplasm was noted in 111, with a subset of 23 for whom pathology data was available. Based on this subset, CT PPV for appendiceal neoplasm was 22% (9.77%-41.6%, CI95%). Among 4173 patients (mean-age 36.9y, 56% male) who participated in randomized or observational components of CODA, CT NPV was 99% (99.0%-99.2%, CI95%). Among 2062 patients for whom initial management data were available, 12 (mean-age 46y, range 21-74y, 50% male) had appendiceal neoplasm (0.58%, 0.25%-0.91%, CI95%), including seven (0.69%, 0.33%-1.0%, CI95%) who underwent appendectomy at index admission and five (0.48%, 0.18%-0.78%, CI95%) who underwent antibiotics management (Figure). For patients who underwent antibiotics initially, mean time-to-diagnosis was 114d (range 36-232d) and mean follow-up time for antibiotics arms was 655d (IQR198d). Cancer stage in patients who underwent antibiotics initially was I or less. None from either treatment group had a stage greater than IIB.

Conclusions: Missed neoplasm in patients undergoing antibiotics for appendicitis was rare and cancer staging was similar between those identified at index admission for appendicitis or subsequently. Although CT has high NPV and low PPV for neoplasm, its value of routine use for this purpose remains to be determined.

Figure. Appendiceal neoplasm pathology types



DEVELOPMENT OF A LOW-COST, SMARTPHONE-COMPATIBLE
VIRTUAL REALITY SYSTEM FOR HEALTHCARE APPLICATIONS

TASLAKIAN EN, NG A, BERARDO-CATES A, LIU Y, MILLER EA

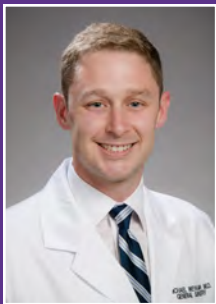
Background: Virtual Reality (VR) distraction therapy is effective in reducing pain and anxiety during routine wound care, physical therapy, and small clinic procedures. It has been predicted to result in significant cost savings in hospitalized patients. However, widespread adoption of VR in healthcare has been limited by affordability, accessibility, technological literacy, and sanitization between uses. We created a novel VR system that is low-cost, easy to sanitize, and can use any smartphone.

Methods: Our VR system features a headset comprised of ten interlocking ethylene-vinyl acetate (EVA) foam pieces cut using a CO2 laser. It is modeled to fit all National Institute for Occupational Safety and Health (NIOSH) Anthropometric Headforms. Two biconvex lenses can be positioned to match the user's interpupillary distance. An adjustable rear elastic strap allows for hands-free headset usage and stability. A smartphone is inserted into the headset. Any commercially available VR application may be used.

Results: This VR system overcomes many of the barriers limiting the use of VR in healthcare. The single-unit cost is less than \$6. The foam material allows pieces to be cleaned with sanitizing wipes. The interlocking design of its pieces are easy to reassemble. The near ubiquity of smartphones increases accessibility, eliminating the complex setup, dedicated personnel training, and long-term maintenance required of traditional VR systems.

Conclusions: Developing a low-cost, accessible, and easy to clean VR system is key to disseminating VR-based therapies across healthcare settings. Systems currently used require expensive headsets, handheld controllers, gaming computers, state-of-the-art graphics cards, and significant storage space and maintenance. This novel VR system minimizes these obstacles for hospital- and clinic-based settings. We are currently conducting pilot studies to examine the efficacy of our VR system in reducing pain and anxiety for clinic-based procedures and to explore the safety of independent use in the home setting.





MIKE WEYKAMP, MD

Research Resident

Research Interests: Hemorrhagic shock, pre-hospital trauma care, and care of combat casualties

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Hometown: Grand Rapids, MI

AMIR GHAFFARIAN, MD

Vascular Surgery R4

Research Interests: Clinical outcomes research

Faculty Mentor: Niten Singh, MD

Medical School: University of Utah

Hometown: Salt Lake City, UT



TRAUMA CHEST TUBE MANAGEMENT: PRACTICE, POPULATION, & OUTCOME HETEROGENEITY AND DEVELOPMENT OF THE HARBORVIEW PROTOCOL

WEYKAMP M, BILODEAU K, HARUTA A, LINNAU K, O'KEEFE G, ROBINSON BRH

Introduction: Variability exists regarding the management of chest tubes placed after injury due to a lack of practice guidelines. Inconsistency in practice has been implicated in delays in care advancement leading to variability in outcomes and resource utilization. We sought to understand current outcomes at a level-one trauma center without a chest tube management protocol and hypothesized that these outcomes would vary based on patient phenotype.

Methods: We reviewed the Harborview trauma registry for consecutive patients, from July 2020 - January 2021, who received chest tubes for trauma-related indications (n=152). Patients were excluded if: younger than 18, chest tube for non-trauma indication, chest tube placed at an outside facility, they had multiple thoracic operations, or died prior to chest tube removal. Demographic and chest-tube related data were collected pertaining to placement, management-related outcomes, and complications. Descriptive statistics were applied as were Welch two sample t-tests for comparing groups.

Results: 100 patients met inclusion criteria. Patients had mean ISS of 25.2, mechanical ventilation rate of 55%, and a 7:3 ratio of blunt to penetrating mechanism of injury. Mean indwelling chest tube duration was 5.0 days (d); shorter durations were measured in patients with isolated chest injuries at 3.9 d (p<0.05). Mechanical ventilation was associated with longer chest tube durations than non-ventilated patients at 5.7 vs. 4.0 d (p<0.05). No difference in indwelling chest tube duration or chest radiograph utilization was detected between patients with a pneumothorax and those with hemothorax/hemopneumothorax. Rates of empyema (5%) retained hemothorax (14%) and need for chest tube replacement (4.2%) were consistent with published literature.

Conclusion: Rate of care progression and resource utilization related to trauma chest tubes is variable and associated with well-defined patient factors. Institutional protocol development represents an opportunity to minimize variability and leverage differences in patient phenotype to improve efficiency and resource utilization.

CLINICAL OUTCOMES OF A DIAGNOSTIC AND MANAGEMENT PROTOCOL FOR POPLITEAL ARTERY ENTRAPMENT SYNDROME AT A LARGE REFERRAL CENTER

GHAFFARIAN AA, NKANSAH R, QUIROGA E, TRAN N, STARNES BW, SINGH N

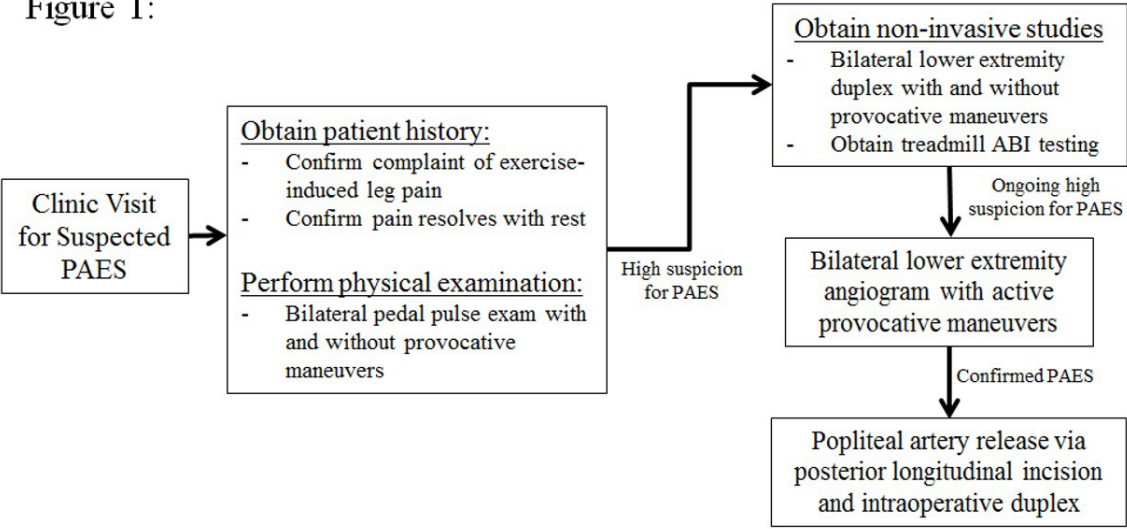
Background: Popliteal Artery Entrapment Syndrome (PAES) is a rare clinical entity without a standardized algorithm for diagnosis. Our objective was to evaluate clinical outcomes using a unique diagnosis and management algorithm for PAES.

Methods: We retrospectively reviewed patients diagnosed with PAES at a single institution between 2013 and 2021. Demographics, physical exam findings, non-invasive imaging results, and angiograms were assessed to validate a diagnostic and management algorithm (Figure 1).

Results: Thirty extremities in 20 patients were treated for PAES. The mean age was 27 and 73.3% were female. 23% of extremities had undergone prior fasciotomies for presumed chronic exertional compartment syndrome before referral. Physical examination revealed a decrement in pedal pulse with provocative maneuvers in 90% of treated limbs. Noninvasive studies to include treadmill exercise testing revealed a mean ABI drop of 0.28 and positional duplex demonstrated peak systolic velocity increase by a mean ratio of 2.09 with provocative maneuvers. Diagnostic arteriography was performed in all patients and revealed well-developed collaterals in 100% of treated limbs and complete effacement of the popliteal artery with active provocative maneuvers. Surgical exposure occurred via a posterior approach using a vertical incision and intraoperative completion duplex was performed in all cases. Arterial reconstruction was required in 2 patients who presented with an occluded popliteal artery. Median operative time was 87 minutes and 90% were diagnosed with type III PAES. 95% were discharged on post-operative day 1. Wound complications occurred in 4 limbs and included seroma and hypertrophic scarring. All patients experienced symptomatic relief with median follow-up of 4 months.

Conclusions: We report 100% technical and clinical success in patients with PAES diagnosed and managed using our clinical algorithm. Dynamic angiography to confirm the diagnosis and intraoperative duplex to confirm complete surgical release are essential for successful clinical outcome.

Figure 1:





DEION SIMS, BS

Medical Student M3

Research Interests: Patient reported outcomes, patient-centered care, health disparities

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Hometown: Nashville, TN

EUSTINA KWON, MD, MPH

Research Fellow

Research Interests: Health disparities in pediatric colorectal surgery and pediatric trauma

Faculty Mentor: Samuel Rice-Townsend, MD

Medical School: Penn State College of Medicine

Hometown: Newport News, VA



DIVERTICULITIS FEELS LIKE A LIFE SENTENCE

SIMS DT, DROULLARD DJ, HANTOULI MN, LOIS AW, STRATE LL, READ TE, FLUM DR, KRANE MK

Background: After an episode of acute diverticulitis, many patients experience chronic or recurrent symptoms that adversely affect their quality of life. Understanding these issues is key to improving clinical communication and patient-centered research. In this study, we aim to characterize elements of the patient experience with diverticulitis that patients feel are under-recognized.

Methods: We conducted a survey of members of diverticulitis support groups on Facebook from February through April 2020. Participants were invited to take an anonymous web survey in which participants were asked: “What would you like doctors and researchers to know about your experiences with diverticular disease?” All responses were evaluated by two coders (DS and DD) using thematic analysis.

Results: A total of 564 responses were analyzed and three consistent themes emerged: (1) Need for dietary recommendations; (2) Inconsistent information from providers; (3) Under-recognition of quality-of-life impact. (Table 1)

Table 1

Theme	Illustrative Quote
Diet	Way more information on diet and what to look for and expect.
	More info on proper diet and eating options is desperately needed; an appointment with a nutritionist was VERY helpful for me.
	We need more information on what is best and safe to eat.
Information	So much confusion because of a lack of reliable information and contradictory information given by the two doctors I've seen.
	The lack of solid information about the disease and conflicting information.
	Ask five different doctors the same questions, you'll get five different answers.
Quality of Life	I'd like doctors to be fully aware of just how debilitating and painful this disease really is...it has truly robbed me of my life.
	It is so disruptive. It makes me feel worthless as a mother and a partner.
	It is life changing and it feels like a life sentence. I would like them to not make me feel like it's not a big deal as it is for all who suffer.

Conclusion: Patients with diverticulitis perceive a need for more detailed dietary recommendations, more consistent information from their providers, and better recognition of their quality-of-life issues. Future work should evaluate dietary interventions, improve patient education materials, and prioritize patient reported outcomes. Understanding these experiences is key to developing strategies to improve patient-centered care.

SOCIAL VULNERABILITY INDEX: A VALUABLE TOOL TO IDENTIFY YOUTH AT HIGH RISK FOR GUN-VIOLENCE?

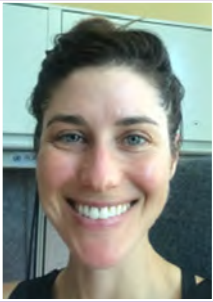
KWON EG, RICE-TOWNSEND SE, NEHRA D

Background: We aimed to understand the relationship between community-level social vulnerability measured by the social vulnerability index (SVI) and pediatric trauma mechanism type and outcomes.

Methods: All injured pediatric trauma patients (≤17 years) cared for at a single institution over a 10-year period (2011-2020) were identified using the institutional trauma registry and demographic and injury-related characteristics collected. Out-of-state patients were excluded. SVI was determined for each zip-code using the CDC Indices and Housing and Urban Development zip-code crosswalk files to calculate weighted SVI. The indices are reported by composite score and four subcategories: socioeconomic, household composition/disability, minority/language, and housing type/transportation. Univariate and multivariate analyses were performed using multinomial logistic regression adjusting for individual patient characteristics.

Results: 5,495 pediatric trauma patients were included, and injury mechanism differed by age. Twenty-two percent of patients had high social vulnerability (>75th percentile) and 15.9% had low social vulnerability (≤25th percentile). SVI was most strongly associated with gun-related injuries with this cohort having significantly higher SVI subindex scores in the socioeconomic, minority/language and housing type/transportation categories ($p<0.001$). Amongst older adolescents, every 10th percentile increase in minority/language and housing type/transportation SVI was associated with a 17.8% ($p=0.001$) and 23.5% ($p<0.001$) higher chance respectively, of injury due to guns compared to motor vehicle/motorcycle crash (MVC/MCC). In addition, adolescents who were male, Black, and those with substance use disorder or Medicaid insurance were more likely to present with gun-related injury ($RRR = 3.5, 16.3, 2.5, 1.8; p < 0.05$) and assault ($RRR = 2.5, 4.1, 3.0, 2.2; p < 0.01$) than MVC/MCC.

Conclusions: Community-level social vulnerability, measured by SVI, is correlated with pediatric trauma mechanism. Those living in the highest SVI areas are at significantly higher risk of injury due to guns. The SVI may provide direction for community-level interventions to decrease gun violence.



KATHERINE STERN, MD
T32 Research Fellow, Translational Research in Trauma and Critical Care Fellowship

Research Interests: Sepsis, shock, microbiome, nutrition

Faculty Mentor: Grant E. O'Keefe MD, MPH

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Hometown: Los Angeles, CA

Discussant: Barclay Stewart, MD, PhD, MPH



JAKE HEMINGWAY, MD
Vascular Surgery Chief Resident

Research Interests: Limb salvage, vascular trauma, acute aortic syndromes

Faculty Mentor: Niten Singh, MD

Medical School: University of Washington School of Medicine

Hometown: Bellevue, WA

Discussant: Matthew Smith, MD, PhD

ARTIFICIAL INTELLIGENCE TO ANTICIPATE SEPSIS
IN CRITICALLY ILL TRAUMA PATIENTS

STERN KE, STEWART TR, HU J, BENI CE, BRAKENRIDGE SC, TEREDESAI AM, O'KEEFE GE

Background: Sepsis is associated with significant morbidity and mortality in the trauma population. Artificial intelligence (AI) is an emerging strategy for early detection of sepsis. The objective of this study was to develop an AI-based rounding tool that identifies critically ill trauma patients within 24 hours of sepsis onset.

Methods: We performed a retrospective analysis of data collected from the electronic health records of critically injured adults presenting to a single level 1 trauma center from 2012 through 2019. We compared the performance of two machine learning techniques: Extreme Gradient Boost (XGBoost) and recurrent neural networks (RNN), to predict a binary sepsis event within 24-hours of a 7:00 AM reference time. The following features were explored in a group-wise fashion: hourly vital signs, admission physiology, lab values, and cumulative anesthesia hours and blood products. Models were trained using 5-fold cross validation, targeting a false positive fraction of $\leq 30\%$. Performance to predict sepsis onset was measured using the AUC, sensitivity, specificity, and the F1 score.

Results: There were 2,802 patient records that met inclusion criteria. In the training cohort (n = 1263, observations = 347,520), the median age was 51 years (IQR 31, 65), 73% were male, the median injury severity score was 29 (IQR 21, 38), and 202 (16%) developed sepsis. The XGBoost and RNN models trained on hourly vital signs predicted sepsis with an AUC of 0.71 (Sn 55%, Sp 73%), and AUC of 0.70 (Sn 58%, Sp 71%), respectively. A RNN developed using vital signs and cumulative exposures predicted sepsis onset with an AUC of 0.77 (Sn 68%, Sp 72%).

Conclusions: In a cohort of critically ill trauma patients, crude AI models predicted an impending sepsis event with moderate accuracy. An AI-informed rounding tool may be useful for sepsis monitoring and screening once validated.

A NORMAL PHYSICAL EXAM DOES NOT RELIABLY EXCLUDE VASCULAR INJURY
REQUIRING REPAIR FOLLOWING PENETRATING UPPER EXTREMITY TRAUMA

HEMINGWAY JF, YANG AW, GETNET R, TRAN N, STARNES BW, QUIROGA E, SINGH N

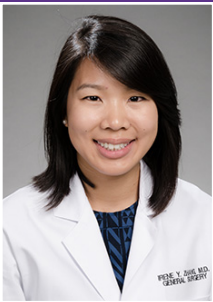
Background: Although current Western Trauma Association guidelines recommend the use of the physical exam and brachial-brachial index in the initial evaluation of penetrating upper extremity trauma, their accuracy in detecting upper extremity vascular injuries has not been validated.

Methods: A retrospective review of all patients presenting to our level I trauma center with penetrating upper extremity trauma and concern for vascular injury between 2017-2019 was performed. Demographic data, clinical features, procedural details, and outcomes were recorded.

Results: A total of 96 patients (82% male), with a mean age of 36 (range 1-84), met inclusion criteria. 51 patients (53%) had clinically significant vascular injuries requiring operative exploration or repair, with 49 (96%) undergoing open repair. The radial and ulnar arteries, alone or in combination, were injured in 24 patients (47%), with the brachial artery injured in 21 (41%). The remainder of injuries occurred in the axillary (n=5, 10%) or distal subclavian arteries (n=1, 2%). Patients with vascular injuries requiring repair did not have significantly (P>.05) higher rates of amputation (2% vs. 0%) or 30-day mortality (2% versus 4%). Although differences were noted in the rate of physical exam abnormalities, with all 3 exam findings demonstrating a high specificity and positive predictive value in detecting vascular injury after penetrating trauma, the sensitivity and negative predictive value (NPV) of each was low (Table I). The sensitivity and NPV of an abnormal vascular exam were only 0.71 and 0.73, respectively.

Conclusions: While vascular injuries in penetrating upper extremity trauma are more likely to have physical exam abnormalities, unlike in lower extremity trauma, a normal physical exam is not sufficient in excluding clinically significant vascular injuries. Current guidelines should therefore be revised, as the physical exam is not reliable as an initial screening tool.

Table I – Penetrating trauma				
Physical Exam Abnormality	Sensitivity	Specificity	Positive Predictive Value	Negative Predictive Value
Motor	0.27	0.84	0.67	0.51
Sensory	0.33	0.80	0.65	0.51
Vascular	0.71	0.89	0.88	0.73
All 3	0.12	1	1	0.5



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Research Resident

Research Interests: Surgical outcomes, health systems, and decision science

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Medical School: Harvard Medical School

Hometown: Las Vegas, NV

Discussant: Giana H. Davidson, MD, MPH

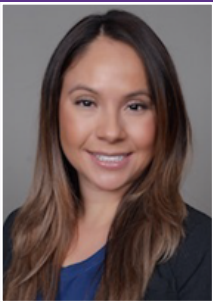
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POSTOPERATIVE OPIOID PRESCRIBING AMONG SURGEONS
AND THE IMPACT OF A SYSTEM-WIDE INTERVENTION

ZHANG IY, WONG ES, ROSEN JR, GORDON DB, FLUM DR, LIAO JM

Background: To support surgeons and other clinicians in judicious opioid prescribing, the University of Washington implemented in November 2017 a system-wide electronic medical record (EMR) intervention limiting new opioid prescriptions to 42 pills, based on state Medicaid policies. The impact of this intervention is unknown.

Methods: We used 2016-2020 data from the University of Washington and Harborview Medical Center on opioid-naïve patients to examine postoperative opioid prescribing (quantity of pills prescribed at discharge). We conducted a quasi-experimental interrupted time series analysis (ITSA) to investigate the impact of the 2017 intervention on postoperative prescribing, adjusting for patient age, sex, race, ethnicity, Elixhauser index, chronic pain, cancer, surgery division, and postoperative length of stay.

Results: Our sample included 63,464 surgical encounters, spanning General Surgery (26%), Orthopedics (20%), and other specialties. Patients were 52% female, 80% White, with a mean age of 53. Overall, 81% were prescribed opioids at discharge, with varying adjuncts (73% acetaminophen, 30% NSAIDs, 7% gabapentin). The mean prescribed opioid quantity decreased from 37 ± 32 pills in 2016 to 17 ± 18 in 2020. This trend was seen across specialties, though amounts varied, with Orthopedics generally prescribing the most and Ophthalmology the least. The proportion of prescriptions exceeding the 42-quantity limit decreased from 35% in 2016 to 5% in 2020. In the ITSA, the EMR intervention was associated with a change of -8.4 opioid pills per prescription in the month subsequent to the intervention (p < 0.001), after which the quantity prescribed continued to decrease at rates similar to the pre-intervention period.

Conclusions: There was a decrease in opioid prescribing among surgeons at a large academic hospital system from 2016 to 2020, with a system-wide EMR intervention contributing immediate effects. These findings pose implications for hospital systems and leaders seeking to address the opioid crisis via judicious clinician prescribing.

DIALYSIS-DEPENDENT PATIENTS HAVE INCREASED RISK
OF MYOCARDIAL INFARCTION AND PERI-OPERATIVE
DEATH FOLLOWIG CAROTID REVASCULARIZATION

SALDANA-RUIZ N, AHMAD M, DEERY SE, SCHERMERHORN M,
SODEN P, SMITH M, SINGH N, AND ZETTERVALL SL

Objective: Dialysis-dependent patients have been reported to have high rates of stroke and death following carotid revascularization; however, recent data suggests that outcomes may be better than previously surmised. We aimed to study outcomes following the treatment of symptomatic and asymptomatic carotid stenosis using TCAR among dialysis-dependent patients.

Methods: The Vascular Quality Initiative was utilized to assess all patients undergoing TCAR. Outcomes were compared between dialysis-dependent patients and those who were not. Patients with asymptomatic and symptomatic carotid stenosis were assessed separately. Univariate and multivariable analysis using multivariable logistic regression and cox regression models were utilized.

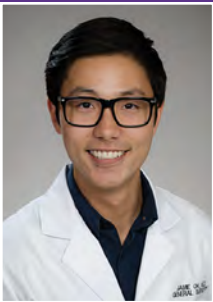
Results: A total of 20,927 patients undergoing TCAR were identified from 2016 to 2021. Among patients with asymptomatic carotid stenosis 12,275 (98.6%) were not on dialysis and 173 patients (1.4%) were on dialysis. Among patients with symptomatic carotid stenosis 8,348 (98.5%) were not on dialysis, and 128 patients (1.5%) were on dialysis. Among asymptomatic and symptomatic patients, dialysis was not associated with an increased risk of perioperative stroke or TIA (Table 1). Asymptomatic dialysis-dependent patients had increased risk of peri-operative mortality (0.7 % vs 4.6%, p-value <0.001), myocardial infarction (0.5% vs 2.3%, p-value 0.002), and cardiac complications (1.9% v 4.6%, p-value 0.011). All dialysis patients had increased risks of prolonged length of stay. After adjustment, asymptomatic patients remained at increased odds of peri-operative mortality (OR 5.8 [95% CI 2.2-15.0]), stroke/mortality (OR 2.9 [95% CI 1.2-6.8]), myocardial infarction (OR 3.3 [95% CI 1.1-9.2]), and overall cardiac complications (OR 2.2 [95% CI 1.1-4.6]).

Conclusion: Perioperative revascularization outcomes among dialysis-dependent patients undergoing TCAR for carotid artery stenosis demonstrate acceptable stroke and TIA, when compared to non-dialysis patients. Similar to previous studies studying carotid endarterectomy and carotid artery stenting, dialysis dependence is associated with increased risk of myocardial infarction and peri-operative mortality following TCAR.

Table I. Perioperative outcomes

Asymptomatic (n=12,448)						Symptomatic (n=8,476)					
	No Dialysis (n=12,275, 98.6%)		Dialysis (n=173, 1.4%)		<i>P value</i>	No Dialysis (n=8,348, 98.5%)		Dialysis (n=128, 1.5%)		<i>P value</i>	
Peri-operative mortality	65	0.7%	5	4.6%	<0.001	89	1.5%	2	2.5%	0.495	
Stroke/peri-operative mortality	167	1.9%	6	5.6%	0.006	233	4.0%	4	4.9%	0.658	
Stroke	113	0.9%	2	1.2%	0.741	171	2.0%	2	1.6%	0.699	
TIA	50	0.4%	1	0.6%	0.722	66	0.8%	2	1.6%	0.333	
MI	66	0.5%	4	2.3%	0.002	49	0.6%	0	0.0%	0.381	
Cardiac Complication	234	1.9%	8	4.6%	0.011	192	2.3%	4	3.1%	0.564	
Surgical Site Infection	3	0.0%	0	0.0%	0.838	3	0.0%	0	0.0%	0.831	
LOS > 2 days	1466	12%	42	24%	<0.001	3089	37%	65	51%	0.001	
Access Site Complications	334	2.7%	8	4.6%	0.130	237	2.8%	0	0.0%	0.053	
Cranial Nerve Injury	23	0.2%	0	0.0%	0.569	29	0.4%	0	0.0%	0.496	
Hemodynamic instability (Requiring IV meds)					0.099					0.064	
Hypotension	2038	57%	28	47%		1304	54%	23	41%		
Hypertension	1516	43%	32	53%		1126	46%	33	59%		

TIA: Transient ischemic attack, MI: Myocardial infarction, LOS: Length of stay, Neurological Event include stroke or TIA, Cardiac complications include MI, congestive heart failure and dysrhythmia.



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Hometown: Federal Way, WA

Discussant: Tam N. Pham, MD

TEMPERATURE SENSITIVITY AFTER BURN INJURY:
A BURN MODEL SYSTEM NATIONAL DATABASE HOT TOPIC

OH JG, MADISON C, FLOTT G, BROWNSON EG, SIBBETT S, SEEK C,
CARROUGHER GJ, RYAN CM, KOWALSKE K, GIBRAN NS, STEWART BT

Background: People living with burn injury often report temperature sensitivity. However, its epidemiology and associations with health-related quality of life (HRQOL) are unknown. We aimed to characterize temperature sensitivity and determine its impact on HRQOL to inform patient education after recovery from burn injury.

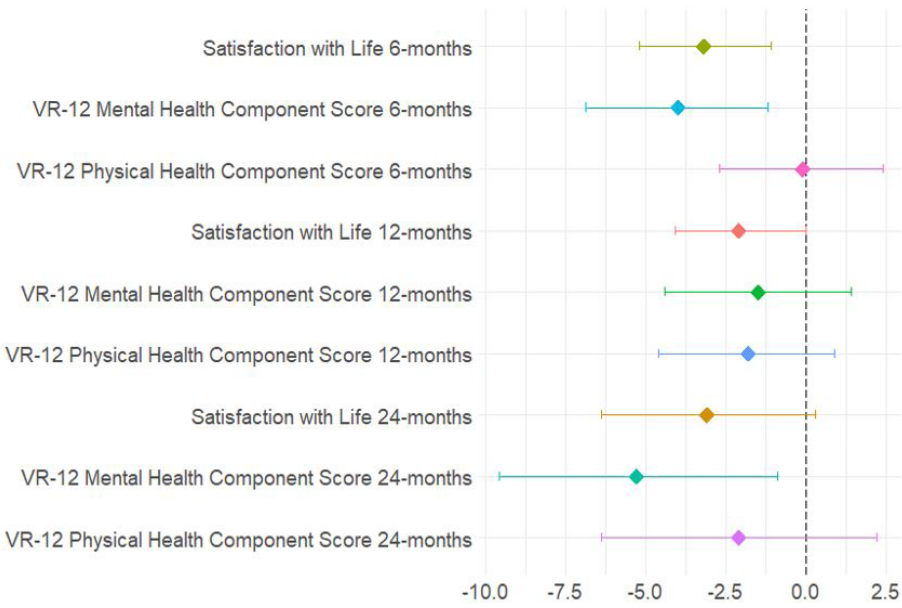
Methods: We used the multicenter, longitudinal Burn Model System National Database to assess temperature sensitivity at 6, 12 and 24 months after burn injury. Chi-square and Kruskal-Wallis tests determined differences in patient and injury characteristics. Multivariable, multi-level generalized linear regression models determined the association of temperature sensitivity with Satisfaction with Life Scale (SWL) scores and Veterans RAND 12 (VR-12) physical (PCS) and mental health summary (MCS) component scores.

Results: The cohort comprised 637 participants. Two thirds (66%) experienced temperature sensitivity. They had larger burns (12% TBSA, IQR 4-30 vs 5% TBSA, IQR 2-15; p<0.0001), required more grafting (5% TBSA, IQR 1-19 vs 2% TBSA, IQR 0-6; p<0.0001), and had higher intensity of pruritus at discharge (11% severe vs 5% severe; p=0.002). After adjusting for confounding variables, temperature sensitivity was strongly associated with lower SWL (OR -3.2, 95% CI -5.2, -1.1) and MCS (OR -4.0, 95% CI -6.9, -1.2) at 6-months (Figure 1). Temperature sensitivity decreased over time (43% at discharge, 4% at 24-months) and was not associated with poorer HRQOL at 12 and 24 months.

Conclusion: Temperature sensitivity is common after burn injury and associated with worse SWL and MCS during the first year after injury. However, temperature sensitivity seems to improve and be less intrusive over time.

Figure 1. Multivariable linear regression of temperature sensitivity with quality-of-life measures

Linear regression model demonstrating temperature sensitivity was strongly associated with lower SWL and MCS at 6-months. The regression model includes patient and injury characteristics that were determined to be significantly different within our population (burn size, graft percentage, location of burn, intensity of pruritus, amputation, pre-injury MCS), comorbid conditions that were determined to be significantly different within our population (depression and anxiety) along with review of system components that may impact quality of life. A p-value of <0.017 indicates significance to account for multiple hypothesis testing.



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The Helen and John Schilling Lecture is an annual lecture established by the late Helen Schilling to bring distinguished scholars to the Department of Surgery at the University of Washington, and to enhance the Department's commitment to the highest standards of patient care, teaching, research and scholarship. It was Mrs. Schilling's wish that the lectureship be in honor of her husband, John.

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