

UNIVERSITY OF  
WASHINGTON

DEPARTMENT OF  
SURGERY

2018  
RESEARCH DAY  
&  
24<sup>TH</sup> ANNUAL  
HELEN & JOHN  
SCHILLING  
LECTURE

UW TOWER AUDITORIUM  
4333 BROOKLYN AVE NE  
SEATTLE, WA 98105

FRIDAY, FEBRUARY 16, 2018

# AGENDA

7:00am	Breakfast & Registration	
7:30am	Welcome: <b>Douglas E. Wood, MD, FACS, FRCSEd</b> ( <i>ad hom</i> ) Introduction: <b>David R. Flum, MD, MPH</b>	
7:40am	<b>Y. David Seo, MD:</b> Combination T-Cell Receptor Immunosequencing and Multiplex Immunohistochemistry Reveal Novel Insights into the Immune Response to Human Pancreatic Cancer	Page 9
7:55am	<b>John N. Dentel, MD:</b> Poor Out-Patient Clinic Appointment Compliance is a Predictor of Post-Heart Transplant Mortality in Children	Page 10
8:10am	<b>Matthew A. Bartek, MD, MPH:</b> Washington State Trends in Aortic Aneurysm-Related Deaths 1996–2016	Page 11
8:25am	<b>Anna Ohlsson, MD:</b> Epidural Analgesia is Less Effective for Veterans Than Community Practice Patients After Open Aortic Surgery	Page 12
8:40am	Faculty Presentation: <b>Robert M. Sweet, MD, FACS</b>	Page 7
8:55am	<b>Proceed to Poster Session 1</b>	
9:00am	<b>John I. Monu, MD:</b> Using Crowdsourcing to Understand Knowledge, Attitudes, Beliefs, and Experiences About Lung Cancer Screening	Page 13
9:05am	<b>Ashley D. Meagher, MD, MPH:</b> Identification of High Risk Geriatric Trauma Patients	Page 14
9:10am	<b>Jamil A. Matthews, MD, MS:</b> Establishing Branch Angle Boundary Conditions in Fenestrated-Branched Endografts	Page 15
9:15am	<b>Jason R. Hurd, MD:</b> Secondary Interventions After Fenestrated Endovascular Aneurysm Repair	Page 16
9:25am	<b>Haig A. Yenikomshian, MD:</b> Outpatient Opioid Use of Burn Patients: A Retrospective Review	Page 17
9:40am	<b>Kevin M. Sullivan, MD:</b> The T Cell Microenvironment in Fibrolamellar Hepatocellular Carcinoma	Page 18
9:55am	<b>Lucas W. Thornblade, MD, MPH:</b> Elective Surgery for Diverticulitis and the Risk of Recurrence and Colostomy	Page 19
10:10am	<b>Veeshal H. Patel, MD, MBA:</b> A Magnetic Jejunoileal Partial Diversion: A Step Forward in Translation and Metabolic Surgery	Page 20
10:25am	<b>Catherine Kling, MD, MPH:</b> Living Donation Versus Donation After Circulatory Death Liver Transplantation for Low MELD Recipients	Page 21
10:40am	<b>Proceed to Poster Session 2</b>	
10:45am	<b>James L. Grijalva, MD:</b> Duration of ECMO Support Predicts Survival in Transplant Patients	Page 22
10:50am	<b>Benjamin B. Massenburg, MD:</b> The Burden of Burn Injuries in the United States	Page 23
10:55am	<b>Lara Senekjian, MD, MAT, MS:</b> Cost-Utility in the Management of Blunt Splenic Injury: Is there a Role for Splenic Artery Embolization?	Page 24

11:00am	<b>P. Chulhi Kang, MD:</b> Disease Based Observational Cohort Study of Patients with Thoracoabdominal Aortic Aneurysm	Page 25
11:05am	<b>Eleanor E. Curtis, MD, MPVM:</b> Early Patient Deaths After Transfer to a Burn Center	Page 26
11:15am	Faculty presentation: <b>Giana H. Davison, MD, MPH, FACS</b>	Page 7
11:30am	<b>Morgan K. Richards, MD, MPH:</b> Pediatric Living Donor Liver Transplantation Improves Patient and Graft Survival	Page 27
11:45am	<b>Dustin R. Cummings, MD, MPH:</b> Improved Outcomes at Reduced Healthcare Costs After Implementation of a Hernia-Specific Enhanced Recovery After Surgery (ERAS) Pathway	Page 28
12:00pm	<b>Kathryn M. Stadeli, MD:</b> Do You Trust Me? Factors Associated with Low Trust in Patients with Surgical Disease	Page 29
12:15pm	<b>Daniel Y. Cho, MD, PhD:</b> Visual Representation of Racial Diversity in Aesthetic Plastic Surgery Literature	Page 30
12:30pm	<b>Break for Lunch &amp; Special Exhibit: ACS Future #ILookLikeASurgeon</b>	
1:30pm	Faculty presentation: <b>Sara H. Javid, MD</b>	Page 7
1:45pm	<b>Sarasijhaa Desikan, MD:</b> Incidence and Outcomes of Vascular Injury in the Setting of Tibial Plateau Fractures: A Single Institution Review	Page 31
2:00pm	<b>Jay Zhu, MD:</b> Smooth Muscle Cell TBR2 Deletion in Mice Causes Aortic Hypercontractility and Impaired Endothelial-Dependent Relaxation	Page 32
2:15pm	<b>Robert A. Tessler, MD:</b> Transfer and Non-Transfer Patients in Isolated Low-Grade Blunt Pediatric Solid Organ Injury: Implications for Regionalized Trauma Systems	Page 33
2:30pm	<b>Francys C. Verdial, MD:</b> Invasive Mediastinal Staging for Lung Cancer - Better Prediction, Better Selection	Page 34
2:45pm	Closing: <b>David R. Flum, MD, MPH</b>	
3:30pm	<b>24th Annual Schilling Lecture – Caprice C. Greenberg, MD, MPH</b> <b>Surgical Coaching: The Intersection of Surgical Education and Quality of Care</b>	Page 4

# INTRODUCTION



**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, Associate Chief  
Medical Officer,  
UW Medicine*

Welcome to the 24th Annual Department of Surgery Research Symposium and Schilling Lecture! This event was 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 it is with enormous pride and gratitude that we carry on their commitment through research-related events such as this.

This year we host as our Schilling lecturer Caprice C. Greenberg, MD, MPH, Professor of Surgery and the Morgridge Distinguished Chair in Health Services Research at the University of Wisconsin. Dr. Greenberg is a surgical oncologist specializing in breast cancer, and a health services researcher focused on improving patient safety and quality of care. In today's Schilling Lecture, "Surgical Coaching: The Intersection of Surgical Education and Quality of Care," Dr. Greenberg will discuss the current gap in surgery that can be met by surgical coaching, and explore the critical considerations that are necessary when designing a surgical coaching program.

The Schilling Research Symposium is a forum for bringing together faculty, residents, fellows, students, and friends to share the innovative research happening in our Department. It is also an important learning opportunity for residents and fellows to refine their scientific presentation skills through oral and poster presentations, audience Q&A, and feedback from our panel of judges. We view this day as a celebration of the passion for research that exists within our Department. Each and 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. This year's symposium format will again feature both podium and poster presentations, as well as assigned discussants for the plenary session. Tonight, we will honor Dr. Greenberg and all participants and their faculty mentors, and present prizes to the top poster and oral presenters.

We are pleased that you are joining us today and hope that you find today's event both informative and engaging!

Sincerely,

Douglas E. Wood, MD, FRCSEd (*ad hom*)  
*The Henry N. Harkins Professor and Chair*  
Department of Surgery  
University of Washington

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

# CAPRICE C. GREENBERG, MD, MPH



## Wisconsin Surgical Outcomes Research Program

Department of Surgery

UNIVERSITY OF WISCONSIN

SCHOOL OF MEDICINE AND PUBLIC HEALTH

Caprice C. Greenberg MD, MPH is a tenured Professor of Surgery and the Morgridge Distinguished Chair in Health Services Research at the University of Wisconsin. She is a surgical oncologist specializing in breast cancer and a health services researcher focused on improving patient safety and quality of care. She completed a general surgery residency at Brigham and Women's Hospital and a Masters of Public Health at the Harvard School of Public Health in Boston, as well as a surgical oncology fellowship at the Partners-Dana Farber Cancer Center. Following her clinical and research fellowship training, she joined the faculty at Harvard Medical School, Brigham and Women's Hospital, and Dana-Farber Cancer Institute in 2007. While there, she served as the Associate Director and then Director of the Center for Surgery and Public Health at Brigham and Women's Hospital. She was recruited to the University of Wisconsin-Madison in 2011 to serve as Director for the Wisconsin Surgical Outcomes Research Program. Her multi-disciplinary research program in comparative effectiveness and patient centered outcomes research in cancer care, as well as performance and quality measurement and improvement in surgery, has been funded by a variety of agencies, including NIH, AHRQ, and PCORI. Dr. Greenberg is past Recorder and Past-President of the Association for Academic Surgery and Past-President and Co-Founder of the Surgical Outcomes Club.



**Caprice C. Greenberg, MD, MPH**  
Professor of Surgery  
Morgridge Distinguished Chair  
in Health Services Research  
Director, Wisconsin Surgical  
Outcomes Research Program  
Vice Chair of Research in the  
Department of Surgery  
University of Wisconsin-Madison



# 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.

# JUDGES

## Special Guest Judge



**Caprice C. Greenberg, MD, MPH**  
Professor of Surgery, Morgridge Distinguished Chair  
in Health Services Research, Director, Wisconsin  
Surgical Outcomes Research Program, Vice Chair of  
Research in the Department of Surgery  
University of Wisconsin–Madison

## Research Leadership Committee



**Saman Arbabi, MD, MPH**  
Professor



**Eileen Bulger, MD**  
Professor



**Joseph Cuschieri, MD**  
Professor



**Farhood Farjah, MD, MPH**  
Associate Professor



**Nicole Gibran, MD**  
Professor



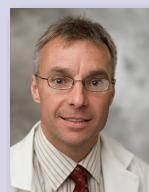
**Danielle Lavallee, PharmD, PhD**  
Research Associate Professor



**Ronald Maier, MD**  
Professor, Division Chief



**Michael Mulligan, MD**  
Professor



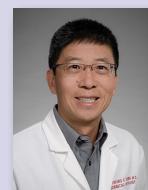
**Grant O'Keefe, MD, MPH**  
Professor



**Kimberly Riehle, MD**  
Associate Professor



**Robert Sawin, MD**  
Professor, Division Chief



**Raymond Yeung, MD**  
Professor



**Douglas E. Wood, MD, FACS, FRCSEd (ad hom)**  
The Henry N. Harkins Professor and Chair



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

# FEATURED DEPARTMENT OF SURGERY FACULTY



## Robert M. Sweet, MD, FACS

*Professor, Department of Urology, Executive Director, Washington Wyoming Alaska Montana Idaho (WWAMI) Institute for Simulation in Healthcare (WISH) and the UW Center for Research in Education and Simulation Technologies (CREST)*

Dr. Sweet is a Professor of Urology at the University of Washington and Executive Director of both the Washington Wyoming Alaska Montana Idaho (WWAMI) Institute for Simulation in Healthcare (WISH) and the UW Center for Research in Education and Simulation Technologies (CREST). He is the Principal Investigator of numerous simulation research and development projects including the Combat Casualty Training Consortium and the Advanced Modular Manikin. Dr. Sweet has served in leadership positions in the area of simulation and education within the American College of Surgeons, the Society for Laparoendoscopic Surgeons, the Endourology Society and the American Urological Association. With a vision of training leaders in Surgical Simulation, he helped develop the Surgical Simulation Fellowship Accreditation Program for the American College of Surgeons (ACS) Division of Education. Dr. Sweet has been involved in the founding of two major Simulation Centers: The University of Minnesota's SimPORTAL and University of Washington WISH.



## Giana H. Davidson, MD, MPH

*Assistant Professor, Division of General Surgery*

Dr. Davidson's research focuses on improving outcomes of emergency general surgical patients and hospitalized patients discharged to the post-acute care setting. She obtained a Master's Degree in Public Health and Epidemiology as a NIH T32 fellow at Harborview Injury Prevention & Research Center (HIPRC) where she focused on analyses of large databases to help answer clinical questions on the long-term outcomes of acute care surgery patients. As a faculty member, in 2013, she joined Washington State's Comparative Effectiveness Research and Translational Network (CERTAIN) focused on improving quality for patients during transitions of care and optimizing perioperative care to improve surgical outcomes. She is the Principal Investigator of a multidisciplinary collaborative, Improving Nursing Facility Outcomes using Real-Time Metrics (INFORM), which targets quality improvement processes to improve transitions of care between healthcare settings. Dr. Davidson is a NIH funded co-investigator examining patient reported outcomes in diverticulitis management and is the Clinical Coordinating Center Director and co-investigator for the Patient-Centered Outcomes Research Institute (PCORI) funded pragmatic randomized trial for appendicitis. On most winter weekends, Giana can be found with her husband chasing their two first graders down a snowy mountain.



## Sara H. Javid, MD

*Associate Professor, Division of General Surgery*

Dr. Javid's research focuses on studying the underlying causes of variation in surgical treatment for patients with early stage breast cancer as well as cancer decision-making and patient-reported outcomes related to the treatment of breast cancer. From 2015–2017, Dr. Javid pursued a mentored early career development award as a Cancer Research Network Scholar funded by the National Cancer Institute (NCI) under the mentorship of Drs. Diana Buist and David Flum. Her past publications address issues such as disparities in the receipt of guideline-concordant cancer care among populations such as the elderly and American Indian/Alaska Natives as well as geographical variation in the treatment of stage 0 breast cancer, or DCIS. Dr. Javid is currently collaborating with mentors and colleagues within the CRN to study the role of emotion and cognition in surgical decision-making and decision quality among patients newly diagnosed with early-stage breast cancer. Dr. Javid's work has been funded by the NCI, the American Cancer Society, the Safeway Foundation, and the Athena Endowed Award for Excellence in Breast Cancer Research.

# ACS FUTURE: #ILookLikeASurgeon

I have worked as a nurse for the past 28 years, the last 19 with surgeons in an academic medical center. This series started out as one painting of a friend I work with, a surgical resident at the time. I was thinking about visual representation, and how it shapes our perception of the world around us, how we see ourselves, how we perceive the people around us.

Walking down the hallways of most medical schools, looking at those who are honored with portraits in auditoriums and hospital wings, one would assume that all or nearly all physician leaders are white men. I was thinking about the children in my life and how it must feel not being able to see yourself in those faces, how that may affect what seems possible for you. I also was thinking about the news stories about airline employees not believing a Black woman was a doctor during a medical emergency, or the need for the “ILookLikeASurgeon” hashtag. I was considering all the times my surgical residents told me stories of being mistaken for nurses or housekeeping after having operated and rounded on a patient for days. Or the innumerable racist and sexist “jokes” they put up with from patients and colleagues alike. Or how the only two Black female surgical residents in the program were constantly being mistaken for each other, hence the title of one piece, “Not Estell.”

The title “ACS Future” references the American College of Surgeons, the largest professional scientific and educational association of surgeons. While it is diversifying, it remains a white male dominated organization. As a major professional organization, it is a large umbrella that not every surgeon fits under, yet these young surgeons are the future of the College.

Given the glacial pace that diversity and gender issues are addressed, I chose to create my own portraits to hopefully promote positive role models for the kids in my life and change perceptions of what a physician looks like. I imagine a more inclusive portrait collection in our hospital hallways, one enriched by a more diverse representation of physicians. I also wanted to honor the residents I work with so they too can see themselves one day being one of the venerated surgeons on those walls.

## Artist's Bio:

Andrea Gahl is a Seattle based artist with a studio at Inscape Arts. She has studied with Holly White-Gehrt at the Georgetown Atelier, and artists Jamie Bollenbach, Michael Shelby Edwards, and Kimberly Trowbridge. She works as a nurse in Seattle. You can see more of her art at [www.andreagahl.com](http://www.andreagahl.com) or on Instagram @andreagahl



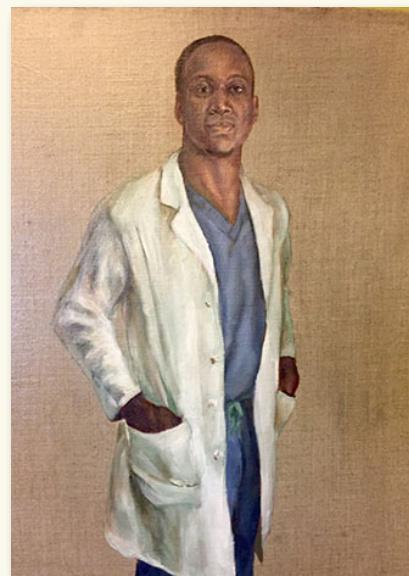
**Andrea Gahl**



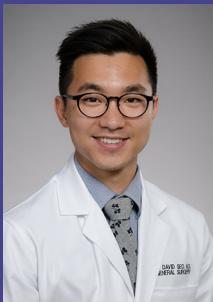
**“I Think About Your Mother”**



**“More Than Meets The Eye”**



**“Nina Said It Best”**



**Y. David Seo, MD**  
Research Resident

**Faculty Mentor**  
Venu G. Pillarisetty, MD

**Hometown**  
Los Gatos, CA

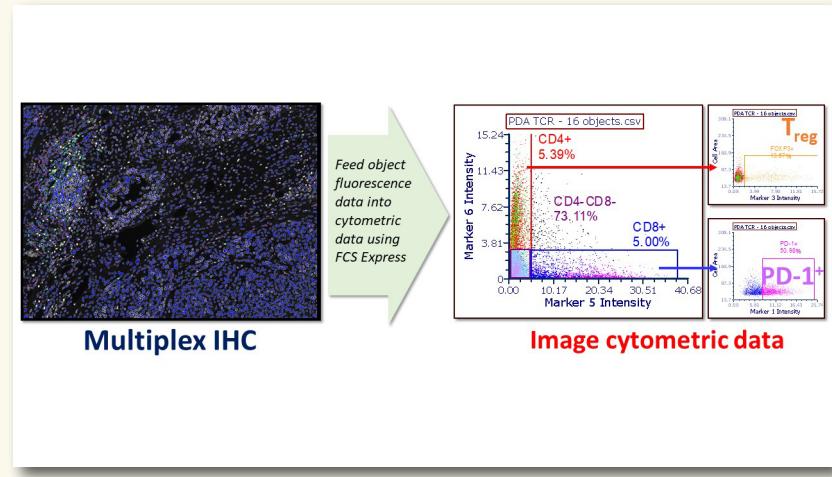
**Medical School**  
University of Michigan

**Research Interests**  
Cancer Immunology

## COMBINATION T-CELL RECEPTOR IMMUNOSEQUENCING AND MULTIPLEX IMMUNOHISTOCHEMISTRY REVEAL NOVEL INSIGHTS INTO THE IMMUNE RESPONSE TO HUMAN PANCREATIC CANCER

Seo YD, Jalikis FG, Jiang X, Sullivan KM,  
Vignali M, Robins H, Pillarisetty VG

**Background:** Despite advancements in therapy, pancreatic ductal adenocarcinoma (PDA) remains an aggressive cancer with high mortality. It is characterized by dense inflammation, including many T cells; however, it is unclear whether these T cells signify a true anti-tumor response. In the setting of disappointing early results of immunotherapy in PDA, we sought to gain a deeper understanding of the tumor-associated T-cell response.



**Methods:** With IRB approval, we obtained archival resected PDA tumors in paraffin-embedded blocks from 54 patients and performed T-cell receptor (TCR) immunosequencing on extracted DNA. Productive clonality was defined as 1-Pielou's evenness; TCR fraction was calculated from number of observed templates versus housekeeping genes. Two-tailed t-tests were used to compare subgroups. Multiplex immunohistochemistry (IHC) was performed on slides immediately adjacent to blocks sent for TCR sequencing using the PerkinElmer Vectra system. Image analysis was performed using FCS Express (DeNovo), turning object fluorescence data into cytometric outputs. Correlation analysis between multiplex and TCR data was performed using Pearson's correlation. Survival analysis was done using the Mantel-Cox test.

**Results:** Among samples that did not contain LN, mean TCR fraction was 0.27, and mean clonality was 0.15 (typical peripheral blood clonality is 0.08). TCR fraction was positively correlated with clonality ( $R^2=0.23$ ,  $p=0.007$ ), but there was no survival difference between high or low TCR fraction or clonality. Over 5 million individual cells were phenotyped using multiplex IHC and image cytometry; this demonstrated that CD4 T cells, CD8 T cells, and macrophages made up on average 8.9%, 6.9%, and 7.0% of all objects analyzed. 35.5% of CD8 T cells were positive for PD-1, an important immune checkpoint molecule. Among CD4 T cells, 17.7% had nuclear FOXP3 expression, signifying a regulatory T cell phenotype. Presence of CD4 and CD8 T cells correlated positively with TCR fraction ( $R^2=0.27$  for CD4,  $R^2=0.35$  for CD8,  $p<0.0001$  for both); however, only CD8 T cells correlated positively with clonality ( $R^2=0.17$ ,  $p=0.001$ ). In contrast, the fraction of both CD4 and CD8 T cells which were PD-1<sup>+</sup> correlated negatively with TCR fraction.

**Conclusions:** Here we demonstrate a novel approach to compare the level of clonal expansion of T cells and the overall immunophenotypic landscape within the human PDA microenvironment. We found that PDA contains a clonally expanded T cell population, but that the clonality was correlated only with CD8 (but not CD4) T cells. In contrast, the presence of the exhaustion marker PD-1 on either CD4 or CD8 T cells was correlated with decreased T cell infiltration. These reveal new insights into how immune checkpoint signaling affects T cell recruitment, and delineates CD8 T cells as a potential marker of clonal expansion and putative anti-tumor T cell activity.

## POOR OUT-PATIENT CLINIC APPOINTMENT COMPLIANCE IS A PREDICTOR OF POST-HEART TRANSPLANT MORTALITY IN CHILDREN

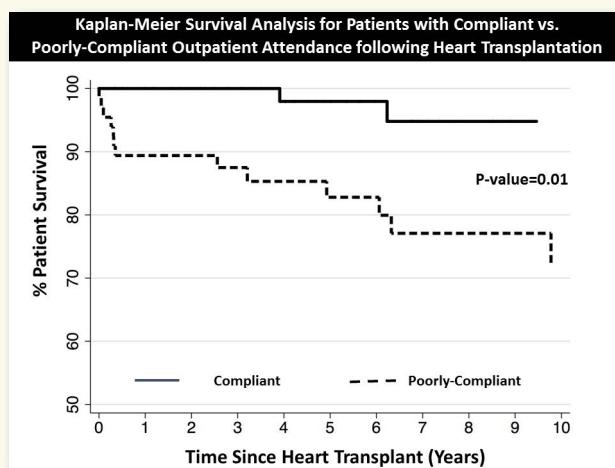
Dentel JN, Keeshan BC, Grijalva JL, Law YM, Chen JM, McMullan DM

**Background:** Patient behavioral characteristics such as medication non-adherence are associated with increased risk for rejection and poor post-transplant outcomes. It remains unknown if poor compliance with scheduled outpatient clinic appointments is a risk factor for post-transplant mortality in pediatric heart transplant recipients.

**Methods:** A single center retrospective analysis of clinical data from all pediatric heart transplant recipients between 1994–2017 was performed. Patient compliance with attending scheduled outpatient clinic appointments was determined and compliance cohorts were defined. Kaplan-Meier survival analysis was performed for cohorts and Cox proportional hazard modeling was used to determine risk of post-transplant mortality.

**Results:** During the study period, 172 patients were scheduled for 25,635 outpatient clinic appointments. Ninety-nine (56%) patients were identified as *Compliant* ( $\leq 5\%$  missed appointments; median 3%, IQR 2–4%) and 73 patients (42%) were identified as *Poorly-Compliant* ( $> 5\%$  missed appointments; median 9%, IQR 7–14%). The overall median appointment compliance rate was 95% (IQR 92–97%). Compliance cohorts were similar with respect to gender, race, primary language, age, diagnosis, and length of follow-up. Poorly-compliant patients had increased rates of rejection (59.5% vs. 36.4%,  $p < 0.01$ ), hospital readmission (25.7% vs. 3.0%,  $p < 0.01$ ) and death (28.8% vs. 7.7%,  $p < 0.01$ ). Kaplan-Meier survival analysis is demonstrated in Figure 1. Patients with  $< 95\%$  compliance with hospital appointments are at significantly higher risk for post-transplant mortality when compared to patients who are compliant (unadjusted Hazard Ratio 3.2, 95% CI 1.2 – 8.0).

**Conclusions:** Poor compliance with outpatient clinic appointments is associated with increased risk of mortality in the pediatric heart transplant population. Outpatient appointment compliance may represent a potentially modifiable risk factor for post-transplant survival.



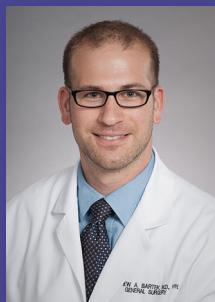
**John N. Dentel, MD**  
*Congenital Cardiac Surgery Fellow*

**Faculty Mentor**  
D. Michael McMullan, MD

**Hometown**  
Addison, MI

**Medical School**  
Wayne State University

**Research Interests**  
Congenital Heart Disease

**Matthew A. Bartek, MD, MPH***Research Resident***Faculty Mentor**

Sherene Shalhub, MD, MPH

**Hometown**

Newton, MA

**Medical School**

University of Massachusetts

**Research Interests**

Health Services, Decision Sciences

**WASHINGTON STATE TRENDS IN  
AORTIC ANEURYSM-RELATED DEATHS 1996 – 2016**

Bartek MA, Kessler LG, Talbot JM, Nguyen J, Shalhub S

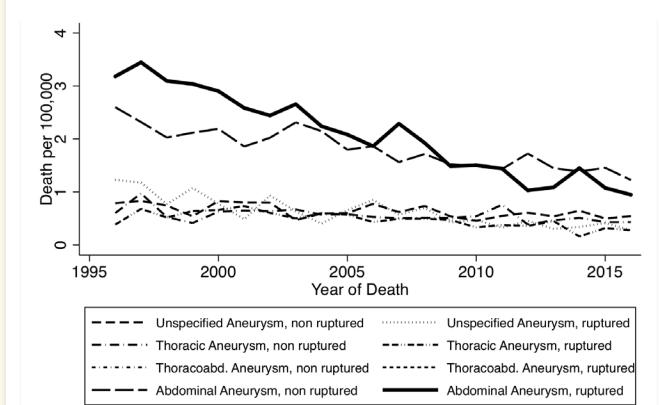
**Background:** We have witnessed considerable clinical advances in aortic aneurysm management over the last two decades. However, there exists a gap in the published literature demonstrating population effects of these advances. We undertook an analysis to evaluate aortic aneurysm-related mortality trends in Washington State.

**Methods:** Mortality data recorded in death certificates were obtained from the Washington State Department of Health for the period between 1996 and 2016. Cause and contributing causes of death were coded using the International Classification of Diseases (ICD-9 and ICD-10). Aortic aneurysm-related mortality was defined as a death where aortic aneurysm (ICD9 441.1 – 441.6; ICD10 I71.1 – I71.9) was listed as a cause or a contributing cause of death. We derived age-standardized aortic aneurysm-related death rates using the 2016 Washington State population and compared trends by sex, race, and county. Linear regression was used to evaluate differences in trends. Geographic variation in ruptured abdominal aortic aneurysm mortality was assessed by comparing county-specific age-standardized rates using a Pearson's chi-square test.

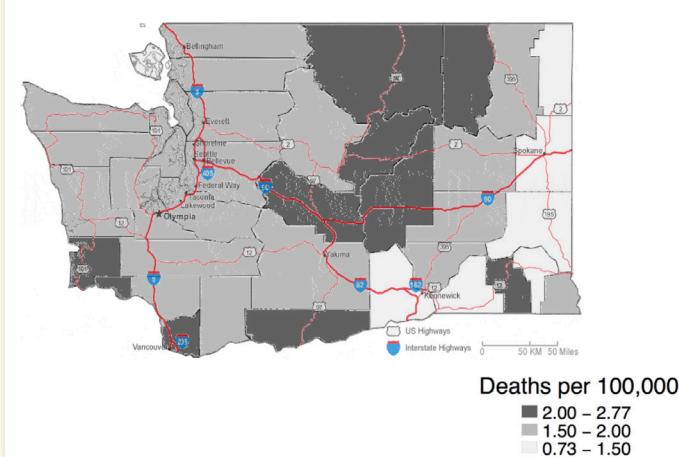
**Results:** Of the 1,014,039 deaths occurring over 21 years, 7207 (0.71%) were related to aortic aneurysm (60.9% Male, 93.7% White, mean age at death  $78.6 \pm 10.5$  years). In 4438 (61.3%) of the cases, abdominal aortic aneurysms (AAA) were listed as the cause or a contributing cause of mortality. The mean age-standardized aortic aneurysm-related mortality rate was 6.3 deaths  $\pm$  1.7 per 100,000 and demonstrated a steady decline of 0.27 deaths per 100,000 per year (95% CI -0.29 – 0.24 deaths per 100,000) on linear regression. The most pronounced decline due to the decline in mortality related to ruptured AAA (rAAA), which declined from 3.2 to 0.9 deaths per 100,000 during the study period. Comparison of aortic aneurysm-related mortality rates by sex demonstrated higher rates in males than females (6.7 vs. 4.2 per 100,000,  $p < 0.001$ ). The age at death was younger in males compared to females ( $77.2 \pm 10.6$  vs.  $80.8 \pm 10$  years respectively). The highest rate in aortic aneurysm-related mortality was in those of white race compared to black and other races ( $6.1 \pm 1.2$  vs.  $2.2 \pm 1.0$  vs.  $2.9 \pm 0.9$  deaths per 100,000,  $p < 0.001$ ). There was statistically significant variability in deaths related to rAAA by county based on Pearson's chi-square ( $p < 0.001$ ).

**Conclusions:** Aortic aneurysm-related mortality has declined over the last 21 years in Washington State. The most pronounced decline was in rAAA-related mortality. Males had a higher aortic aneurysm related mortality rate and a younger age of death than females. There is a variation in rAAA death rates by county. Future analysis should focus on the contributing factors to the geographic variation.

**Figure 1: Aortic aneurysm age-standardized death rates, by diagnosis. 1996 – 2016**



**Figure 2: Age-standardized death rates from ruptured abdominal aortic aneurysm in Washington State by county, averaged over 21 years.**



## EPIDURAL ANALGESIA IS LESS EFFECTIVE FOR VETERANS THAN COMMUNITY PRACTICE PATIENTS AFTER OPEN AORTIC SURGERY

Ohlsson AH, Deal SB, Wallace GA, Nathan DP, Tang GL

**Background:** Our objective was to test the effectiveness of epidural analgesia after open aortic surgery in a VA population compared to a community teaching practice.

**Methods:** This is a retrospective analysis of 253 patients who underwent open aortic surgery between 2007 and 2013 at the VA Puget Sound Health Care System (n=155) or Virginia Mason Medical Center (n=98). Patients were categorized into three groups for the primary endpoint: patient-controlled analgesia alone (PCA), successful epidural, or inadequate epidural (defined as the need for a supplemental PCA). Secondary endpoints included total IV morphine equivalents (ME) and subjective pain scores in the first three post-operative days. Groups were compared using student's t-test and Z-score using  $P < .05$  as significant.

**Results:** VA patients undergoing open aortic surgery were significantly more likely to have an inadequate epidural (78%) than community practice patients (25%,  $P < .001$ ). For PCA alone, VA patients used a similar amount of ME ( $194 \pm 153$  vs  $298 \pm 375$ ,  $P = .35$ ) and had similar pain scores ( $4.3 \pm 2.6$  vs  $3.2 \pm 2.5$ ,  $P = .22$ ). For successful epidural, VA patients used significantly less ME than community practice patients ( $95 \pm 74$  vs  $724 \pm 1478$ ,  $P < .001$ ), but had higher median pain scores ( $3.0 \pm 1.9$  vs  $1.8 \pm 1.3$ ,  $P < .01$ ). For inadequate epidurals, VA patients used significantly less ME than community practice patients ( $210 \pm 182$  vs  $424 \pm 391$ ,  $P = .02$ ), but trended towards higher median pain scores ( $4.0 \pm 1.8$  vs  $3.3 \pm 1.7$ ,  $P = 0.1$ ). VA patients were more likely to have a history of preoperative narcotic use (25% vs 4%,  $P < 0.01$ ), and those patients were more likely to have an inadequate epidural (23% vs 4%,  $P = .03$ ). The rate of preoperative narcotic use in community practice was similar amongst patients with successful and inadequate epidurals (3% vs 5%,  $P = \text{NS}$ ).

**Conclusions:** Epidurals were significantly less effective in a VA patient population after open aortic surgery than in a community teaching practice. This difference likely is secondary to a higher concentration of narcotic used in the community practice epidural formulation, leading to more effective pain control and less need for a supplemental PCA.



**Anna Ohlsson, MD**  
*Vascular Surgery, R3*

**Faculty Mentor**  
Gale L. Tang, MD

**Hometown**  
Boise, ID

**Medical School**  
University of Washington

**Research Interests**  
Radiation Safety, Aortic Aneurysms

**John I. Monu, MD***Research Resident***Faculty Mentor**

Farhood Farjah, MD, MPH

**Hometown**

Issaquah, WA

**Medical School**

Chicago Medical School

**Research Interests**Lung Cancer Screening,  
Lung Transplantation

## USING CROWDSOURCING TO UNDERSTAND KNOWLEDGE, ATTITUDES, BELIEFS, AND EXPERIENCES ABOUT LUNG CANCER SCREENING

Monu J, Wolff EM, Wood DE, Triplett M, Lavallee DC, Flum DR, Farjah F

**Background:** Lung cancer is the leading cause of cancer-related death in the United States. Screening—despite its proven mortality benefit—remains vastly underutilized. Prior studies have examined the knowledge, attitudes, and beliefs of screen-eligible individuals as a means of better understanding the reasons underlying low screening rates. However, these investigations were restricted to select populations (e.g. low socioeconomic status, ethnic minorities, Veterans) with limited generalizability. In order to assess knowledge, attitudes, beliefs, and experiences in a potentially more generalizable population, we used a publicly-accessible crowdsourcing platform to survey screen-eligible individuals.

**Methods:** We developed a 40-item survey to assess knowledge, attitudes, beliefs, and experiences regarding lung cancer screening among individuals eligible for screening based on United States Preventative Services Task Force (USPSTF) criteria (age 55–80, former or current 30 pack-year smokers, former smokers who quit within the last 15 years). Using Amazon's internet-based crowdsourcing platform, Mechanical Turk, we offered potential participants \$2 to complete the survey.

**Results:** A total of 212 screen-eligible individuals responded to the survey invitation and qualified for the study (median age 59 years, median 42 pack-year history, 58% current smokers, 42% former smokers, median 7 years since quitting). Only 93 respondents (44%) were aware of lung cancer screening, and of those individuals only 34 (37%) correctly identified low-dose computed tomography as the appropriate screening test. One hundred thirty-six respondents (64%) believed they were at high-risk for lung cancer even though all survey participants are in fact high-risk by virtue of meeting USPSTF screening criteria (i.e. screening is only recommended for high-risk individuals). One-hundred ninety-five respondents (92%) reported believing in the efficacy of screening. However, 66 respondents (31%) were unwilling to undergo screening if recommended by their provider. Among these 66 respondents, 59 (89%) wanted more information about screening before deciding; 3 (5%) were concerned about the costs of screening; and only 3 (5%) did not want to know if they had lung cancer. In total, 11 respondents (5%) reported having ever undergone lung cancer screening.

**Conclusions:** A minority of screen-eligible individuals know about lung cancer screening and very few have been screened. Although one-third of screen-eligible individuals would not undergo screening if recommended by their provider, an overwhelming majority of these individuals report wanting more information about lung cancer screening. Our findings suggest that efforts to raise awareness of and provide education about the benefits, risks, and costs of screening may increase lung cancer screening rates. We are currently developing a multi-level intervention aiming to increase lung cancer screening rates within the UW Medicine population.

## IDENTIFICATION OF HIGH RISK GERIATRIC TRAUMA PATIENTS

Meagher AD, Lin A, Mandell SP, Newgard CD, Bulger E

**Background:** As our population ages, increasing numbers of trauma patients are within the geriatric age group. Geriatric trauma patients have been found to have increased morbidity and mortality than similarly injured younger patients. This is likely due to the combination of frailty, comorbidity and the trauma injury. We aim to identify and describe the geriatric trauma population at highest risk for poor outcomes.

**Methods:** The AHRQ older adult trauma dataset is a prospective, population-based, consecutive patient cohort of injured patients  $\geq 65$  years of age who have a 911 emergency services call for traumatic injury in the calendar year 2011 in 7 counties in Washington and Oregon. This data was linked with Centers for Medicare and Medicaid services (CMS) data, state trauma registry data, state hospital discharge data, and Oregon POLST data. We identified patients at high risk for 30-day mortality using hospital-based measures with the following predictors: age, overall Charlson score, individual Charlson comorbidities categories, modified frailty index (preliminary), location prior to index event, mechanism of injury, AIS head, AIS chest, AIS abdomen/pelvis, AIS extremity, ISS, index procedures including orthopedic, blood transfusion, vascular, other blood product, and airway.

**Results:** 15,649 EMS trauma patients were identified, those with Medicare part AB coverage for the month of, and month prior to index event, as well as 1 year post event were included ( $n=5,199$ ). We excluded patients with POLST forms requesting comfort measures, limited treatment, or hospice ( $n=426$ ), resulting in a final cohort with 4,773 patients. 3,163 (67.3%) were female, with a mean age of 81.7 years, 4,378 (93.2%) were white race. 234 (4.9%) patients had a 30-day mortality. On unadjusted analysis, these patients were more likely to have a skilled nursing (5.6%), or inpatient claim (9%) and have an oral anticoagulant claim (24.1%) within 30 days of the index event. These patients were also more likely to have myocardial infarction (20%), cerebrovascular event (40%), chronic renal failure (37%), and malignancy (27%) within the prior year. Patients with 30-day mortality were more likely to have a higher injury severity score (9.7), undergo vascular procedures (14%), receive blood products (7%), have an airway procedure (11%), and other major procedure (10%) than those without a 30-day mortality.

**Conclusions:** Geriatric patients with traumatic injury are more likely to have 30-day mortality if they have more comorbidities prior to injury, do not reside at home, and are more severely injured. More work needs to be done in identifying the characteristics of these high-risk injured patients.



**Ashley D. Meagher, MD, MPH**

*Surgical Critical Care Fellow*

**Faculty Mentor**

Eileen M. Bulger, MD

**Hometown**

Golden, CO

**Medical School**

University of Utah

**Research Interests**

Health Care Disparities,  
Geriatric Trauma, Trauma Outcomes

**Jamil A. Matthews, MD, MS**

Vascular Surgery, R4

**Faculty Mentor**

Matthew P. Sweet, MD, MS

**Hometown**

Pasadena, CA

**Medical School**

Virginia Commonwealth University

**Research Interests**

Vascular Endograft Device Design

**ESTABLISHING BRANCH ANGLE BOUNDARY CONDITIONS  
IN FENESTRATED-BRANCHED ENDOGRAFTS**

Matthews JA, Sweet MP

**Background:** Branched thoracic endovascular aneurysm repair (B-TEVAR) is an evolving technique for the repair of thoraco-abdominal aneurysms. B-TEVAR use either an axially oriented cuff (branch) or a reinforced fenestration (fenestrated-branch) to mate with the branching stent. The devices are subject to longitudinal and rotational forces that effect wall shear stress, device integrity, and ultimately, branch patency. The purpose of this study was to assess branch angulation of fenestrated-branched endografts to determine boundary conditions of this construct.

**Methods:** This study was a retrospective review of post-operative CT scans from 40 patients treated with a physician modified fenestrated-branched endograft from December 2012 to September 2016 within an FDA approved IDE study. The degree of branch deviation for the celiac, superior mesenteric and bilateral renal arteries (n= 156) relative to the vertical and horizontal axis of the main body were measured in the coronal, sagittal and axial planes on a 3-D imaging workstation (Tera Recon, Foster City, CA). Statistical analysis was performed using Stata.

**Results:** The mean rotational and vertical deviations for the celiac, superior mesenteric, left renal and right renal arteries are 27.7, 16.7, 15.6, 30.6 and 28.1, 33.5, 18.9, 24.7 degrees respectively. 153 branches (98%) were successfully implanted. Three renal branches could not be successfully implanted, all of which had an angle of deviation exceeding 70 degrees in at least 1 plane. One other branch with a 70 degree deviation dislodged immediately post-operation. All 21 branches (14%) with angles of deviation between 45 and 70 degrees were successfully implanted. Over a mean 16 month follow up (range 1-44) no branches have fractured, migrated, or occluded.

**Conclusions:** Fenestrated-branched endografts tolerate a wide range of branch angle deviation. Extremes of deviation were associated with failure of branch implantation, although this was also impacted by target vessel anatomy. These data contribute to establishing boundary conditions of branched and fenestrated-branched endografts, and demonstrate the adaptability of the construct to varying aortic anatomy.

## SECONDARY INTERVENTIONS AFTER FENESTRATED ENDOVASCULAR ANEURYSM REPAIR

Hurd JR, Starnes BW

**Background:** Type 1a endoleak represents failure of the primary mode of therapy to treat juxtarenal abdominal aortic aneurysm (jAAA) with endovascular means. Fenestrated endovascular aneurysm repair (FEVAR) is associated with low rates of type 1a endoleak and low rates of re-intervention. In most modern series of standard EVAR, the rate of secondary intervention is between 3.8 and 37%\* and up to two-thirds of these are due to endoleak. Our objective was to characterize the incidence and types of secondary interventions in a modern series of FEVAR.

**Methods:** Patients with jAAA who were not candidates for open repair were enrolled into an investigational device exemption clinical trial (#NCT01538056) and treated with FEVAR. Clinical and imaging data were collected out to 5 years.

**Results:** A total of 92 patients were treated with FEVAR over the reporting period. There were a total of 22 secondary interventions in 16 subjects (17.4%). Of these 22 interventions, 8 were access-related (36%), 7 were branch-related (32%) and 6 were related to endoleak (27%). One was both branch-related and due to endoleak. There were one type 2, one type 1b and four type 3 endoleaks that required treatment. The rate of type 1a endoleak requiring secondary intervention was zero (0%). The overall rate of endoleak requiring intervention was 6.5% and the incidence of branch vessel complication requiring intervention was 7 out of a total of 242 fenestrations (2.9%). All patients underwent an attempt at a completely percutaneous procedure (N=184) and 20 access devices failed (10.9%) requiring immediate surgical conversion and CFA repair during the index operation. Of 184 vessels accessed for the procedure 8 required secondary intervention (4.3%) after the index procedure. No patient in this series ruptured at any time with a mean of 22 months of follow up.

**Conclusions:** These data compare favorably with all other reported FEVAR series. Access-related complications are infrequent but still the most common after FEVAR. When performed for appropriate indications, type 1a endoleaks are rare if not absent after FEVAR. It appears that secondary intervention for endoleak is much less common than in contemporary series of standard EVAR. Branch vessel patency after FEVAR is excellent.

\*Nordon et al, Eur J Vasc Endovasc Surg (2010) 39, 547-554



**Jason R. Hurd, MD**

Vascular Surgery Fellow

**Faculty Mentor**

Benjamin W. Starnes, MD

**Hometown**

Missoula, MT

**Medical School**

University of Pennsylvania

**Research Interests**

Aortic Aneurysm, Vascular Trauma



**Haig A. Yenikomshian, MD**  
Surgical Critical Care Fellow

**Faculty Mentor**  
Samuel P. Mandell, MD, MPH

**Hometown**  
Monte Sereno, CA

**Medical School**  
University of Southern California

**Research Interests**  
Burn Reconstruction, Patient Outcomes, Surgical Education

## OUTPATIENT OPIOID USE OF BURN PATIENTS: A RETROSPECTIVE REVIEW

Yenikomshian HA, Curtis EE, Carrougher EJ, Qiu Q, Gibran NS, Mandell SP

**Background:** Opioid overuse is a growing patient safety issue in the United States. Despite this, the use of these medications continues to be integral to pain management for burn patients. This study aims to characterize opioid use in discharged patients and factors predictive of long term use.

**Methods:** With IRB approval, we reviewed participants over age 14 admitted with burn injuries to a single center from 2006 – 2015. Total outpatient morphine equivalent dose (MED) was recorded at discharge and each clinic visit. Visits were categorized as 7, 14, 30, 60, 90, 180, and 365 days, based on nearest day since discharge. Burn size, percent grafted, age, sex, and preadmission drug use were collected. For each time point, multivariate logistic regression analysis was performed to examine the relationship of discharge MEDs and long-term opioid use, adjusting for age, sex, burn size, and percent grafted. MEDs were divided into low (0–150 mg per day), medium (151–300 mg per day), and high (greater than 301 mg) groups on day of discharge.

**Results:** We identified 407 participants who met our inclusion criteria. Average age was 45 and 75% were male. At discharge, 366 (91%) patients received opiates. Table 1 outlines the breakdown of the different MED groups based on days since discharge. At day 14, both the medium MED (OR 2.55; CI 1.16–5.63) and high MED (OR 3.01; CI 1.15–7.88) groups had an increased risk for continued opioid use. On day 60, both the medium MED group (OR 3.75; CI 1.34–10.50) and the high MED group (OR 7.79; CI 2.35–25.81) had an increase risk. At day 90, only the high MED group had an increased risk of continuing on opioids (OR 4.38; CI 1.29–14.89). There was no increased risk after day 90. Burn size, TBSA grafted, or pre-burn drug use did not significantly influence opioid use at any time point.

**Conclusions:** Whereas opioids are widely prescribed upon discharge, most patients no longer use them 30 days later. Higher opiate utilization at discharge increases risk of long term use, but burn size, amount grafted, and history of drug use do not.

**Table 1: Patient Breakdown Based on Morphine Equivalent Dose (MED)**

	All Patients	Low MED at Discharge	Medium MED at Discharge	High MED at Discharge
Number of Patients	407	226 (56%)	126 (31%)	55 (14%)
Burn Size (%)	18	17	19	24
Preinjury drug use (%)	12	9	14	17
Taking Opioids at 7 Days (%)	68	66	67	80
Taking Opioids at 14 Days (%)	60	51	73	74
Taking Opioids at 30 Days (%)	30	28	32	46
Taking Opioids at 60 Days (%)	18	11	25	41
Taking Opioids at 90 Days (%)	14	11	14	30
Taking Opioids at 180 Days (%)	9	10	5	11
Taking Opioids at 365 Days (%)	8	13	5	7

## THE T CELL MICROENVIRONMENT IN FIBROLAMELLAR HEPATOCELLULAR CARCINOMA

Sullivan KM, Campell JS, Kenerson HL, Seo YD,  
Yeung RS, Riehle KJ, Pillarisetty VG

**Background:** Fibrolamellar carcinoma (FLC) is a rare form of hepatocellular carcinoma (HCC) that represents less than 10% of primary liver cancers and affects younger patients without underlying liver disease. A chromosomal deletion causing the fusion of the genes *DNAJB1* and *PRKACA* was found to result in a novel fusion protein unique to FLC. Surgery is the mainstay of treatment for FLC, as standard systemic chemotherapeutic agents have minimal therapeutic benefit in these patients. There have been recent advances in immunotherapeutic options for solid tumors including classic HCC, as evidenced by the approval of anti-PD1 immunotherapy for its treatment. We hypothesize that the fusion protein could serve as a source of tumor specific antigens serving to create an immune response. We thus compared the expression of immune system-related genes between FLC and HCC, with the aim of further defining the immune microenvironment in FLC to ultimately identify potential therapeutic targets.

**Methods:** Extraction of mRNA was performed from fresh frozen HCCs of varying etiologies: non-alcoholic steatohepatitis (NASH, n=2), untreated hepatitis C (HCV, n=3), and treated HCV (n=3), as well as from FLCs (n=4). Paired non tumor livers (NTL) from each patient served as controls. Nanostring™ gene expression analysis using the PanCancer Immune Profiling Panel was used, as it contains 770 genes from 24 immune cell types. Analysis of gene expression data was performed using nSolver™ Analysis software and its associated Advanced Analysis add-on, allowing for immune cell population profiling and pathway-specific response analysis based on the expression pattern of characteristic genes.

**Results:** Data passed quality control measures, included positive and negative controls, and was normalized to multiple housekeeping genes. In HCC tumor (T) tissue, characteristic genes relating to T cell population abundance, including total T cell score, CD8 T cell score, and cytotoxic cell score, were decreased compared to NTL. However, in FLC these scores were found to be similar to the matched NTL. The exhausted CD8 T cell score for both HCC and FLC trends toward decreased when compared to their matched NTL. In contrast, genes characteristic of other immune cell types, such as neutrophils, demonstrated the same trend toward decreased abundance in both FLC and HCC.

**Conclusions:** The T cell microenvironment of FLC differs from that of classic HCC. In FLC, the pattern of gene expression suggests that the T cell population in tumors is similar in abundance to that of NTL, and that the T cells appear to be cytotoxic rather than exhausted. The immune microenvironment of FLC warrants further investigation, including multiplex immunohistochemistry and T cell receptor sequencing, in order to identify and exploit potential therapeutic targets.



**Kevin M. Sullivan, MD**

Research Resident

**Faculty Mentor**

Venu G. Pillarisetty, MD

**Hometown**

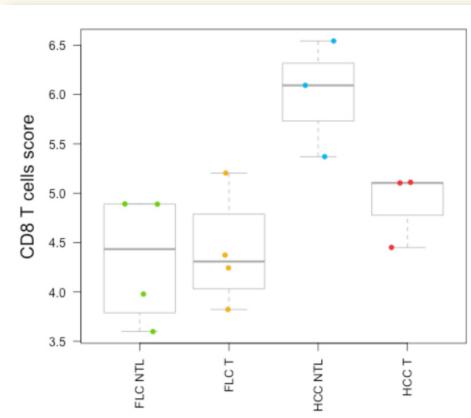
Milwaukee, WI

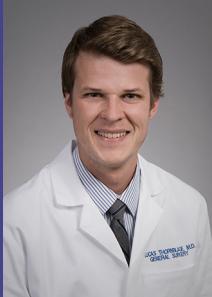
**Medical School**

Medical College of Wisconsin

**Research Interests**

Hepatobiliary Cancer, Immunology



**Lucas W. Thornblade, MD, MPH**

General Surgery, R4

**Faculty Mentor**

David R. Flum, MD, MPH

**Hometown**

Castleton, VT

**Medical School**

Boston University

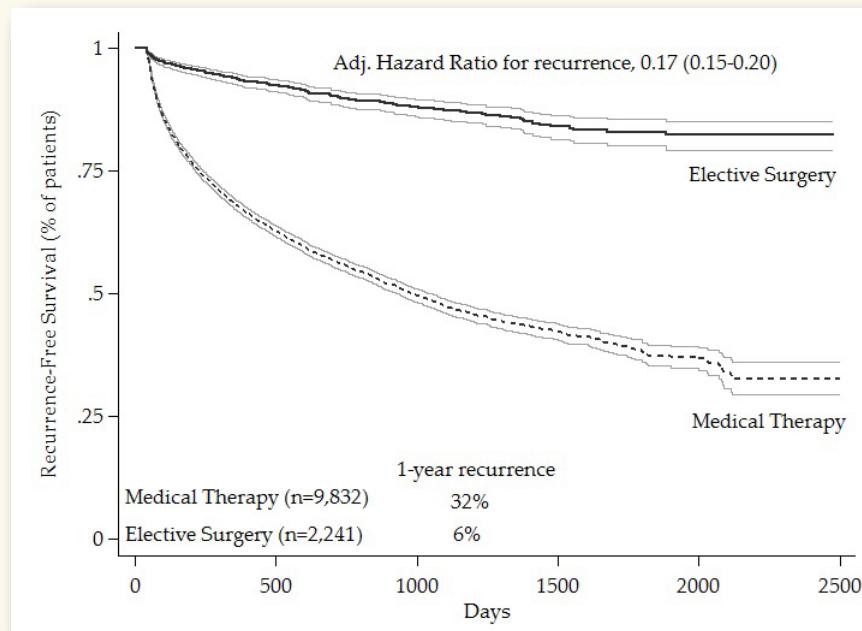
**Research Interests**Reducing Low-Value Care,  
Cancer Care Delivery**ELECTIVE SURGERY FOR DIVERTICULITIS AND THE RISK OF RECURRENCE AND COLOSTOMY**

Thornblade LW, Simianu VV, He H, Davidson GH, Flum DR

**Background:** Despite recommendations to limit its use, elective colon resection for uncomplicated diverticulitis is increasingly common. Surgeons typically recommend resection to avoid disease recurrence or future colostomy but prior studies to quantify this risk do not include outpatient episodes. It remains to be determined if elective surgery actually decreases those risks. We aimed to assess the comparative risk of recurrence and colostomy after elective resection or medical therapy for uncomplicated diverticulitis, incorporating outpatient episodes of recurrence.

**Methods:** A nationwide retrospective cohort study of adults with  $\geq 1$  year continuous enrollment treated for  $\geq 2$  episodes of uncomplicated diverticulitis from the MarketScan® commercial claims dataset (2008–2014). An adjusted time-to-event analysis was applied to assess the relationship of medical therapy or elective surgery with diverticulitis recurrence and/or receipt of a colostomy.

**Results:** Of 12,073 patients (mean age  $56 \pm 14$  years, 59% women), 19% underwent elective surgery and 81% were treated by medical therapy on their 2nd treatment encounter for uncomplicated diverticulitis. At one year, patients treated by elective surgery had lower rates of recurrence (6%) compared to those treated by medical therapy (32%), (15% vs. 61% at 5 years, adjusted hazard ratio (HR) 0.17 [95% CI: 0.15–0.20]). At 1 year, the rate of colostomy after both treatments was low (surgery [inclusive of stoma related to the elective colectomy], 4.0%; medical therapy, 1.6%).



Kaplan Meier curves for survival from recurrence of diverticulitis after medical therapy or elective surgery.

**Conclusions:** Elective resection for uncomplicated diverticulitis decreases the risk of recurrence, still 6–15% of patients will recur within 5 years of surgery. The risk of colostomy is not lower after elective resection, and considering colostomies related to elective resection, colostomy prevention should not be considered an appropriate indication for elective surgery.

## A MAGNETIC JEJUNOILEAL PARTIAL DIVERSION: A STEP FORWARD IN TRANSLATION AND METABOLIC SURGERY

Patel VH, Kwiat D, Leeflang E, Graham J, Havel PJ, Harrison MR

**Background:** We hypothesize that a jejunointestinal anastomosis and partial diversion using Magnamosis, a novel magnetic compression device, is technically feasible and will improve insulin resistance and metabolic syndrome. Metabolic surgery has demonstrated improvements in various parameters including insulin resistance, triglyceride levels, and cholesterol. It may be possible to perform a less-invasive operation through partial diversion, and thereby stimulate an increase in incretins from the L-cells of the ileum to glean these benefits.

**Methods:** We performed a laparotomy and jejunointestinal partial diversion using Magnamosis in five Rhesus macaques with induced insulin resistance through dietary modifications. After surgery, weight was monitored and timed tests were performed at baseline and again at 3 and 6 weeks postoperatively for triglyceride levels, GLP-1, insulin, glucose, and bile acids. The primates were followed for 8 weeks prior to euthanasia. Results are represented as mean (SD) and all p-values were calculated using a two-sample Student's t-test.

**Results:** All five monkeys successfully underwent surgery without technical or post-operative complications. Mean weight at 8 weeks decreased from baseline 17.9 (2.6) kg to 15.1 (3.4) kg ( $p=0.067$ ), for a mean weight loss of 9.6%. At 6 weeks, there was a statistically significant decrease in mean triglyceride levels from 354.0 (12.2) mg/dL to 83.6 (4.0) mg/dL ( $p=9.8 \times 10^{-15}$ ), mean fasting glucose from a baseline of 68.2 (13.8) mg/dL to 60.3 (9.4) mg/dL ( $p=0.0066$ ), and fasting insulin from 96.4 (19.1)  $\mu$ U/mL to 35.2 (7.0)  $\mu$ U/mL ( $p=1.7 \times 10^{-6}$ ). At 6 weeks, bile acid levels increased from 4.4 (1.2)  $\mu$ mol/L to 6.0 (0.4)  $\mu$ mol/L ( $p=5.93 \times 10^{-7}$ ). Additionally, at 3 weeks, GLP-1 active levels increased from the mean baseline value of 2.1 (0.6)  $\mu$ g/mL to 7.0 (2.9)  $\mu$ g/mL ( $p=4.5 \times 10^{-7}$ ). Due to unanticipated effects of anesthesia during the timed mixed meal tolerance and oral glucose tolerance tests, we were unable to effectively demonstrate an improvement in insulin resistance.



**Veeshal H. Patel, MD, MBA**

Research Resident

**Faculty Mentor**

Michael R. Harrison, MD  
University of California,  
San Francisco

**Hometown**

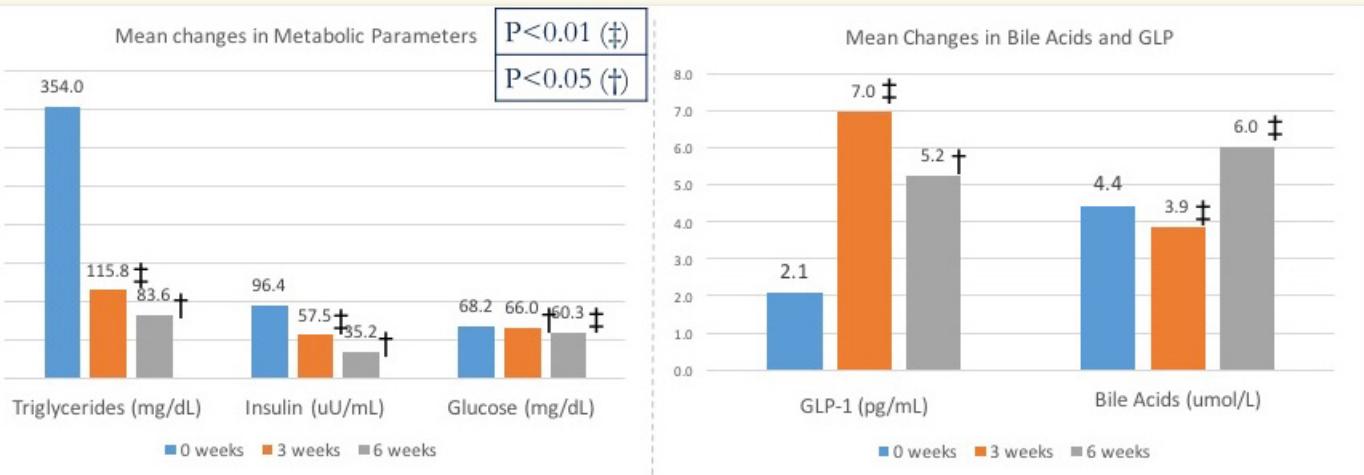
Marlboro, NJ

**Medical School**

Boston University

**Research Interests**

Medical Device Development,  
Value-Based Healthcare



**Conclusions:** The creation of a magnetic jejunointestinal partial diversion in the rhesus monkey is technically feasible, safe, and reproducible. The translational similarities between the rhesus macaque metabolome and humans demonstrated expected improvements in specific metabolic parameters and GLP-1. More definitive tests of insulin resistance and additional markers of metabolic syndrome are necessary to elucidate the mechanism of action, improve future human translation, and further clarify the efficacy of this novel operation for metabolic surgery.

**Catherine Kling, MD, MPH***Transplant Surgery Fellow***Faculty Mentor**

Martin I. Montenovo, MD

**Hometown**

Melbourne, Australia

**Medical School**

Vanderbilt University

**Research Interests**Outcomes Research,  
Liver Transplant, Kidney Transplant**LIVING DONATION VERSUS DONATION AFTER CIRCULATORY DEATH LIVER TRANSPLANTATION FOR LOW MELD RECIPIENTS**

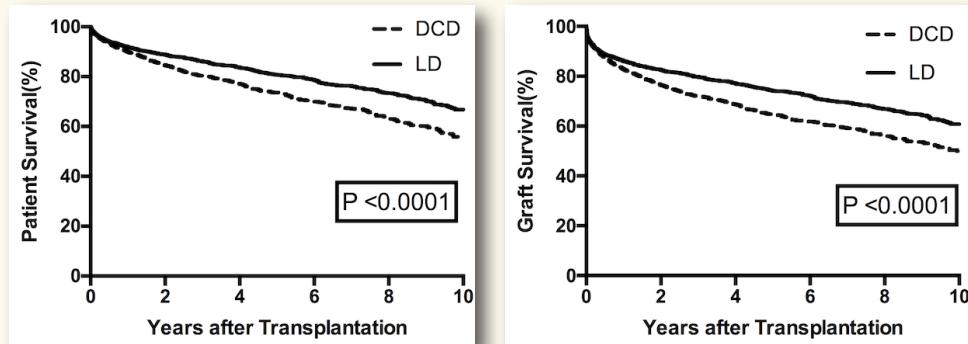
Kling CE, Perkins JD, Reyes JD, Montenovo MI

**Background:** In this era of organ scarcity, living donor liver transplant (LDLT) is an alternative to using deceased donors (donation after brain death or donation after circulatory death (DCD)) and is often used in low MELD recipients. We sought to compare the perioperative outcomes, patient survival and graft survival between recipients of liver transplantation from LDLT and DCD donors in patients with low MELD scores.

**Methods:** Retrospective cohort analysis of adult liver transplant recipients from DCD or LDLT donors with a laboratory MELD  $\leq 20$  who underwent transplantation between 1/1/2003 and 3/31/2016. Recipients were categorized by donor graft type (DCD or LDLT) and recipient and donor characteristics were compared. Ten-year patient and graft survival curves were calculated using Kaplan-Meier analyses and Cox proportional hazards model was performed to determine the contributions of recipient and donor variables on patient and graft survival. Post-operative complications were compared.

**Results:** 4,450 liver transplants were performed-2166 (48.7%) were from DCD donors and 2284 (51.3%) from LDLT. LDLT recipients had significantly better 10-year patient and graft survival than DCD recipients ( $p < 0.0001$ ). In the multivariable model, DCD status was an independent predictor of patient death and graft loss when compared to LDLT ( $p = 0.02$  and  $p = 0.009$ , respectively). LDLT recipients had more vascular complications (31.5% vs 12.8%  $p < 0.0001$ ), but fewer biliary complications (15.1% vs 34.4%,  $p < 0.0001$ ) and lower rates of retransplantation (7.9% vs 10.0%,  $p = 0.014$ ).

**Conclusions:** For liver transplant recipients with low laboratory MELD, LDLT offers a significantly improved patient and graft survival compared with using DCD donors.



## DURATION OF ECMO SUPPORT PREDICTS SURVIVAL IN TRANSPLANT PATIENTS

Grijalva JL, Keeshan B, Dentel JN, Chen JM, McMullan DM

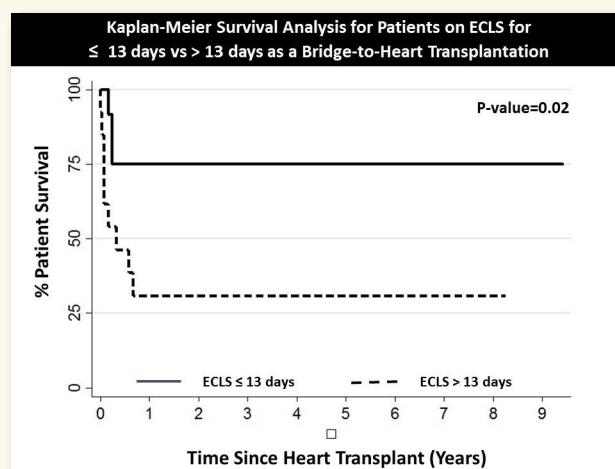
**Background:** The use of extracorporeal membrane oxygenation (ECMO) in the management of pediatric patients awaiting heart transplantation is generally associated with poor outcomes. The relationship between duration of ECLS on waiting list survival and post-transplant survival has not been clearly established.

**Methods:** Single center data was analyzed from all pediatric heart transplant candidates who received ECMO as a bridge-to-bridge or bridge-to-transplant between 2014-2017. Comparisons were made between survivors and non-survivors, as well as, prolonged vs. shorter duration of ECMO support to determine potential risk factors and predictors for mortality.

**Results:** Twenty-five patients (median age 10 months, range 9 days - 14 years) were included in analysis. Overall survival was 52%. Sixteen (64%) patients survived to transplantation. Three (18.75%) patients who survived to transplantation died within 5 months of transplantation. Overall survival in patients < 1 year of age was lower than older patients (30.8% vs. 75%, p=0.047). Prolonged ECMO > 13 days was associated with reduced survival when compared to ECMO duration ≤ 13 days (30.8% vs. 75%, p=0.03). Kaplan-Meier survival analysis is depicted in Figure 1. Prolonged pre-transplant ECMO is predictive of overall mortality (hazard ratio 3.9, 95% CI 1.1-14.6).

**Conclusions:** Use of ECMO as a bridge-to-bridge or bridge-to-transplant beyond 13 days is associated with worse survival in pediatric patients awaiting heart transplantation. Earlier transition to non-ECMO mechanical support may lead to improved survival in this patient population.

**Figure 1**



**James L. Grijalva, MD**  
ECLS Fellow

### Faculty Mentor

D. Michael McMullan, MD

### Hometown

Salcha, AK

### Medical School

New York Medical College

### Research Interests

ECMO



**Benjamin B. Massenburg, MD**  
Plastic Surgery, R1

**Faculty Mentor**  
Jeffrey B. Friedrich, MD

**Hometown**  
Kula, HI

**Medical School**  
Icahn School of Medicine  
at Mount Sinai

**Research Interests**  
Craniofacial Surgery, Plastic Surgery,  
Global Surgery

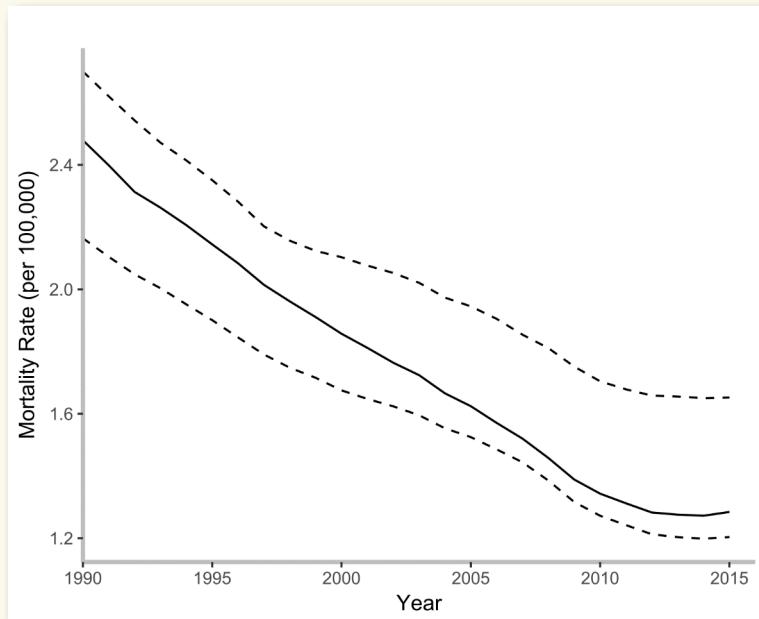
## THE BURDEN OF BURN INJURIES IN THE UNITED STATES

Massenburg BB, Crowe CS, Morrison SD, Naghavi M

**Background:** In the United States, improvements in burn care are due in large part to a shift in complex burn care from clinics and community hospitals to more specialized, high-volume burn centers. This study aims to investigate the relationship between the location of a burn center and the morbidity and mortality due to burn injuries in each state in the United States.

**Methods:** Using Global Burden of Disease Methodology, the morbidity and mortality for burn injuries was estimated for the United States. These results were broken down by state and analyzed to identify an association with the location of an accredited burn center with burn morbidity and mortality.

**Results:** Mortality rate due to burns in the United States has significantly decreased over the past 25 years (Figure 1). In 2015, Mississippi and Alaska have the highest age-standardized mortality rate due to burns (each with 2.8 deaths per 100,000 people), and neither contain an American Burn Association burn center. California has the lowest age-standardized mortality rate due to burns (0.7 deaths per 100,000 people), and contains fourteen burn centers.



**Conclusions:** States without burn centers experience more deaths attributable to burns than do states with burn centers. Further research is warranted to investigate the etiology of this discrepancy.

## COST-UTILITY IN THE MANAGEMENT OF BLUNT SPLENIC INJURY: IS THERE A ROLE FOR SPLENIC ARTERY EMBOLIZATION?

Senekjian L, Cuschieri J, Robinson BR

**Background:** Practice management guidelines advocate for non-operative management (NOM) of patients with high-grade splenic injuries if hemodynamic stability is present. It remains unclear which patient subtypes are associated with unsafe failure rates. Splenic artery embolization (SAE) has been proposed to reduce NOM failure rates though the cost-effectiveness of this strategy remains unknown.

**Methods:** A cost-utility analysis was developed for a 40-year-old male base-case patient with grade III blunt splenic injury. The strategies compared were non-operative management to splenic artery embolization. Non-operative patients were modeled with the probability of failure requiring splenectomy (0.11) readmission (0.23) and post procedure complications (0.05). Patients managed by SAE were modeled with probability of failure leading to splenectomy (0.12) and post interventional radiology (IR) complications (0.18). Probabilities of complications, readmissions requiring additional management, and utilities were extracted from published data. Probabilistic sensitivity analysis was completed to account for uncertainty in variables. Costs were collected from the Centers for Medicare and Medicaid Services and expressed in 2014 dollars. Utility outcome was quality-adjusted life years (QALY).

**Results:** Non-operative management was less costly and more effective than splenic artery embolization. The cost of non-operative management was \$45,733 with 17.4 QALY. The cost of SAE was \$127,155 with 15.6 QALY. After varying the probability of failure of NOM to 0.38, NOM remained the dominant strategy. When the probability of failure of NOM was increased to 100%, NOM remained the dominant strategy. Probability of failure of SAE was decreased to 0.018, and NOM remained the dominant strategy. Non-operative management remained the dominant strategy when SAE was decreased to 0%.

**Conclusions:** In patients with grade III splenic injury NOM is dominant and should be considered in patients that can be closely observed. Though SAE may decrease the risk of failure of watchful waiting, NOM is less costly and more effective.



**Lara Senekjian MD, MAT, MS**

*Surgical Critical Care Fellow*

**Faculty Mentor**

Bryce R. H. Robinson, MD, MS

**Hometown**

Ogden, Utah

**Medical School**

University of Utah

**Research Interests**

Health Economics, Outcomes,  
Cost Effectiveness



## DISEASE BASED OBSERVATIONAL COHORT STUDY OF PATIENTS WITH THORACOABDOMINAL AORTIC ANEURYSM

Kang PC, Bartek MA, Shalhub S, Nathan DP, Sweet MP

**Background:** Current understanding of patients with thoracoabdominal aortic aneurysms (TAAA) is limited to institutional case series and administrative data describing patients selected to undergo surgical repair. The purpose of this study is to describe a disease-based cohort of patients with TAAA, including those undergoing repair by various methods and those not having surgery.

**Methods:** Data on patients with TAAA within a multi-hospital academic medical system were obtained from 2009 to 2017. This hospital system serves as the primary regional referral center for a population of 11 million. Patients were identified by two methods: an administrative database was screened by diagnosis codes for ruptured or non-ruptured TAAA; and individual surgeons in our group identified their operative and non-operative patients. The diagnosis of TAAA was then confirmed based on the CT finding of aneurysmal degeneration > 3.2 cm of the para-visceral aorta in continuity with aneurysmal aorta meeting standard criteria for repair. Patients under the age of 18 and those with mycotic aneurysms were excluded. The primary outcome measure among those operated upon was a composite measure of “good” outcome at 1 year, indicating survival with a return to pre-operative functional status and freedom from permanent loss of organ system function. Statistical analysis was performed using StataIC version 14 (StataCorp, College Station, TX).

**Results:** A total of 342 patients with TAAA were identified, with patients' demographics similar to those in published operative case series. 160 patients (47%) were deemed ineligible for or declined treatment. At 1 year, a “good” outcome was achieved in 63, 72, 83, and 53 percent of those undergoing open, endovascular, hybrid, and partial repairs, respectively. Re-intervention was common, and occurred most frequently in the hybrid group.

**Conclusions:** This inclusive cohort study of patients with TAAA shows that half of patients with TAAA did not undergo treatment, and an additional 16% had incomplete repair. Overall, two thirds of patients with TAAA never went on to have definitive repair of the peri-visceral aorta despite access to all treatment options, suggesting that data from operated case series are achieved among highly selected patient cohorts and do not reflect the overall outcomes of patients with TAAA. A majority of patients with TAAA never undergo repair, and that among those who are repaired, similar results are achieved with different techniques in appropriately selected patients.

**P. Chulhi Kang, MD**  
Vascular Surgery, R2

**Faculty Mentor**  
Matthew P. Sweet, MD, MS

**Hometown**  
Camarillo, CA

**Medical School**  
University of Wisconsin

**Research Interests**  
Complex Aortic Disease

## EARLY PATIENT DEATHS AFTER TRANSFER TO A BURN CENTER

Curtis EE, Yenikomshian HA, Carrougher GJ, Gibran NS, Mandell SP

**Background:** Patients who sustain burn injuries are frequently transferred to regional burn centers. Severely injured patients may be transported far from home and family to die shortly after arrival. An examination of early deaths within a week of transfer may offer an opportunity to revise the way we think about critical burns and the best way to support regionalized burn care.

**Methods:** This focused review of burn patients who survived ≤ 1 week after transfer to a regional center from 2013–2017 included analysis of transfer data, mode of transport and distance traveled, as well as patient characteristics: burn size (% TBSA), inhalation injury, and medical history with calculation of revised-Baux (r-Baux) score.

**Results:** 25 patients of 2091 transfers met inclusion criteria. Code status was not always addressed prior to the decision to transfer as 1 patient was on hospice care at time of injury and another patient was intubated after the local provider withdrew the DNR/DNI order. The vast majority of patients died on comfort measures and 28%, after discussion with family, did not complete a full resuscitation as their projected course would not align with their wishes. Only 3 patients were transported by ground, the rest were transported by air with projected costs of \$12,000 dollars for short helicopter flights to \$135,000 for long range fixed wing aircraft. Families traveling to be with patients would be responsible for their own transportation as well as lodging and food once arrived at the referral center.

**Conclusions:** Transferring patients for whom resuscitation is not appropriate or would not go along with patient wishes may have a profound impact on resource utilization from a variety of perspectives including transferring centers, receiving centers, transportation providers, and patient families. Referring providers need to be supported in identifying these severely injured, potentially expectant patients. Transfer of patients may negatively impact families as a loved one may die far from home, before family can arrive, or place undue financial hardship on them for travel. With our increasing access to telehealth, transfer may not always provide the best support we can offer for providers, patients, and families.



**Eleanor E. Curtis, MD, MPVM**

*Surgical Critical Care Fellow*

**Faculty Mentor**

Samuel P. Mandell, MD, MPH

**Hometown**

Columbus, OH

**Medical School**

University of Cincinnati

**Research Interests**

Clinical Trauma, Burns,  
Palliative Care

	Count	Percentage
Female	12	48%
Male	13	52%
Ground Transport	3	12%
Air Transport	22	88%
TBSA to support resuscitation	21	84%
Patients underwent full resuscitation efforts	10	40%
Patients placed on Comfort Care on Admission	4	16%
Patients placed on Comfort Care after Discussion with family, prior to resuscitation completion	7	28%
Patients who were full code at the time of death	4	8%
Patients transitioned to comfort care after failed resuscitation or with comorbid events	8	32%
Total Patients to transition to Comfort Care	21	84%
Medicare/Medicaid insurance	14	56%
Other insurance	2	8%
	Median	Range
TBSA	50%	0-100%
Age	63 years	3-91 years
Distance traveled	222 miles	16-2146 miles
r-Baux	110	61-159
Population at transferring medical center	76000 people	1000-216,000



## PEDIATRIC LIVING DONOR LIVER TRANSPLANTATION IMPROVES PATIENT AND GRAFT SURVIVAL

Richards MK, Dick AAS, Healey PJ, Reyes JD, Perkins JD, Montenovo MI

**Background:** The utilization of living donor grafts resulted in an increased availability of liver for pediatric recipients. Accordingly, this was associated with a significant decrease in waiting time before liver transplantation and reduction in pre-transplant mortality. We hypothesized that the use of living donors (LD) in pediatric liver transplant (LT) may lead to improved graft and patient survival, when compared to LT using deceased donors.

### Morgan K. Richards, MD, MPH

General Surgery, R5

#### Faculty Mentor

Martin I. Montenovo, MD

#### Hometown

Seattle, WA

#### Medical School

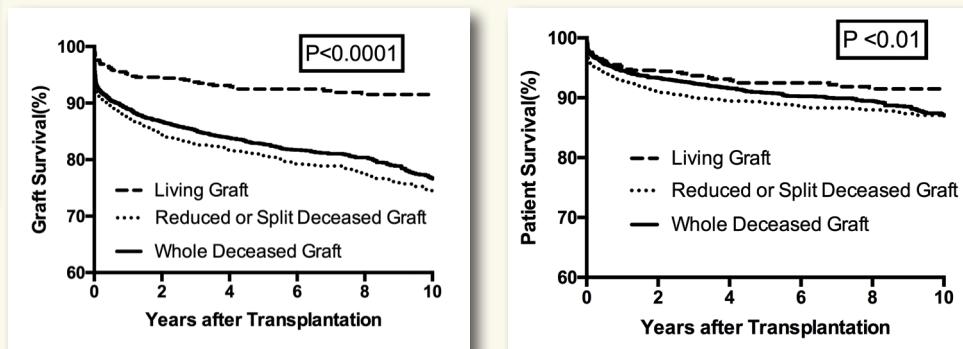
Case Western Reserve University

#### Research Interests

Pediatric Surgery Outcomes Research

**Methods:** A retrospective cohort analysis was performed of pediatric recipients (aged <18 years) registered in the UNOS database who received a primary liver transplant between Feb 2002 and Dec 2016. Covariates predictive of survival by multivariable analyses were included in the Cox proportional hazards regression models to determine predictors of patient and graft survival

**Results:** 6,312 children received a primary LT from a LD (n=800) or a deceased donor (n=5,517; partial graft n=1,784 and whole graft n=3,733). Vascular and biliary complications were similar. Kaplan-Meier graft and patient survival rates were superior in LD recipients compared with recipients of deceased whole and reduced grafts (Figures 1-2). In the multivariable analysis, LD was an independent predictor of improved patient and graft survival.



**Conclusions:** The use of LD in children is associated with improved patient and graft survival. The option of LD should be introduced early in the evaluation of every pediatric patient being evaluated for liver transplant.

## IMPROVED OUTCOMES AT REDUCED HEALTHCARE COSTS AFTER IMPLEMENTATION OF A HERNIA-SPECIFIC ENHANCED RECOVERY AFTER SURGERY (ERAS) PATHWAY

Cummings D, Pederson R, Yates R, Wright A

**Background:** Enhanced Recovery After Surgery (ERAS) pathways have been demonstrated to improve outcomes in colorectal surgery. There is only one prior published report of outcomes following ERAS implementation in hernia surgery which did not analyze cost. It remains unknown whether a multidisciplinary hernia ERAS pathway results in improved outcomes without increasing healthcare costs. We hypothesize that implementation of an ERAS pathway in patients undergoing ventral hernia repair (VHR) results in shorter hospitalization, decreased 30-Day readmission, and reduced direct costs.

**Methods:** A hernia-specific ERAS pathway was developed by a multidisciplinary team with members from surgery, anesthesia, nursing, physical therapy, nutrition, pharmacy, and administration. Outcomes and direct costs of consecutive patients with inpatient admission after VHR were analyzed for the 1 year preceding and 18 months following ERAS implementation at 2 hospitals in a single system. Outpatient cases were excluded from this analysis. Data was extracted from hospital billing, quality improvement, and administrative datasets. Outcomes analyzed included mortality, length of stay (LOS), ICU LOS, 30-Day readmission, and direct healthcare costs.

**Results:** A hernia-specific ERAS pathway was developed with key components being pre-operative optimization (smoking cessation, glucose control with HgbA1c<8, immunonutrition), patient education, and peri-operative management (advanced pain management, glucose control, limited fluid resuscitation, early feeding, aggressive mobilization). There were no mortalities in either group ( $p<0.05$ )



**Dustin R. Cummings, MD, MPH**

*MIS Surgery Fellow*

**Faculty Mentor**

Andrew S. Wright, MD

**Hometown**

Saginaw, MI

**Medical School**

University of Michigan

**Research Interests**

Surgical Quality Outcomes

	# cases	LOS	ICU LOS	Direct Cost	30 Day Readmission
All Cases	Pre-ERAS	138	5.21	\$13,875	7.25%
	Post-ERAS	264	4.22	\$11,917	5.30%
	% Improvement	19.22%*	14.11%	14.10%*	26.90%*
Open Cases	Pre-ERAS	116	5.31	\$14,387	6.89%
	Post-ERAS	204	4.60	\$12,372	6.86%
	% Improvement	13.20%	69.40%	14.00%*	3.00%
Lap Cases	Pre-ERAS	22	4.75	\$12,358	9.00%
	Post-ERAS	60	2.90	\$10,729	0.00%
	% Improvement	39.00% *	41.30%	13.10%*	100.00%

**Conclusions:** Development and implementation of a multidisciplinary ERAS pathway for patients requiring inpatient admission following VHR results in decreased LOS (-19%) without increasing 30-day readmission. Direct healthcare costs were reduced by \$1,958/case, thereby saving \$516,000 during the study period. Improvements were seen for both open and laparoscopic cases. Implementation of a hernia-specific ERAS pathway improved health outcomes while decreasing cost.

**Kathryn M. Stadeli, MD**

Research Resident

**Faculty Mentor**

Giana H. Davidson, MD, MPH

**Hometown**

Silverton, OR

**Medical School**

University of California, San Diego

**Research Interests**Surgeon–Patient Relationships,  
Health Disparities, Surgical Ethics**DO YOU TRUST ME? FACTORS ASSOCIATED WITH LOW TRUST IN PATIENTS WITH SURGICAL DISEASE**

Stadeli K, Khor S, Brewer E, Lavallee D, Doll K,

Cizik A, Flum D, Pellegrini C, Davidson G

**Background:** Trust in the medical profession is associated with adherence to treatment recommendations, satisfaction with care, and improved outcomes.<sup>1,2</sup> However, trust has not been well described in surgical populations and the episodic nature of patient encounters with surgeons may make establishing trust even more difficult. Prior work suggests there are patient, physician, system, and process level factors that influence trust, some of which may be modifiable.<sup>3,4,5</sup> We hypothesize that trust in the medical profession varies widely across surgical patients, and the extent to which patient factors account for this variability is unknown. We aimed to describe and quantify associations between patient level factors and trust.

**Methods:** Surveys were completed by patients enrolled in two prospective observational cohort studies of treatment effectiveness (spine fusion surgery and diverticulitis management) at 14 centers in Washington and California from April 2016 to September 2017. Univariate and multivariate analysis were utilized to assess associations between level of patient trust in the medical profession (validated tool with low score 5 to high score 25)<sup>6</sup> and 15 patient characteristics; these included sociodemographics, insurance status, fear of medical bills, health literacy<sup>7</sup>, caregiver status, type of work, emotional support,<sup>8</sup> and instrumental support.<sup>9</sup> For the univariate analysis, total trust scores derived from the five item tool was divided into tertiles (lower (range 10 to 16), moderate (17 to 19), and higher (20 to 25)).

**Results:** 248 participants (mean age 56.7 years, 50% female) completed surveys. There was wide variation in trust (mean 17.7, range 10–25) with 98% of participants completing the trust survey questions. When comparing across tertiles, participants in the lower trust tertile have younger mean age (lower 55.8, moderate 62.7, higher 62.5 [ $p=.001$ ]), higher proportion with reported fear of medical bills (55%, 43%, 27% [ $p=.002$ ]), and lower mean emotional support score (50.8, 55.6, 62.0 [ $p=.001$ ]). After adjustment ( $n = 216$ ), younger age (linear regression coefficient [ $b$ ] = 0 .04,  $p = 0.01$ ), proportion with reported fear of medical bills ( $b = -1.37$ ,  $p = 0.004$ ) and less emotional support ( $b = 0.10$ ,  $p = 0.001$ ) were associated with lower trust. We were not powered to evaluate the association of race/ethnicity with low trust in this (87.6% white) surgical population. Overall, patient factors accounted for just 19% of the variability in trust scores ( $R^2 = 0.19$ ), suggesting clinician or system actors may also be involved. Of note, sex, level of education, household income, type of insurance, employment status, health literacy, and instrumental support were not significantly associated with level of patient trust in the medical profession.

**Conclusions:** We found a wide range of trust among those undergoing or considering surgical procedures for diverticulitis or spinal disease and associations between lower trust, younger age, fear of medical bills, and lower emotional support. Since patient factors account for only a small portion of the observed variation, future work should focus on modifiable surgeon, system, and process-level factors that may improve patient trust in this population.

**References:**

1. Haywood, C., Lanzkron, S., Bediako, S., Strouse, J. J., Haythornthwaite, J., Carroll, C. P. IMPORT Investigators. (2014). Perceived discrimination, patient trust, and adherence to medical recommendations among persons with sickle cell disease. *Journal of General Internal Medicine*, 29(12), 1657–62. <https://doi.org/10.1007/s11606-014-2986-7>
2. Hall, M. A., Camacho, F., & Dugan, E. (2002). Trust in the Medical Profession : Conceptual and Measurement Issues, 1419–1439.
3. Keating, N. L., Gandhi, T. K., Orav, E. J., Bates, D. W., & Ayanian, J. Z. (2004). Patient Characteristics and Experiences Associated With Trust in Specialist Physicians. *Archives of Internal Medicine*, 164(9), 1015. <https://doi.org/10.1001/archinte.164.9.1015>
4. Rolfe, A., Cash-Gibson, L., Car, J., Sheikh, A., & McKinstry, B. (n.d.). Interventions for improving patients' trust in doctors and groups of doctors. <https://doi.org/10.1002/14651858.CD004134.PUB3>
5. Safran, D. G., Montgomery, J. E., Chang, H., Murphy, J., & Rogers, W. H. (2001). Switching doctors: predictors of voluntary disenrollment from a primary physician's practice. *The Journal of Family Practice*, 50(2), 130–6. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/11219560>
6. Dugan, E., Trachtenberg, F., & Hall, M. A. (2005). Development of abbreviated measures to assess patient trust in a physician, a health insurer, and the medical profession, 7, 1–7. <https://doi.org/10.1186/1472-6963-5-64>
7. Morris, N. S., MacLean, C. D., Chew, L. D., & Littenberg, B. (2006). The Single Item Literacy Screener: evaluation of a brief instrument to identify limited reading ability. *BMC Family Practice*, 7(1), 21. <https://doi.org/10.1186/1471-2296-7-21>
8. Patient-Reported Outcomes Measurement Information System. (2015). EMOTIONAL SUPPORT: A brief guide to the PROMIS Emotional Support Instruments. Retrieved from <https://www.assessmentcenter.net/documents/PROMIS Emotional Support Scoring Manual.pdf>
9. Patient-Reported Outcomes Measurement Information System. (2015). INSTRUMENTAL SUPPORT: A brief guide to the PROMIS Instrumental Support Instruments. Retrieved from <https://www.assessmentcenter.net/documents/PROMIS Instrumental Support Scoring Manual.pdf>

## VISUAL REPRESENTATION OF RACIAL DIVERSITY IN AESTHETIC PLASTIC SURGERY LITERATURE

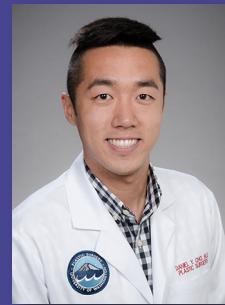
Cho DY, Kneib CJ, Morrison SD, Sousa JD

**Background:** Aesthetic surgery research relies heavily of visual images and graphics to document results and demonstrate technique. The purpose of this study was to determine if images and graphics in aesthetic surgery literature accurately reflect the distribution of racial skin tone in the United States. We also sought to determine if particular fields of aesthetic surgery differed in the representation of racial diversity.

**Methods:** Articles from the Aesthetic Surgery Journal (ASJ) were reviewed for 1996, 2000, 2010, 2016, which include the most recent complete year as well as the first year of publication and each decade in between. Three multi-disciplinary plastic surgery journals (Annals of Plastic Surgery [APS], Journal of Plastic, Reconstructive, and Aesthetic Surgery [JPRAS], Plastic and Reconstructive Surgery [PRS]) were selected and reviewed for 2016 for comparison amongst the journals. All articles published in the selected years were evaluated. The Fitzpatrick scale was used as a guide to determine whether the subject of each figure had white skin tone or not. The country of origin was determined using the corresponding author's academic affiliation. Results were compared to the US Census Bureau Population Estimates Program Data from 2015 and the American Society of Plastic Surgeons (ASPS) 2016 Plastic Surgery Statistics Report.

**Results:** The 2015 US Census Bureau estimates the population to be 76% white and 24% non-white, while the ASPS reports that 70% of cosmetic procedures performed in 2016 were on Caucasian patients and 30% were in non-Caucasians. A review of the published photographs in the ASJ revealed an increase in non-Caucasian subjects between 1996–2016 (1996, 2000, 2010, 2016: 5.4%, 6.2%, 25.6%, 23.2%), which corresponds to an increase in publications by international groups (11.5%, 3.5%, 49.1%, 48.6%). This was most notable in 2010 and 2016 with 47.3% and 36.5% of international publications representing non-Caucasian subjects compared to 9.8% and 13.4% in US publications. Facial aesthetic papers showed the most profound increase in diversity with 0%, 10.5%, 35.3%, and 45.5% (1996, 2000, 2010, 2016) non-Caucasian photographs while breast surgery was the least diverse with 0%, 0%, 7.6%, and 1.2%. Compared to aesthetic papers in other journals in 2016, ASJ (23.2%) was the most diverse followed by JPRAS (13.7%) while APS (8.2%) and PRS (5.5%) had relatively little diversity.

**Conclusions:** Aesthetic surgery literature is becoming increasingly diverse; however, US articles alone do not reflect the US population in ASJ, APS, JPRAS, or PRS. The growing diversity is a result of the increased number of publications from international groups, especially in ASJ and JPRAS. This increasing diversity is most notable in facial aesthetics due to a recent increase in publications from Asian groups while breast surgery remains very homogenous. Further analysis is underway to better understand contributing factors to this phenomenon. It is important for plastic surgeons to consider the patient populations represented in the specific techniques reported by each paper and the applicability to their practice. Additionally, plastic surgeons should work to achieve a more diverse representation of patients in plastic surgery literature to more closely represent the populations we serve.



**Daniel Y. Cho, MD, PhD**

Plastic Surgery, R3

**Faculty Mentor**

Janelle A. Sousa, MD

**Hometown**

Paramus, NJ

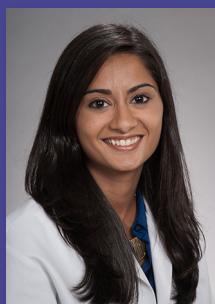
**Medical School**

Brown University

**Research Interests**

Biomaterials,

Tissue Engineering, Drug Delivery

**Sarasijhaa Desikan, MD**

Vascular Surgery, R5

**Faculty Mentor**

Elina Quiroga, MD

**Hometown**

Little Rock, AR

**Medical School**

University of Arkansas

**Research Interests**

Vascular Injury in Lower Extremity

Trauma, Nonatherosclerotic

Peripheral Vascular Disease

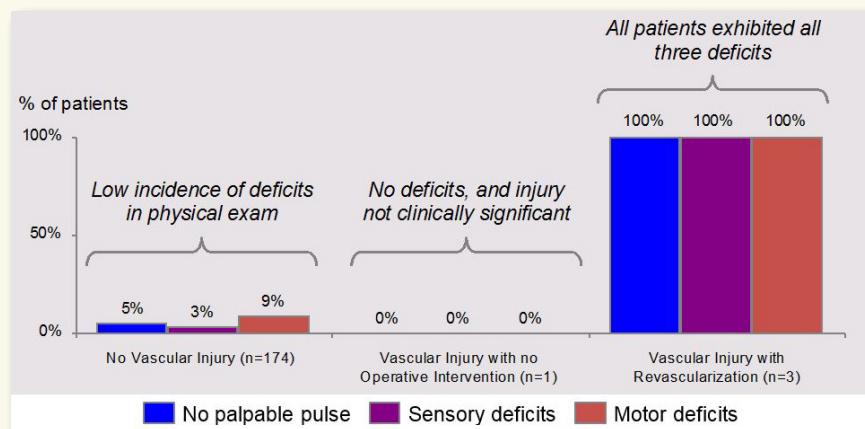
**INCIDENCE AND OUTCOMES OF VASCULAR INJURY IN THE SETTING OF TIBIAL PLATEAU FRACTURES: A SINGLE INSTITUTION REVIEW**

Desikan SK, Hemingway J, Swenson A, Terle M, Tran N, Singh N, Quiroga E

**Background:** Vascular injury in the setting of lower extremity trauma is rare, but carries significant morbidity & risk of limb loss. Currently, there is no algorithm to predict the likelihood of vascular injury based on fracture type or injury characteristics. The purpose of this study was to determine the incidence, clinical risk factors, & outcomes of vascular injury in patients sustaining tibial plateau fractures. Our second objective was to determine if the incidence of vascular injury corresponds with certain fracture patterns.

**Methods:** A retrospective analysis was conducted on consecutive patients presenting with tibial plateau fractures at our institution from Jan-Dec 2014. The trauma database was queried based on ICD-9/10 codes for tibial fractures. A reviewer blinded to the outcomes determined the fracture patterns based on the Schatzker Classification System. Patient demographics, clinical presentation, & outcomes were collected and analyzed.

**Results:** 333 consecutive patients were initially extracted based on our query for tibial fractures. Patients who did not have a tibial plateau fracture were excluded; leaving a total of 178 patients. The mean age was 49 with an equal male to female distribution (52% vs. 48%). The incidence of vascular injury in our cohort was 2% (n=4). Three of these patients underwent successful revascularization. The remaining patient was managed nonoperatively as he had a viable limb in the setting of anterior tibial artery thrombosis.



Physical exam deficits were rare in patients without vascular injury. Conversely, all of the patients requiring revascularization presented with a triad of sensory deficits, motor deficits, and no palpable pulse (Figure). Furthermore, when ABI was recorded, all patients who did not require revascularization had an ABI>0.6. On the other hand, all of the patients who needed revascularization had an ABI<0.6. Vascular injury was seen in patients with Schatzker Type 2,4,6 tibial plateau fractures, while no injuries were seen in patients with Types 1,3,5.

**Conclusions:** There was a 2% incidence of vascular injury in the setting of tibial plateau fractures at our institution. Vascular injuries were not found in patients who presented with palpable pulses and an intact motor and sensory exam. Conversely, patients with all three physical exam deficits had vascular injuries that warranted revascularization. Thus, we believe that a detailed physical exam is often sufficient to exclude clinically significant vascular injury. This may obviate the need for costly imaging in these patients. Vascular injury seems to correlate with certain fracture patterns. Further studies are needed to confirm this finding.

## **SMOOTH MUSCLE CELL TBR2 DELETION IN MICE CAUSES AORTIC HYPERCONTRACTILITY AND IMPAIRED ENDOTHELIAL-DEPENDENT RELAXATION**

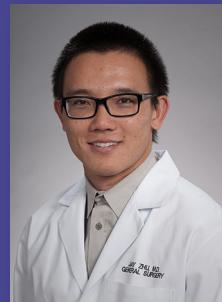
Zhu J, Alp FI, Wei H, Angelov SN, Dichek DA

**Background:** Abnormal smooth muscle cell (SMC) TGF- $\beta$  signaling is thought to play an important role in development of thoracic aortic aneurysms and dissections (TAAD) associated with heritable conditions such as Marfan and Loeys-Dietz Syndromes. However, the mechanisms by which altered SMC TGF- $\beta$  signaling causes TAAD are poorly understood. Mice generated in our lab with deficient SMC TGF- $\beta$  signaling (due to SMC-specific deletion of the type II TGF- $\beta$  receptor) have thicker aortic medias and demonstrate increased aortic contractility. We hypothesize that this hyper-contractile phenotype observed in the aortas of mice with deficient SMC TGF- $\beta$  signaling is the result of impaired endothelial function.

**Methods:** We measured the vasomotor function in ascending aortic segments of mice with normal or deficient SMC TGF- $\beta$  signaling after endothelial denudation using tension myography. We also examined aortic endothelial nitric oxide synthase (eNOS) protein expression and phosphorylation using Western blotting.

**Results:** Endothelial denudation caused the ascending aortic rings from mice with normal SMC TGF- $\beta$  signaling to contract with more force in response to phenylephrine, but had no effect on the ascending aortas of mice with deficient SMC TGF- $\beta$  signaling. Total eNOS levels from aortas of mice with deficient SMC TGF- $\beta$  signaling was unchanged, and we did not find any differences in the phosphorylation of eNOS at Ser1177 (activating) or Thr495 (deactivating).

**Conclusions:** The effect of deficient SMC TGF-beta signaling on aortic contractility depends on the presence of endothelium. Our findings indicate that physiologic SMC TGF- $\beta$  plays a surprising role in mediating endothelial function. This effect does not appear to be associated with changes in eNOS protein expression or phosphorylation.



**Jay Zhu, MD**

*Research Resident*

**Faculty Mentor**

David A. Dichek, MD

UW Department of Medicine

**Hometown**

San Diego, CA

**Medical School**

University of Southern California

**Research Interests**

Surgery, Vascular Biology,

Patient Safety



**Robert A. Tessler, MD**  
Surgical Critical Care Fellow

**Faculty Mentor**  
Frederick P. Rivara, MD, MPH  
UW Department of Pediatrics

**Hometown**  
Scarsdale, NY

**Medical School**  
University of California,  
San Francisco

**Research Interests**  
Violence/Injury Prevention,  
Trauma Systems

## TRANSFER AND NON-TRANSFER PATIENTS IN ISOLATED LOW-GRADE BLUNT PEDIATRIC SOLID ORGAN INJURY: IMPLICATIONS FOR REGIONALIZED TRAUMA SYSTEMS

Tessler RA, Lyons VH, Hagedorn JC, Vavilala MS, Goldin A, Rivara FP

**Background:** Regionalization of trauma care is a national priority and hospitalization for blunt abdominal trauma, that may include transfer, is common among children. The objective of this study was to determine whether there were differences in mortality, treatment, or length of stay between patients treated at or transferred to a higher level trauma center and those not transferred and admitted to a lower level trauma center.

**Methods:** Cohort from Washington state trauma registry from 2000–2014 of patients 16 years or younger with isolated Grade I–III spleen, liver, or kidney injury.

**Results:** Among 54,034 patients 16 years or younger, the trauma registry captured 1,177 (2.2 %) patients with isolated low grade solid organ injuries; 226 (19.2%) presented to a higher level trauma center, 600 (51.0%) presented to a lower level trauma center and stayed there for care, and 351 (29.8%) were transferred to a higher level trauma center. Forty patients (3.4%) underwent an abdominal operation. Among the 950 patients evaluated initially at a lower level trauma center, the risk of surgery did not differ significantly between those who were not transferred compared to those who were (RR 2.19 95%CI 0.80–6.01). The risk of total splenectomy was no different for patients who stayed at a lower level trauma center compared to those who were transferred to a higher level trauma center (RR 0.84 95%CI 0.33–2.16). Non-transferred patients had a 0.63 (95% CI: 0.45–0.88) times lower risk of staying in the hospital for an additional day compared to patients who were transferred to a higher level trauma center. One patient died.

**Conclusions:** Few pediatric patients with isolated low grade blunt solid organ injury require intervention and thus may not need to be transferred; trauma systems should revise their transfer policies. Prevention of unnecessary transfers is an opportunity for cost savings in pediatric trauma.

## INVASIVE MEDIASTINAL STAGING FOR LUNG CANCER— BETTER PREDICTION, BETTER SELECTION

Verdial FC, Madtes D, Hwang B, Mulligan MS,  
Odem-Davis K, Waworuntu R, Wood DE, Farjah F

**Background:** Guidelines recommend selective invasive mediastinal staging for lung cancer. It is unknown how efficient this strategy is in selecting patients with true nodal disease for invasive staging (sensitivity), and avoiding invasive procedures among those without true nodal disease (specificity). We aimed to describe the sensitivity and specificity of national guidelines for invasive staging; develop a prediction model for nodal disease that outperforms guideline recommendations; and test whether a previously described serum marker for nodal metastasis (vascular–endothelial growth factor C [VEGF-C]) improves our model's ability to predict nodal disease.

**Methods:** We conducted a prospective cohort study of adults with suspected or confirmed non–small cell lung cancer (NSCLC) without evidence of metastatic disease by computed tomography or positron emission tomography. Pathologic confirmation of disease within any station was the gold standard for nodal disease. Guideline recommended indications for invasive staging included tumor size > 3cm, central location, lymphadenopathy, or fluorodeoxyglucose uptake by any nodal station. The prediction model included these four variables plus the maximum standardized uptake value of the primary tumor. A likelihood ratio test was used to compare prediction models with and without plasma levels of VEGF-C.

**Results:** Among 123 eligible subjects, 31 (25%) had pathologically confirmed nodal disease. A guideline recommended strategy of selective invasive staging had a sensitivity and specificity of 100% and 35%, respectively. The prediction model for nodal disease fit the data well (goodness-of-fit test  $p=0.55$ ) and had excellent discrimination ( $c$ -statistic 0.82, 95% confidence interval 0.74–0.90). We attempted to select a cut-off for risk-stratification to match the high sensitivity and exceed the low specificity of guideline recommendations—resulting in a sensitivity and specificity of 97% and 55%, respectively. The addition of plasma levels of VEGF-C did not improve our model's ability to predict nodal disease (likelihood ratio test  $p=0.89$ ). Use of our prediction model in this cohort would have failed to select one patient with true nodal disease for invasive staging (this patient had level 7 disease discovered by intraoperative nodal dissection despite a negative endobronchial ultrasound and mediastinoscopy). However, the prediction model would have averted unnecessary invasive staging in 19 out of 91 patients (21%) recommended invasive staging by national guidelines.

**Conclusions:** A guideline recommended strategy for invasive mediastinal staging selects all patients with true nodal disease, but also selects many without true nodal disease. Within a close margin of sensitivity, our prediction model had a higher specificity than a guideline recommended strategy of invasive staging, allowing more efficient application of invasive staging procedures. Plasma levels of VEGF-C do not improve prediction of nodal disease. Improving the specificity of guidelines—while maintaining their high sensitivity—will likely result in fewer invasive procedures without compromising our ability to detect true nodal disease prior to treatment.



**Francys C. Verdial, MD**

Research Resident

**Faculty Mentor**

Farhood Farjah, MD, MPH

**Hometown**

San Pedro Sula, Honduras

**Medical School**

Vanderbilt University

**Research Interests**

Surgical Outcomes, Cancer Care

# PREVIOUS SCHILLING LECTURERS

2017

**Diana L. Farmer, MD**  
Chair and Pearl Stamps  
Stewart Professor  
Department of Surgery  
University of California, Davis  
Surgeon-in-Chief  
UC Davis Children's Hospital

2016

**Melina R. Kibbe, MD, FACS, FAHA**  
Professor and Vice Chair for Research,  
Edward G. Elcock Professor of Surgical Research  
Department of Surgery  
Northwestern University

2015

**Walter J. Pories, MD**  
Professor of Surgery, Biochemistry and Kinesiology  
Brody School of Medicine  
East Carolina University  
North Carolina

2014

**Timothy R. Billiar, MD**  
George Vance Foster Professor & Chair  
Department of Surgery  
University of Pittsburgh

2013

**Anthony Atala, MD**  
Director of the Wake Forest Institute for  
Regenerative Medicine  
The W.H. Boyce Professor & Chair of the Department of  
Urology at Wake Forest University

2012

**Gerald Fried, MD, FRCS(C), FACS**  
Professor of Surgery and Gastroenterology  
Adair Family Chair of Surgical Education  
Montreal General Hospital

2011

**Julie A. Freischlag, MD**  
The William Stewart Halsted Professor  
Chair, Department of Surgery  
Surgeon-in-Chief, The Johns Hopkins Hospital  
Baltimore, MD

2010

**Jeffrey B. Matthews, MD**  
Dallas B. Phemister Professor of Surgery  
Chair, Department of Surgery  
Dean for Clinical Affairs,  
Biological Sciences Division  
The University of Chicago

2009

**Michael W. Mullholland, MD, PhD**  
Frederick A. Coller Distinguished  
Professor of Surgery  
Chair, Department of Surgery,  
University of Michigan School of Medicine

2008

**Timothy J. Eberlein, MD**  
Bixby Professor and Chair  
Department of Surgery  
Washington University School of Medicine

2007

**Shukri F. Khuri, MD, MS (Hon.)**  
Professor of Surgery, Harvard Medical School  
Chief, Cardiothoracic Surgery,  
VA Boston Healthcare System  
Vice Chairman, Department of Surgery,  
Brigham and Women's Hospital

2006

**Richard H. Bell, Jr., MD**  
Professor and Chair of Surgery  
Feinberg School of Medicine  
Northwestern University

2005

**Barbara L. Bass, MD**  
Professor of Surgery  
Maryland University School of Medicine

2004

**Michael T. Longaker, MD**  
Director of Children's Surgical Research in the  
Department of Surgery  
Stanford University School of Medicine

2003

**Michael G. Sarr, MD**  
Professor of Surgery  
Mayo Clinic Rochester

2002

**Ori D. Rotstein, MD**  
Peter A. Crossgrove Chair in General Surgery  
The University of Toronto

2001

**John Mannick, MD**  
Moseley Distinguished Professor of Surgery  
Harvard Medical School, Brigham & Women's Hospital

2000

**Lazar J. Greenfield, MD**  
Frederick A. Coller Professor and Chairman  
Department of Surgery  
The University of Michigan

1998

**Haile T. Debas, MD**  
Chancellor and Dean, School of Medicine  
University of California at San Francisco

1997

**Murray F. Brennan, MD**  
Alfred P. Sloan Chair in Surgery  
Memorial Sloan-Kettering Cancer Center

## NOTES

# NOTES

## NOTES

# UW Medicine

---

## DEPARTMENT OF SURGERY

---

**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.

### Research Day—Schilling Lecture Publication Contributors

Managing Editor:  
Kaitlin Underwood, *Human Resources Coordinator*

Assisting Managing Editor/Layout & Publication:  
Michael Hilleary, *Public Information Specialist*

Photo credits:  
UW Visual Design and Production (portraits)  
Clare McLean/UW Medicine  
(Pages 1–2 background and  
front/back covers backgrounds)

University of Washington  
Box 356410  
Seattle, WA 98195–6410  
206–543–3680  
206–685–6912 FAX  
[surgeditors@uw.edu](mailto:surgeditors@uw.edu)

[WWW.UWSURGERY.ORG](http://WWW.UWSURGERY.ORG)

 [FACEBOOK.COM/UWDOS](https://www.facebook.com/uwdos)

 [TWITTER.COM/UWSURGERY](https://twitter.com/uwsurgery)

 [YOUTUBE.COM/UWDEPTSURGERY](https://www.youtube.com/uwdeptsurgery)

© 2018 University of Washington—Department of Surgery.  
All rights reserved.

**Learn more about Research in  
Department of Surgery**

[bit.ly/2Dv4ISo](http://bit.ly/2Dv4ISo)