2016 DEPARTMENT OF SURGERY RESEARCH DAY & 22ND ANNUAL HELEN & JOHN SCHILLING LECTURE

UW TOWER AUDITORIUM
4333 BROOKLYN AVE NE
SEATTLE, WA 98105

FRIDAY, FEBRUARY 26, 2016

UW Medicine

AGENDA

7:00am Breakfast & Registration

7:30am Introduction: **David R. Flum, MD, MPH**

7:40am **Amir A. Rahnemai-Azar, MD:** Improvements in Post-Liver Transplant Survival in Post-Meld Era

7:55am **Anne P. Ehlers, MD:** Improved Risk Prediction after Colorectal Surgery Using Machine Learning Algorithms

8:10am **Brodie Parent, MD:** Trending Physiologic State Using Metabolomics in Critically-Injured Trauma Patients

8:25am **H. Jonathan Chong, MD:** The Association between Venous Coupler Size and Post-Operative Complications in Microsurgical Breast Reconstruction

8:40am **Cameron E. Gaskill, MD:** Is Computed Tomography Effective in Determining Perforation in Patients with Appendicitis?

8:55am **Poster Session 1 (Visitors' Dining Room)**

- 8:55am **Shani Belgrave, MD:** Short Term Outcomes in Progrip vs. Parietex Mesh in Laparoscopic Inguinal Hernia Repair
- 9:00am **Elisha G. Brownson, MD:** Combining Store-and-Forward Pictures and Videoconferencing for Outpatient Burn Follow-up Care
- 9:05am **Elissa K. Butler, MD:** Optimizing Surgical Care Delivery in Uganda: Understanding the Abdominal Disease Burden
- 9:10am **Katherine Flynn-O'Brien, MD, MPH:** Leveraging Existing Data System Investments to Improve Quality Care for Critically Injured Children
- 9:15am **Sarah R. Goldsberry-Long, MD, MS:** Assessing the Safety of Combined Breast Reconstruction and Gynecologic Surgery

9:30am Faculty presentation: **Eileen M. Bulger, MD**

9:45am **Chris R. Burke, MD:** The Use of Extracorporeal Life Support in Drowning Victims

10:00am **Cordelie E. Witt, MD:** Effect of Body Mass Index on Risk of Complications After Pediatric Appendectomy

10:15am **Callie M. Thompson, MD:** Patient Reported Outcomes & Return to Work in Individuals with Pre-Burn Injury Drug or Alcohol Abuse

10:30am **Kevin M. Riggle, MD:** Neurotensin Enhances Cell Proliferation in Fibrolamellar Hepatocellular Carcinoma

10:45am **Poster Session 2 (Visitors' Dining Room)**

- 10:45am **Tatiana Hoyos Gomez, MD:** Donor Age Still Matters in Liver Transplantation: Results from the UNOS-SRTR Database
- 10:50am **Angelo B. Lipira, MD, MA:** A Radiographic Analysis of Extraocular Muscle Volume Changes in Orbital Floor Fractures
- 10:55am **Daiva Nevidomskyte, MD:** Influence of Gender on Abdominal Aortic Aneurysm Repair in the Community
- 11:00am **Eugene Oh, MD, PhD:** Crowdsourcing as a Novel Method for the Evaluation of Postoperative Outcomes in Unilateral Cleft Lip Repair
- 11:05am **H. Alejandro Rodriguez, MD:** High Variability in Outcome Reporting in the Treatment of Achalasia

11:15am Faculty presentation: **Giana H. Davidson, MD, MPH**

11:30am **Lucas Thornblade, MD:** Preoperative Immunonutrition and Elective Colorectal Resection Outcomes – A Propensity Score Matched Analysis

11:45am **Max E. Seaton, MD:** Melanocortin-1 Receptor Polymorphism R163Q is Protective Against Complicated Sepsis After Trauma

12:00pm **Mitchell A. Pet, MD:** Speech and Surgical Outcomes in International Adoptees with Cleft Palate

12:15pm **Morgan K. Richards, MD, MPH:** Establishing Equipoise: National Survey of the Treatment of Pediatric Para-pneumonic Effusion and Empyema

12:30pm **Poster Session 3 (Visitors' Dining Room) and Lunch (Cafeteria)**

- 12:30pm **Lauren A. Jacobson:** Firework-Related Injuries: Patterns, Outcomes, and Risk Factors
- 12:35pm **Patrick C. Sanger, PhD:** Diagnosing Surgical Site Infection Using Wound Photography: A Scenario-Based Study
- 12:40pm **Vlad V. Simianu, MD, MPH:** The Reliability of a Standardized Reporting System for the Diagnosis of Appendicitis
- 12:45pm **Ravi F. Sood, MD, MS:** Respiratory Complications Following Abdominal Wall Reconstruction: Analysis of the Nationwide Inpatient Sample Database
- 12:50pm **Laura K. Tom, MD:** Implant-Associated Complications of the Staged Autologous Breast Reconstruction Pathway: A Single Center's Experience

1:30pm Faculty presentation: **Jason W. Smith, MD**

1:45pm **Galit Ankri-Eliahoo, PhD:** Reduced Expression of p27kip1 Affects Collateralization and Angiogenesis

2:00pm **Sara K. Daniel, MD:** Smooth Muscle Actin Expression by Myofibroblasts in Pancreatic Cancer Correlates with Density of Immune Infiltrate and Tumor Hypoxia following Neoadjuvant Therapy

2:15pm **Sarasi K. Desikan, MD:** The Incidence of Ischemic Colitis after Repair of Ruptured Abdominal Aortic Aneurysms is Decreasing in the Endovascular Era

2:30pm Closing: **Douglas E. Wood, MD, FACS, FRCSEd** *(ad hom)*

3:00pm **22nd Annual Schilling Lecture – Melina Kibbe, MD, FACS, FAHA: "Sex Bias in Surgical Biomedical and Clinical Research"**

4:00pm Reception

INTRODUCTION

Douglas E. Wood, MD, FACS, FRCSEd (ad hom)
Professor and Interim Chair

Welcome to the Department of Surgery Annual Research Symposium and Schilling Lecture! This year we celebrate the 22nd anniversary of the Schilling Lecture, an event made possible by a generous gift from the late Helen Schilling in honor of her husband, Dr. John Schilling. The Schillings shared a deep commitment to teaching, scholarship and research and the Department of Surgery continues to proudly carry on this commitment through research–related events such as this.

This year, we are honored to host as our Schilling Lecturer Dr. Melina Kibbe, Edward G. Elcock Professor of Surgical Research and Vice Chair for Research in the Department of Surgery at Northwestern University, and Editor–in–Chief of *JAMA Surgery*. Dr. Kibbe's research focuses on nitric oxide vascular biology and developing novel and innovative nitric oxide–based therapies for patients with vascular disease. Today, Dr. Kibbe will help adjudicate the symposium then give the annual Schilling Lecture, titled "Sex Bias in Surgical Biomedical and Clinical Research" in which she will discuss gender–related differences that exist within disease processes and in the development and evaluation of drugs, devices, and medical therapies. She will also offer insights and solutions to promote greater inclusivity in biomedical and clinical research.

The purpose of the Schilling Research Symposium is multi–faceted: it is a forum for bringing together faculty, residents, fellows, students, and friends to share and discuss 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. Finally, 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. Discussants will open each Q&A session by giving context to the presentation and asking each speaker a probing question that is designed to help teach Q&A preparedness. Tonight, we will honor all participants and their mentors, and present cash prizes to the top poster and oral presenters.

We are pleased that you are joining us today as we recognize the hard work of our residents, fellows, and their faculty mentors, and continue the Schilling tradition of celebrating research. We hope that you will find today's event both informative and engaging!

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

Sincerely,

Douglas E. Wood, MD, FACS, FRCSEd (ad hom)
Professor and Interim Chair, Department of Surgery
Chief, Division of Cardiothoracic Surgery
Endowed Chair in Lung Cancer Research
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

MELINA R. KIBBE, MD, FACS, FAHA

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

Melina R. Kibbe, MD, is Professor of Surgery with tenure, the Edward G. Elcock Professor of Surgical Research, and Vice Chair of Research in the Department of Surgery at Northwestern University; co–Chief of the Vascular Surgery service at the Jesse Brown VA Medical Center at JBVAMC. Dr. Kibbe also serves as Deputy Director for the Simpson Querrey Institute for BioNanotechnology at Northwestern University. She has significant experience with both open and endovascular surgery, including the treatment of carotid stenosis, peripheral vascular disease, and abdominal aortic aneurysms. She is board certified in general and vascular surgery and is RVT and RPVI certified by ARDMS. Dr. Kibbe completed a fellowship in The Hedwig van Ameringen Executive Leadership in Academic Medicine (ELAM) Program for Women at Drexel University College of Medicine in 2012.

Dr. Kibbe's research interests focus on developing novel therapies for patients with vascular disease while simultaneously studying the mechanism of how these therapies impact the vascular wall. She is currently PI on 3 NIH R01 awards, 1 NIH T32 award, and 1 VA Merit award, in addition to serving as co–Investigator on several other awards. Currently funded projects include developing a novel biodegradable drug–eluting liquid cast stent, developing a new methodology to treat atherosclerosis by reducing plaque burden, investigating the role of resident adventitial progenitor cells in the vasculature, developing and evaluating an endothelial progenitor cell–derived bioengineered ePTFE graft, developing highly innovative, targeted therapeutics to prevent restenosis following cardiovascular interventions, and evaluating the efficacy of nitric oxide–based therapies in diabetic environments. She holds 7 patents or provisional patents. Her research was recognized by President Obama with the Presidential Early Career Award for Scientists and Engineers in 2009.

Nationally, she is actively involved in several societies and has assumed leadership positions. She is past–president for the Association for Academic Surgery, president for the Midwestern Vascular Surgical Society, and president–elect for the Association of VA Surgeons. She is also an active member in the American College of Surgeons, the American Surgical Association, the Society for Vascular Surgery, and the American Heart Association, among others. She is the Editor–in–Chief for JAMA Surgery, and serves as an Associate Editor of the Journal of Surgical Research. She is a member of the editorial boards for Surgery and Annals of Surgery.

More recently, Dr. Kibbe has been a strong advocate for sex inclusion in biomedical research. She was interviewed by Leslie Stahl for 60 Minutes in February 2014 on this topic, and later appeared on the Colbert Report. Her publication in the journal *Surgery* on the presence of sex bias in surgical research gained much media attention nationally and internationally, and resulted in discussions with the National Institutes of Health, the Government Accountability Organization (GAO), and the FDA about policy change.

Her bibliography includes over 190 peer–reviewed manuscripts, review articles, and book chapters, with an emphasis on nitric oxide vascular biology and nitric oxide–based therapies. She has authored or co–authored over 190 nationally and internationally presented abstracts. She has received numerous awards, including the Society of Vascular Surgery Lifeline Research Award, 2010 Women's Leadership Award, the Society of Gene Therapy Young Investigator Award, the Association of Women Surgeons Outstanding Woman Surgeon 2002 Resident Award, and an AMWA Gender Equity Award. She was also inducted into Alpha Omega Alpha Medical Honor Society, in 1994. She has received 16 awards for teaching excellence from Northwestern University as a faculty member.

She co–founded and is the Chief Medical Officer for VesselTek BioMedical, LLC, a company that specializes in the development of medical devices to treat vascular disease.

Dr. Kibbe graduated from the University of Chicago Pritzker School of Medicine in 1994. She completed her internship, residency, and research fellowship at the University of Pittsburgh Medical Center in 2002, and her vascular surgery fellowship at Northwestern University Feinberg School of Medicine in 2003.

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 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 have gone on to become chairmen. 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 chairman, 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 association through the years in Oklahoma and Washington. They were married in 1979. She 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

Melina R. Kibbe, MD, FACS, FAHA
Professor and Vice Chair for Research

Department of Surgery Research Leadership

Douglas E. Wood, MD, FACS, FRCSEd (ad hom)
Professor and Interim Chair, Department of Surgery

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

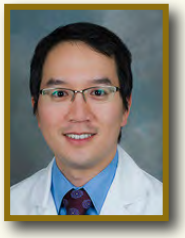
Research Leadership Committee

Saman Arbabi, MD, MPH
Professor

Eileen Bulger, MD
Professor

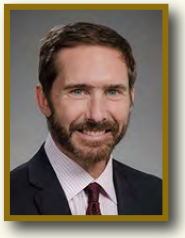
Joseph Cuschieri, MD
Professor

Nicole Gibran, MD
Professor



Jason Ko, MD
Assistant Professor

Ronald Maier, MD
Professor, Division Chief

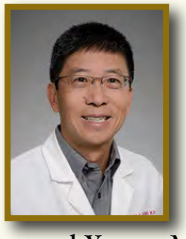


Michael Mulligan, MD
Professor

Grant O'Keefe, MD, MPH
Professor

Kimberly Riehle, MD
Assistant Professor

Robert Sawin, MD
Professor, Division Chief



Raymond Yeung, MD
Professor

FEATURED DEPARTMENT OF SURGERY FACULTY

Eileen M. Bulger, MD
Professor, Division of Trauma, Burn and Critical Care

Dr. Bulger is a Professor of Surgery and the Chief of Trauma at Harborview Medical Center. Her research interests include pre-hospital care after injury, hypertonic resuscitation, modulation of inflammation following hemorrhagic shock, the biomechanics of injury following motor vehicle crashes and necrotizing soft tissue infections. She is funded by both the National Institutes of Health as a Co-Principal Investigator for the Resuscitation Outcomes Consortium (ROC) and the National Highway Transportation and Safety Administration as Principal Investigator for the Crash Injury Research and Engineering Network (CIREN). Dr. Bulger was recently awarded $815,240 by Atox Bio, Inc for the "AB103 Clinical Composite Endpoint Study in Necrotizing Soft Tissue Infections" (ACCUTE Trial), which is a phase III randomized controlled trial of an investigational immune modulator for patients with necrotizing soft tissue infections.

Giana H. Davidson, MD, MPH
Assistant Professor, Division of General Surgery

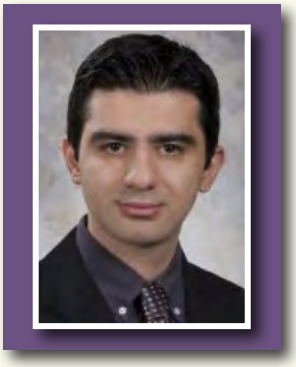
Dr. Davidson's research focus is on improving the health of acute care surgical patients. She leads a multi-disciplinary collaborative, Improving Nursing Facility Outcomes using Real-Time Metrics (INFORM) which evaluates important patient-centered care metrics during transitions of care and at Skilled Nursing Facilities to understand variability in patient-centered outcomes including adverse events, readmission, and successful discharge home. Dr. Davidson is a Co-Investigator and director of the Clinical Coordinating Center of the PCORI-sponsored project "Comparison of Outcomes of Drugs and Appendectomy (CODA)," a large-scale randomized controlled trial comparing appendectomy to antibiotics-first for the treatment of uncomplicated appendicitis. CODA focuses on both clinical outcomes and important patient-reported outcomes (PROs). She is the Clinical Director and Co-Investigator of the NIH R01 "Diverticulitis Evaluation of Burden, Utilization, and Trajectory" (DEBUT) trial. During her surgical residency in UW Department of Surgery Dr. Davidson completed a two-year research fellowship in the Pediatric Injury Research T32 program at the Harborview Injury Prevention and Research Center under Principal Investigator Frederick Rivara, MD, MPH.

Jason W. Smith, MD
Assistant Professor, Division of Cardiothoracic Surgery

Dr. Smith's research interests focus on emerging valve technology, including new ventricular assist device technology and transcatheter valves; heart transplant organ preservation and utilization strategies; and artificial heart pumps. Recently, Dr. Smith has been instrumental in bringing the Transmedic EXPAND trial to the University of Washington, an international trial to "Evaluate the Safety and Effectiveness of The Portable Organ Care System (OCS™) Heart for Preserving and Assessing Expanded Criteria Donor Hearts for Transplantation." This "heart-in-a-box" system allows a donor heart to receive warm, oxygenated and nutrient-enriched blood during transport. The system has the potential to greatly benefit patients within the large WWAMI region by allowing Dr. Smith and his team to procure hearts that would otherwise be too far away.

ORAL & POSTER ABSTRACTS

IN PRESENTATION ORDER



Amir A. Rahnemai-Azar, MD
Transplant Fellow

Faculty Mentor
Martin I. Montenovo, MD

Hometown: Tabriz, Iran
Medical School: Shahid Beheshti University of Medical Sciences, Iran
Research Interests: Liver transplant, hepatobiliary and pancreatic surgery, stem cell

IMPROVEMENTS IN POST-LIVER TRANSPLANT SURVIVAL IN POST-MELD ERA

Rahnemai-Azar AA, Kato T, Morrison SD, Sibulesky L,
Bakthavatsalam R, Rayhill SC, Reyes JD, Montenovo MI

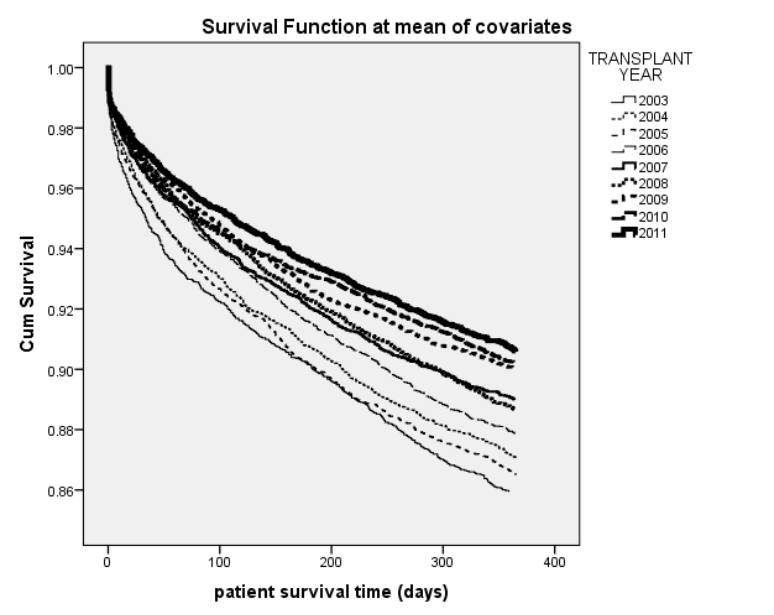
Background: With the ever-increasing divergence between the availability of donor organs and the need for liver transplantation, improving patient survival of liver transplant patients has become the main focus of many investigators. In this study, we investigated the survival of liver transplant recipients since the introduction of the MELD system.

Method: The UNOS data of 51,547 adult liver transplants between 2003 and 2011 were analyzed. Kaplan-Meier method was used to calculate patient survival. Multivariate logistic regression analysis was used to investigate independent factors affecting patient survival.

Results: Mean age was 53.1; 67% were male. One-year patient survival improved every year during this period (P<.000001) (Figure 1). This improvement happened despite significantly more patients were transplanted with higher MELD score (average lab-MELD increased from 20.3 in 2003 vs. 22.6 in 2011). Multivariate logistic regression demonstrated that year of transplantation, patients on life support, re-transplant, in hospital stay, age >60, HCV+, MELD score >30, portal vein thrombosis and previous abdominal surgery to be significant risk factors for patient survival (P<.000001).

Conclusions: Post-liver transplant patient survival improved despite more patients being transplanted with higher MELD score. The explanation of this effect cannot be explained by our analysis but might be explained by better intra and post-operative management of this challenging patient population.

Figure 1. One year patient survival after liver transplantation from 2003 until 2011.



Anne P. Ehlers, MD
Research Resident

Faculty Mentor
David R. Flum, MD, MPH

Hometown: Seattle, WA
Medical School: University of Washington
Research Interests: Comparative effectiveness research

IMPROVED RISK PREDICTION AFTER COLORECTAL SURGERY USING MACHINE LEARNING ALGORITHMS

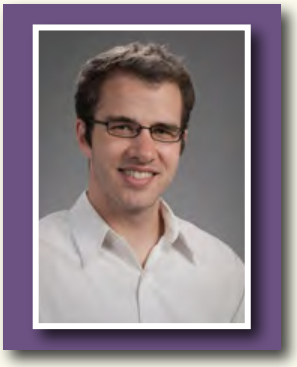
Ehlers AP, Maria M, Basu Roy S, Khor S, Alfonso R, Flum DR

Background: Individualizing risk prediction for adverse events (AE) following surgery may improve quality by targeting resource burden interventions towards high risk patients. Currently available comorbidity indices and risk calculators are limited in that they aggregate conditions without consideration to the patient's unique healthcare utilization (HCU) pattern. Information about the timing, sequence, and intensity of HCU events may better predict outcomes and would therefore be important to include in a risk prediction tool. We sought to build a risk prediction model that would better quantify the risk of an AE following surgery based on a patient's HCU in the six months prior to surgery.

Methods: Patients enrolled in the MarketScan® Commercial Claims and Encounters Database undergoing colorectal surgery from 2007 to 2012 with one or more chronic conditions were included. We considered each claim based on the associated primary condition and translated all claims and HCU types (outpatient, emergency room, acute hospitalization) into a unique sequence that could be used as a predictor. Sociodemographic factors, average length of stay, and insurance were included as well. Multiple supervised machine learning algorithms predicted the likelihood of an AE. We designed a Naïve Bayes statistical classification algorithm, as well as an Adaptive Boosting algorithm. The dataset was randomly partitioned into ten equal sized samples and the algorithms ran in ten iterations. In each iteration, nine–tenth of the samples were used for training and one–tenth for testing, such that no patient was used for both training and testing in the same iteration. We evaluated the model's performance individually, and against a commonly used risk prediction score (Charlson comorbidity index) to assess performance.

Results: 41,835 patients with at least one chronic condition were included (mean age 52, 53% female). Approximately one–third (35%) had an AE following surgery. The Charlson comorbidity index predicted AE's less than half of the time (AUC 0.48). The machine learning algorithms significantly outperformed Charlson in both cases. The Naïve Bayes model had a sensitivity of 76% and a specificity of 66%. The area under the curve (AUC) was 79%, indicating that it accurately predicted four out of every five AE's. Model performance was similar in the Adaptive Boosting algorithm (sensitivity 69%, specificity 78%, AUC 79%). At these rates, in a population of 1000 with 350 AE's, the Charlson comorbidity index would only predict 168 of these, while our proposed model would predict 277.

Conclusions: We present a novel method to predict AE among a commercially insured population undergoing colorectal surgery. Our proposed model significantly outperformed the Charlson comorbidity index, and had similar performance to the American College of Surgeons National Surgical Quality Improvement Program surgical risk calculator (used in prior studies). Precisely quantifying the risk of an AE following surgery may better inform patient–centered decision–making and direct targeted quality improvement interventions in the peri–operative setting. It may also allow more equitable distribution of reimbursement from payers, while supporting accountable care organizations that rely on accurate estimates of population risk. Future work will apply these algorithms to non–colorectal surgery patients to provide more generalizable risk estimates.



Brodie Parent, MD
Research Resident

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

Hometown: Scottsdale, AZ
Medical School: University of Pittsburgh
Research Interests: Metabolomics, nutrition, trauma, reconstructive surgery

TRENDING PHYSIOLOGIC STATE USING METABOLOMICS IN CRITICALLY–INJURED TRAUMA PATIENTS

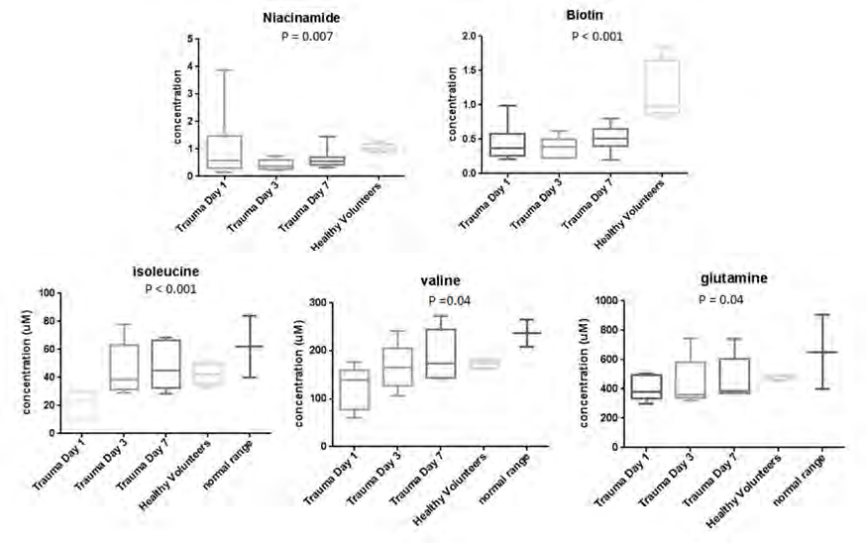
Parent B, Seaton ME, Raftery D, Gu H, Djukovic D, Sood RF, O'Keefe GE

Background: Metabolomics is the study of metabolites within an organism and provides a summary of physiologic state. Use of metabolomics in the clinical setting may help achieve 'precision medicine,' where diagnosis and treatment are tailored to the individual patient. We hypothesized that metabolomics a) can distinguish healthy volunteers from trauma patients and b) can quantify changes in catabolic metabolites over time after injury.

Methods: Blunt trauma subjects were enrolled in this prospective cohort study during 8 months in 2014–2015. Enrolled subjects were admitted to our level–one trauma center within twelve hours of injury, with systolic blood pressure <90mmHg, or base deficit >6. Non–hospitalized volunteers were also enrolled as a comparison group. Plasma samples were obtained on days 1, 3 and 7, and analyzed using mass spectrometry. Principal component analyses and multiple linear regression were used to select biomarkers of interest. Primary hypotheses were tested via a metabolome–wide comparison between trauma subjects and volunteers. Specific biomarkers of interest were oxidative catabolites.

Results: Ten blunt trauma patients and five volunteers were enrolled. Total plasma samples=35. Trauma subjects had median age of 33 and a median injury severity score of 42. Compared to healthy volunteers, trauma subjects showed oxidative stress (decreased niacinamide, biotin; p values <0.05, Figure 1a), and an impaired tricarboxylic acid cycle (decreased alpha–ketoglutarate, succinate; p–values <0.05). Over subsequent days, trauma subjects showed increasing muscle catabolism (elevated isoleucine, valine, glutamine; p–values <0.05, Figure 1b), and only partial reversal of oxidative stress.

Figure 1. Relative to healthy volunteers, the cohort of blunt trauma patients initially demonstrated a) decreased oxidative substrates (niacinamide, biotin), and b) decreased circulating plasma amino acids, with a gradual rise over time, as indicated by mass–spectometry based metabolomics.*



*Box and whisper plots display median, interquartile range, maximum and minimum values.

Conclusions: Metabolomics can function as a serial, comprehensive and personalized tool to characterize metabolism in trauma subjects as they recover from injury. A targeted metabolomics approach demonstrated ongoing oxidative stress, impaired tricarboxylic acid cycling, and initial suppression of protein metabolism followed by increased nitrogen turnover. This technique may provide new therapeutic and nutrition targets in critically–injured patients.

H. Jonathan Chong, MD
Plastic Surgery, Chief Resident

Faculty Mentor
Alexander J. Gougoutas, MD

Hometown: Sunnyvale, CA
Medical School: University of California, San Francisco
Research Interests: Microsurgery and complex reconstruction

THE ASSOCIATION BETWEEN VENOUS COUPLER SIZE AND POST-OPERATIVE COMPLICATIONS IN MICROSURGICAL BREAST RECONSTRUCTION

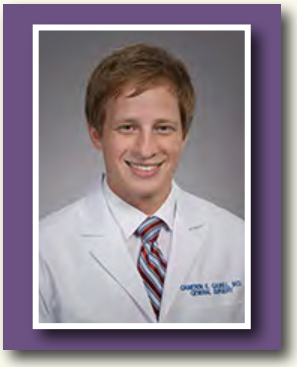
Chong HJ, Sood RF, Chung S, Louie O, Colohan SM, Said HK, Neligan PC, Gougoutas AJ

Background: Multiple studies have reported on the safety and improved operative efficiency when microvascular anastomotic couplers are used in free flap breast reconstruction. However, data remains limited and contradictory as to whether the use of smaller diameter couplers has any impact on the development of post-operative complications and ultimate flap survival. This study seeks to clarify whether there is any association between venous coupler size and the development of post-operative complications in free flap breast reconstruction.

Methods: We conducted a retrospective cohort study of all patients undergoing unilateral deep inferior epigastric artery perforator (DIEP) free flap breast reconstruction from March 2010 through March 2013 at UWMC. During the study period, all venous anastamoses were completed using the microanastomotic Flow Coupler produced by Synovis Life Technologies, Inc. All arterial anastomoses were hand-sewn. The primary exposure was venous coupler size. The primary outcome was the development of any flap-related complication. A secondary outcome of interest was the development of any flap-related complication that resulted in an unplanned return to the operating room. Statistical analysis of flap-related outcomes was based on Poisson regression with robust standard errors. Multivariate analyses were adjusted for the following covariates: age, BMI, diabetes, hypertension, smoking, radiation, and operative length.

Results: We enrolled 132 patients (mean age 51.9 ± 9.0 years, mean BMI 28.0 ± 4.9), with 66 (50%) completing unilateral right-sided breast reconstruction and the other 66 (50%) completing unilateral left-sided breast reconstruction. Of these 132 free flaps, 27 (20.4%) were completed using a 2.0 mm venous coupler, 58 (43.9%) with a 2.5 mm coupler, and 47 (35.6%) with a 3.0 mm coupler. On average, venous coupler size was slightly larger in right-sided reconstructions (2.75 ± 0.31 mm) compared to left-sided reconstructions (2.40 ± 0.34 mm). Across all patients, 36 (27.3%) experienced at least one flap-related complication. These included 5 cases of total flap loss and 1 case of partial flap loss. There were also 4 instances of superficial skin necrosis and 28 cases of documented fat necrosis. Within this study population, 17 (12.9%) patients required an unanticipated return to the operating room for reasons of hematoma, vascular compromise, or both. Larger venous coupler size was significantly associated with a decreased risk of developing post-operative complications. Specifically, a 0.5 mm increase in coupler size was associated with 0.65 times the risk of developing a flap-related complication (95% CI: 0.45–0.94; $p = 0.021$). This association remained significant after adjusting for potential confounders (RR: 0.63; 95% CI: 0.43–0.91; $p = 0.015$). Similarly, a 0.5 mm increase in coupler size was associated with 0.54 times the risk of a flap-related complication resulting in an unplanned return to the operating room (95% CI: 0.31–0.98; $p = 0.044$), and this association was even stronger after adjusting for potential confounders (RR: 0.44; 95% CI: 0.26–0.75; $p = 0.002$).

Conclusions: The use of larger diameter microvascular anastomic venous couplers in free flap breast reconstruction is associated with a decreased risk of post-operative complications, including complications resulting in operative take-back.



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IS COMPUTED TOMOGRAPHY EFFECTIVE IN DETERMING PERFORATION IN PATIENTS WITH APPENDICITIS?

Gaskill CE, Simianu V, Carnell J, Bhargava P, Flum DR, Davidson GH

Background: For the past 130 years, appendectomy has been the standard of care for acute appendicitis. Six randomized trials have now demonstrated that antibiotics can treat appendicitis, however 1 in 4 of these patients eventually require appendectomy. Treatment success is likely limited by presence of perforated or otherwise complicated appendicitis. Future patient selection for antibiotics therapy may depend on imaging to confirm that there is no perforation of the appendix, however the effectiveness of computed tomography (CT) in differentiating perforated from non–perforated appendicitis remains to be determined. The purpose of this study was to assess the diagnostic accuracy of CT differentiating appendiceal perforation in patients imaged with concern for appendicitis.

Methods: We performed a retrospective review of pathology and radiology records from consecutive patients who presented to the emergency room with suspicion for acute appendicitis between January 2012 and May 2015. CT scans were re–reviewed by abdominal imaging fellowship trained radiologists using standardized criteria, and the radiologists were blinded to pathology findings. Radiologists noted presence or absence of periappendicial gas, abscess, appendicolith, fat stranding, and bowel wall thickening. The overall radiologic impression as well as these specific imaging findings were compared to results of pathology and operative reports. Pathology reports were considered the standard for diagnostic accuracy.

CT Finding	Pathology with Perforation (n = 43)	Pathology without Perforation (n = 46)	Sensitivity	PPV	NPV
Abscess	2 (4.6%)	0	4.6%%	100%	53%
Peri–appendiceal Gas	1 (2.3%)	0	2.3%	100%	52%
Appendicolith	15 (34%)	10 (22%)	35%	60%	56%
Simple Fluid Collection	0	4 (8.6%)	0%	0%	49%
Cecal Thickening	22 (51%)	25 (54%)	51%	46%	50%
Fat Stranding	41 (95%)	42 (91%)	95%	49%	67%
Radiologist Diagnosis of Perforation	3 (7%)	6 (13%)	7%	33%	50%

Results: 89 patients (65% male, average age of 34 years) presenting with right lower quadrant pain, underwent CT imaging and immediate appendectomy. Final pathology reported perforation in 48% (n=43) of cases. Radiologic diagnosis of perforation was reported in 9% (n=8), correctly identifying perforation in 37.5% (n=3) and incorrectly overcalled perforation in 62.5% of non–perforated cases per pathology. Radiology missed 93% (n=40) of perforations. The absence of periappendicieal gas, abscess, appendicolith, fat stranding, and cecal wall thickening on CT was correlated to the unperforated appendicitis in 52%, 53%, 56%, 67%, and 50% of cases, respectively. In addition, operative report of perforation was consistent with the pathology report of perforation in only 28% of cases.

Conclusions: Radiologic accuracy in ruling out perforation in appendicitis is poor. As paradigms change in the treatment of complicated appendicitis, it is unclear what role CT should play in guiding management.

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SHORT TERM OUTCOMES IN PROGRIP VS. PARIETEX MESH IN LAPAROSCOPIC INGUINAL HERNIA REPAIR

Belgrave S, Hinojosa M, Parr Z, Davidson GH, Wright AS

Background: The need for mesh fixation during laparoscopic inguinal hernia repair is controversial. Many surgeons use fixation devices to prevent mesh migration and hernia recurrence despite evidence suggesting that mesh fixation is unnecessary and post-operative pain may be related to the use of tacks. Recently we adopted a self-adhering mesh designed for laparoscopic placement without tack fixation (Laparoscopic Progrip, Medtronic). There have been no known early clinical outcome comparisons between conventional mesh and self-adhering mesh for laparoscopic hernia repair.

Methods: All laparoscopic inguinal hernias performed at a single academic institution by 4 experienced laparoscopic hernia surgeons between 1/1/14 and 9/8/15 were retrospectively analyzed through chart review. Self-adhering mesh was introduced in 8/14 with implementation over the following months. Costs of mesh and tackers were obtained from hospital materials management. Data was analyzed using SPSS.

Results: There were 45 inguinal hernia repairs performed using flat sheet self-adhering mesh, and 46 using conventional polyester mesh in a pre-shaped configuration (anatomic Parietex, Medtronic). Median time from surgery to date of review was 449 days for conventional, compared to 206 for self-adhering. Demographics were similar (age, sex, BMI, type of hernia) between groups (ns). Tacks were used in 3/45 self-adhering (6.7%) and 38/46 conventional (82.6%). In the self-adhering group there were 19 bilateral hernias and 12 recurrent hernias repaired, compared to 14 and 6 in the conventional group, respectively (ns). 2 repairs in each group were performed as TAPP, with the remainder being TEP. Operative time was median 95±34min for self-adhering and 94±37min for conventional (ns). In the self-adhering group there were 3 spermatic cord hematomas, 4 seromas, 2 episodes of urinary retention, 1 scrotal swelling, and 2 patients with pain lasting > 1 month. In the conventional group there were 2 hematomas, 1 scrotal swelling, and 1 urinary retention. 5 patients had pain lasting >1month, with 1 requiring reoperation for a retained cord lipoma. There was 1 early recurrence in a large pantaloon hernia repaired with conventional mesh and no tacking. Unit costs were $419/tacker, $314/self-adhering mesh and $128/conventional mesh. Given an overall bilateral hernia rate of 36% and consistent tacker use, switching to self-adhering mesh is estimated to save $3,552/year.

Conclusions: Self-adhering mesh is cost-effective when eliminating the use of tacking devices. Operative times and early outcomes are similar to conventional mesh. Long-term follow-up is needed to analyze recurrence, clinical outcomes, and rates of chronic pain.

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COMBINING STORE–AND–FORWARD PICTURES AND VIDEOCONFERENCING FOR OUTPATIENT BURN FOLLOW–UP CARE

Brownson EG, Thompson CM, Mandell SP, Fudem G,
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Background: Our regional burn center serves a wide region in the Pacific Northwest, which creates major challenges in follow–up care. In 2006, we implemented a store–and–forward protocol ("BurnPics") for established patients to email photographs in order to verify healing and range of motion. Starting August 2014, we established an additional videoconferencing follow–up system for select patients. The purpose of this quality improvement project was to evaluate BurnPics and videoconferencing utilization over the past 12 months.

Methods: We reviewed records of patients enrolled in the BurnPics program from August 2014 through July 2015, including patient and injury characteristics, state of residence, distance from a burn center, successful BurnPics use (defined by at least one photo received), and patient disposition after BurnPics. We also reviewed videoconferencing enrollment, utilization, provider time, and revenue generation. We analyzed all data by descriptive statistics.

Results: There were 398 patients enrolled in BurnPics, with a median age of 29 (IQR 13–50) and median burn size of 2% (IQR 1–6) body surface area. Most patients resided in Washington (82%), followed by Alaska (7%), Idaho (4%), and Montana (3%). Median distance from residence to burn center was 67 miles (IQR 29–228). Of 299 patients who sent at least one photo, 160 (54%) were subsequently followed on an as–needed basis, 52 (17%) also returned for in–person clinic visits, 49 (16%) also underwent videoconferencing visits, 21 (7%) were lost to follow–up, and 17 (6%) remain active in the program. In the past 12 months, 53 patients underwent 85 videoconferencing visits; 30 visits (35%) were billable and generated income, 27 visits (32%) were post–operative follow–ups, and 28 visits (33%) were not billable due to out–of–state residence. Median time spent per patient video–visit was 46 minutes (IQR 35–60), which includes set–up, nursing, provider and therapy time. Median time spent with burn care providers was 11 minutes (IQR 7–14).

Conclusions: The BurnPics program mitigates the challenges of follow–up burn care in our region. This platform allows for patients to submit pictures, and selects individuals who require additional follow–up. Videoconferencing creates minimal additional time burden on providers, and allows timesavings for both patients and clinic workflow. Additional revenue from videoconferencing may justify providers pursuing inter–state licensing in the future as the volume of tele–visits grows.

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OPTIMIZING SURGICAL CARE DELIVERY IN UGANDA: UNDERSTANDING THE ABDOMINAL DISEASE BURDEN

Butler EK, Tran TM, Fuller AT, Luboga S, Haglund MM, Makumbi F, Galukande M, Chipman JG

Background: Surgical disease is of increasing priority for the global health agenda. The first step in improving surgical care delivery in low– and middle–income countries is to accurately and specifically define the burden of disease. Uganda has a population of 37 million people, 84% of whom live in rural areas. Hospital–based data excludes individuals who are unable to access care. The aim of this study was to define the burden of abdominal surgical disease in Uganda via household survey to inform the Ministry of Health in directing efforts to improve surgical care.

Methods: Enumerators sampled 4,248 individuals in 2,315 households across 105 randomly selected clusters stratified by geographic region throughout Uganda. Per the Surgeons OverSeas Assessment of Need (SOSAS) survey, each head–of–household answered demographic and household death questions and two randomly selected individuals answered questions to elicit surgical conditions in each anatomic area. All individuals reporting an abdominal condition were included in this analysis. Frequency analysis was performed to determine prevalence of each type of abdominal condition. Chi square and t–tests demonstrated statistically significant variables contributing to presence of an untreated abdominal condition.

Results: Of the 4,248 individuals, 841 (19.8%) reported having a surgical condition at some point in their life, 528 of which (10.6%) were untreated. Of reported conditions, 18.3% of lifetime (154/841) and 14.2% (75/528) of untreated were abdominal conditions. Mean age of those with abdominal conditions was 35.2 ± 20.1 years and 65.3% were female. There was no association between age and whether a condition was treated. Men were more likely to have an untreated abdominal condition than women (male 59.6%, female 44.9%, p=0.01). The most frequent types of conditions were obstructed labor (23.4%), abdominal masses (21.4%), abdominal pain (16.9%), and hernias (14.3%). Obstructed labor was more likely to be treated (80.6%), than abdominal masses (33.3%), abdominal pain (30.8%), and hernias (45.5%) (p<0.001).

Conclusions: Abdominal conditions make up a significant proportion of the surgical need in Uganda, only superseded by extremity (21%) and facial (16%) conditions. Although obstructed labor is the most common surgical condition, it is more likely to be treated than abdominal masses, abdominal pain, and hernias. World Health Organization efforts have focused on reducing maternal and child mortality, particularly by increasing access to Cesarean section. It is evident, that these efforts have been successful, however, other abdominal surgical conditions remain largely untreated. The Ministry of Health should focus efforts to improve access to treatment for all abdominal surgical conditions.

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LEVERAGING EXISTING DATA SYSTEM INVESTMENTS TO IMPROVE QUALITY CARE FOR CRITICALLY INJURED CHILDREN

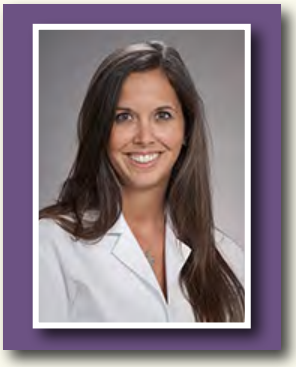
Flynn–O'Brien KT, Fallat ME, Rice TB, Gall CM, Rivara FP

Background: Efforts to improve outcomes after pediatric trauma depend on availability of detailed data to evaluate processes of care, compare hospital performance, and identify areas for quality improvement. Current databases on pediatric trauma fail to capture data elements important for process evaluation throughout the care continuum, risk–adjusted benchmarking, and evaluation of non–mortality outcomes.

Methods: Two national databases, Trauma Registry (TR) and Virtual Pediatric Systems (VPS), from five ACS–verified Pediatric Trauma Centers were merged for all children <18 years old discharged from the PICU with ICD–9 codes 800–859.9, indicating a traumatic injury, during calendar year 2013 (n = 692). Multivariable logistic regression was utilized to create risk–adjusted in–patient mortality models using TR–only variables, VPS–only variables, and a combination of TR and VPS variables (TR+VPS). The TR–only model was modified from the National Trauma Data Bank Pediatric Trauma Quality Improvement Program (TQIP) model, and included age, mechanism of injury, transfer status, Emergency Department (ED) systolic blood pressure, ED pulse rate, maximum head Abbreviated Injury Scale score, and existence of congenital comorbidities. VPS–only models included the Pediatric Index of Mortality 2, the Pediatric Logistic Organ Dysfunction, and the Pediatric Risk of Mortality III (PRISMIII) scores. The TR+VPS model combined the TR–only model and the best performing VPS–only model. For non–mortality outcomes, 103 variables from the resuscitation through stabilization phases of care were evaluated through purposeful covariate selection to create a prediction model for dichotomized Pediatric Overall Performance Category scale (good vs. poor functional status) in children who survived to hospital discharge. Variables were tested for clinically relevant interactions and age– and weight–based parameterization. All univariate and multivariable regressions controlled for clustering by site. Mortality and non–mortality models were tested for goodness–of–fit using McFadden's pseudo–R2, discrimination using the C–test statistic, and parsimony using the Akaiki Information Criterion (AIC). Processes of care were compared across sites using unadjusted and adjusted models.

Results: The use of combined TR and VPS data provided the best risk–adjusted model for predicting mortality, as measured by the C–statistic (discrimination), pseudo–R^2 (model fit) and Akaike Information Criterion (parsimony), when compared to models using TR–only covariates. Risk–adjusted functional outcomes at PICU discharge, measured by dichotomized Pediatric Overall Performance Category scale (good/poor functional status), varied by site (p–value < 0.05). There was large variation in processes of care, including ICP monitor use in severe TBI (site variation 0%–52%), repeat head CT after transfer (39–76%) and during the inpatient stay (3–25% with ≥3), DVT use (mechanical 0–19%, pharmacologic 0–11%), and FAST use (0–37%).

Conclusions: Merging two data systems allowed for improved risk–adjusted modeling for mortality and non–mortality prediction models. The merged database also allowed for evaluation of patient care practice patterns throughout the care continuum, from the pre–hospital setting through discharge, on a multi–institutional level. Merging existing data is feasible, innovative, and has potential to impact care using minimal new resources.



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ASSESSING THE SAFETY OF COMBINED BREAST RECONSTRUCTION AND GYNECOLOGIC SURGERY

Goldsberry–Long SR, Chong HJ, Soni A, Duggan N, Sood RF, Wright TJ, Louie O, Colohan SM, Said HK, Neligan PC, Gougoutas AJ

Background: Combining multiple surgical procedures under a single operative setting has the potential of reducing anesthetic exposure, reducing the total duration of hospitalization, reducing overall healthcare costs, and improving convenience for the patient. Immediate breast reconstruction at the time of mastectomy is one example of a combined operative approach, whereby the breast surgeon and reconstructive surgeon coordinate their respective procedures to be completed on the same date. At current, there is no data commenting on the safety of completing concurrent gynecologic procedures in the same setting as breast reconstruction. The purpose of this study was to estimate the risk of post–operative complications associated with combining breast reconstruction and gynecologic surgery under the same operative setting.

Methods: We conducted a retrospective cohort study at the University of Washington Medical Center from 2005 to 2014, enrolling all patients who underwent mastectomy, breast reconstruction, and gynecologic surgery. The primary exposure was timing of procedures. Subjects who completed their reconstructive and gynecologic procedures on the same date were defined as having "immediate" procedures, while subjects who completed these operations on separate dates were defined as having "staged" procedures. The primary outcome was the development of any post–surgical complication. Total duration of hospitalization was analyzed as a secondary outcome.

Results: Of 74 subjects enrolled (mean age 44.8±8.6 years), 64 patients (86%) completed bilateral salpingo–oophorectomy with or without hysterectomy in a minimally invasive manner (laparoscopic or robot–assisted) while 10 patients (14%) underwent open gynecologic surgery. The majority of patients (45, 61%) completed implant–based reconstruction, with the remainder (29, 39%) completing autologous tissue breast reconstruction. Combined surgery was performed in 18 patients (24%), while the remaining 56 patients (76%) completed their operations in a staged manner. The two cohorts had comparable demographics, comorbidities, and procedure types. Overall, 14 (19%) patients experienced at least one post–operative complication, all of which were breast– or flap–related complications; there were no abdominal complications. Compared against staged procedures, combining breast reconstruction with gynecologic surgery in the same setting was not associated with an increased risk of post–operative complications (RR = 1.24; 95% CI = 0.44–3.51; p = 0.68). Additionally, there was a trend toward decreased total duration of hospitalization in the combined cohort (3.9 ± 2.5 days) versus the staged cohort (4.4 ± 2.5 days), although this difference did not reach statistical significance (p = 0.54).

Conclusions: Combining breast reconstruction with gynecologic surgery in the same setting is not associated with an increased risk of post–operative complications in our cohort. There also appears to be a trend toward shorter duration of hospitalization in patients completing breast reconstruction and gynecologic surgery in a combined manner. Larger studies will be required to more precisely define the risk profile associated with combining breast reconstruction and gynecologic procedures.

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THE USE OF EXTRACORPOREAL LIFE SUPPORT IN DROWNING VICTIMS

Burke CR, Chan T, Brogan TV, McMullan DM

Background: Unintentional drowning is a significant public health concern in the United States and represents a leading cause of death in the pediatric population. Extracorporeal life support (ECLS) may be used to support drowning victims, but outcomes have not been well defined. This study examined survival rates and risk factors for death in this population.

Methods: Retrospective data from the Extracorporeal Life Support Organization registry was examined to determine outcomes of ECLS and risk factors for death in drowning victims.

Results: Two hundred forty-seven patients who received ECLS following a drowning event between 1986 and 2015 were identified. Eighty-four (34%) did not experience cardiac arrest prior to ECLS, whereas 86 (35%) experienced a pre-ECLS cardiac arrest but had return of spontaneous circulation prior to ECLS, and 77 (31%) were placed on ECLS during cardiopulmonary resuscitation (ECPR). Overall survival was 51.4%; 71.4% in patients who did not experience a cardiac arrest, 57.0% in patients who required cardiopulmonary resuscitation prior to ECLS, and 23.4% in patients who received ECPR ($p<0.001$). Logistic regression analysis identified ECPR, venoarterial mode of ECLS, renal failure, and cardiopulmonary resuscitation during ECLS as risk factors associated with mortality.

Conclusions: Outcomes in drowning victims supported with ECLS are encouraging; particularly in patients who do not experience cardiac arrest. These data suggest that early initiation of ECLS in drowning patients with respiratory insufficiency may be beneficial to reduce the likelihood of complete cardiopulmonary failure and ECPR. Additionally, ECLS appears to improve survival in patients who experience post-drowning cardiac arrest.

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EFFECT OF BODY MASS INDEX ON RISK OF COMPLICATIONS AFTER PEDIATRIC APPENDECTOMY

Witt CE, Goldin AB, Vavilala MS, Rivara FP

Background: Pediatric obesity is a leading public health concern, yet literature regarding perioperative risk is sparse. Appendicitis is one of the most common pediatric surgical diseases in otherwise–healthy children. We performed a nationwide, retrospective study to evaluate whether increasing body mass index (BMI) is associated with greater risk of complications following appendectomy.

Methods: Patients aged 2–18 years who underwent appendectomy were identified in the 2012–2013 Pediatric National Surgical Quality Improvement Program (NSQIP) datasets. After exclusion of patients without anthropomorphic data, age and gender–specific BMI percentiles were calculated via the 2000 Center for Disease Control's publically–available algorithms. Underweight patients (BMI <5th percentile) were excluded, leaving 9,606 patients. BMI categories were defined as normal ≤5–<85th, overweight ≤85–<95th, obese ≤95–≤99th, and morbidly obese >99th percentile. Multivariate analysis was performed using logistic and linear regression; the square of BMI percentile was used given improved fit on polynomial model comparisons. P values <0.05 were considered statistically significant.

Results: Mean age was 11.21 years (SD=3.66), and mean BMI percentile was 68.11 (SD=28.01). 90% of appendectomies were laparoscopic. The overall unadjusted 30–day complication rate was 4.96%, increasing from 4.47% in normal–weight patients to 5.27% in overweight, 5.73% in obese, and 7.26% in morbidly obese patients (p=0.014). In univariate and multivariate analysis, rising BMI was associated with a higher rate of superficial incisional infection, unplanned intubation, and longer operative time (table). There was no difference in 30–day mortality, hospital length of stay, readmission or reoperation rate.

Conclusions: In this large–scale, nationwide sample, increasing body mass index was an independent predictor of 30–day complication after appendectomy and was associated with longer operative duration.

Table. Multivariate analysis for complications and operative duration. For complications, values shown are odds ratios (with 95 percent confidence intervals), relative to the 50th percentile for BMI. Values for operative duration are also relative to the 50th percentile.

	BMI 85th percentile	BMI 95th percentile	BMI 99th percentile	P value
Any complication	1.150 (1.004 – 1.316)	1.212 (1.006 – 1.461)	1.241 (1.007 – 1.529)	0.043
Superficial incisional infection	1.434 (1.095 – 1.880)	1.646 (1.133 – 2.390)	1.746 (1.150 – 2.651)	0.009
Unplanned intubation	4.146 (1.063 – 16.169)	7.127 (1.088 – 46.682)	9.01 (1.099 – 73.732)	0.041
Operative duration	1.624 (0.892 – 2.355)	2.243 (1.232 – 3.253)	2.509 (1.379 – 3.640)	<0.0001

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PATIENT REPORTED OUTCOMES & RETURN TO WORK IN INDIVIDUALS WITH PRE-BURN INJURY DRUG OR ALCOHOL ABUSE

Thompson CM, Carrougher GJ, Schneider J, Kowalske K, Fauerbach JA, Herndon D, Gibran NS

Background: The incidence of drug & alcohol (ETOH) abuse among patients with thermal injuries has been reported to approach 30%. Whereas studies have found that these patients have longer hospital stays, higher rates of infection, & greater mortality, no publication has reported long-term health or employment status. The purpose of this study was to summarize the health & employment status of these patients for 2 years post-injury using two validated patient-reported outcomes (PRO) instruments.

Methods: The sample consisted of adults ≥18 years with burn injury that required surgery & who completed the SF-12® Health Survey Physical (PCS) & Mental (MCS) component summaries & the Satisfaction With Appearance Scale (SWAP) at discharge & at least 1 time point at 6, 12, or 24 months post-injury (1993-6/2015). Chi-square and Wilcoxon Mann Whitney tests analyzed differences in subject & injury characteristics, PROs, & employment status pre- & post-injury.

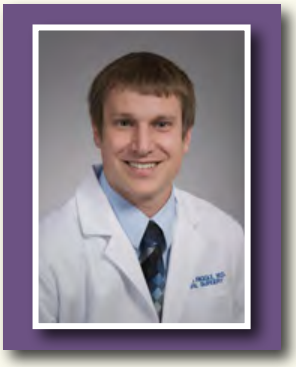
Results: A total of 1779 subjects met inclusion criteria. Subjects who self-reported drug &/or ETOH abuse in the year prior to injury had lower MCS scores pre-injury, at discharge, & at every follow-up time point compared to subjects that did not report abuse. They had lower PCS scores at 6 & 12-month follow-up, Table 1. Subjects who reported drug/ETOH abuse also had higher SWAP scores at discharge & at 6-month follow-up indicating less satisfaction with their appearance. Subjects who were employed pre-injury, had lower rates of returning to work if they self reported drug/ETOH abuse in the prior year.

Table 1. Differences in PROs*

	NO drug/ETOH abuse in last year (N=1455)	Drug/ETOH abuse in last year (N=324)	p-value
MCS Pre-Injury	56.8 (50.7, 59.7)	48 (38.1, 55.7)	<0.0001
MCS at Discharge	47.7 (38.5, 56.7)	45.1 (34.7, 53.6)	<0.0001
MCS at 12mo	50.8 (40.8, 57.7)	43.9 (36, 54.1)	<0.0001
MCS at 24mo	50.6 (40.7, 57.3)	45.2 (37, 54.8)	0.0016
PCS Pre-Injury	55.8 (50.2, 57.5)	55.5 (46.4, 58.4)	0.86
PCS at Discharge	29.8 (23.2, 37.9)	29.8 (23.4, 37.8)	0.88
PCS at 12mo	46.8 (37.5, 54.5)	41.4 (33.3, 51)	0.0003
SWAP at Discharge	22 (12, 36)	30 (14, 46)	0.0001
SWAP at 6mo	26.5 (14, 42)	33.5 (18, 50)	0.006

**Data presented as Median (Interquartile Range)*

Conclusions: Patients who worked at the time of injury & reported pre-injury drug &/or ETOH abuse were less likely to return to work in the 1st 2 years after a burn injury, relative to workers not reporting abuse. Factors associated with self-reported drug/ETOH abuse, compared to non-abusers, include higher %TBSA, longer hospital length of stay, more operations, lower perceived physical and psychosocial quality of life & great dissatisfaction with appearance.



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NEUROTENSIN ENHANCES CELL PROLIFERATION IN FIBROLAMELLAR HEPATOCELLULAR CARCINOMA

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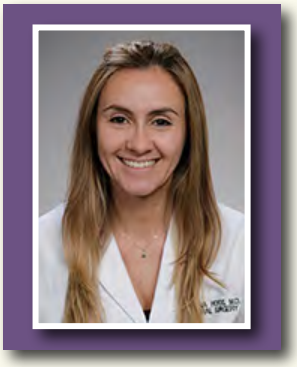
Background: Fibrolamellar hepatocellular carcinoma (FL–HCC) is a subtype of HCC occurring in young people without underlying liver disease. Recently, a novel mutation was discovered that results in increased protein kinase A (PKA) expression in FL–HCCs. FL–HCCs also have increased PKA activity as well as increased serum neurotensin (NTS) levels, but how these factors promote carcinogenesis is unclear, as PKA overexpression alone decreases hepatocyte proliferation. We hypothesize that in FL–HCC, NTS acts as a co–mitogen with other growth factors to promote proliferation, leading to cancer.

Methods: Tissue lysates and RNA from snap–frozen FL–HCCs and paired, non–tumor livers were used in qRT–PCR, immunoblot, and immunohistochemical assays. We assessed the expression of NTS, NTS receptors (NTSR1, 2), and proprotein convertase 1 (PCSK1), which cleaves pro–NTS to its active form. Cell growth and proliferation in non–transformed mouse hepatocytes (AML12 cells) were assessed following treatment with NTS with and without epidermal growth factor (EGF) using BrdU and MTT assays.

Results: NTS, NTSR1, NTSR2, and PCSK1 mRNA and protein are all overexpressed in FL–HCCs compared to paired, normal livers. NTS treatment alone has no effect on AML12 cell proliferation, while NTS + EGF induces significantly greater growth response compared to EGF alone.

Conclusions: The neurotensin pathway is upregulated in FL–HCC. NTS acts as a co–mitogen with EGF to increase DNA synthesis and cell proliferation in hepatocytes. This suggests that in addition to PKA activation in FL–HCC, NTS signaling contributes to tumorigenesis and may serve as a potential therapeutic target.

	% BrdU Incorporation	MTT Cell Proliferation Assay (Fold Increase vs. untreated AML 12 cells)
AML 12 Cells (no treatment)	16 ± 0.6%	1
AML 12 + NTS (1 uM)	14 ± 1.0%	1.17 ± 0.05
AML 12 + EGF (10 ng/mL)	36 ± 0.9%	1.2 ± 0.05
AML 12 + NTS/EGF (1uM:10 ng/mL)	63 ± 1.6%	1.86 ± 0.09



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DONOR AGE STILL MATTERS IN LIVER TRANSPLANTATION: RESULTS FROM THE UNOS–SRTR DATABASE

Hoyos Gomez T, Dick A, Hansen R, Reyes J, Montenovo M

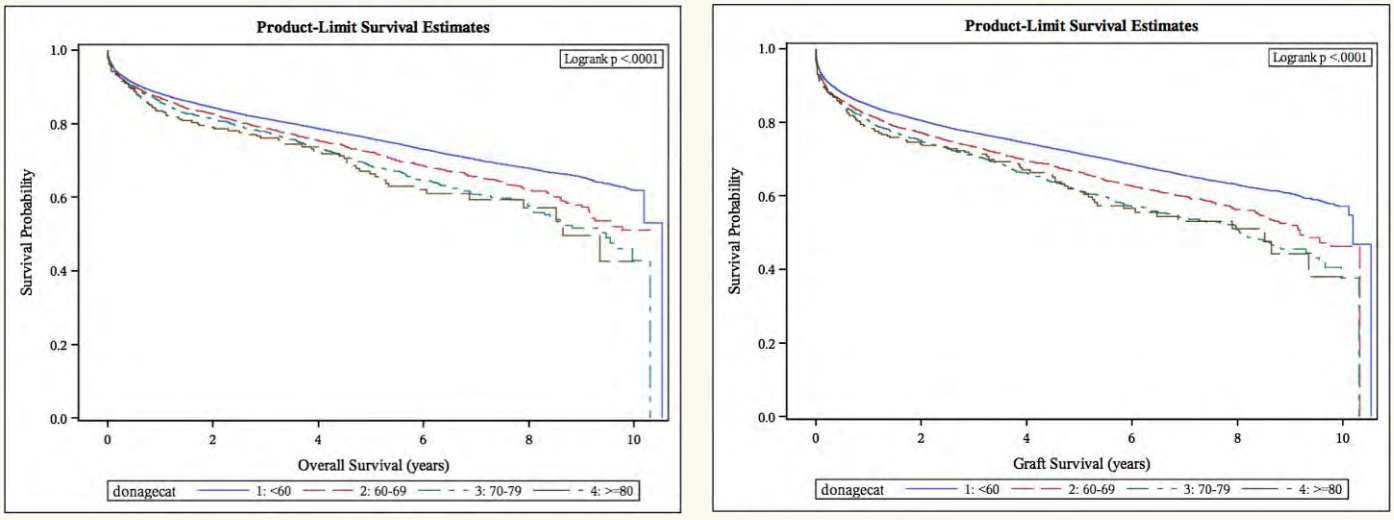
Background: The use of older donor grafts in liver transplant has remained controversial. Traditionally it has been known that the use of older liver donors have a negative impact in both patient and graft survival. However, recent single–center studies have questioned this dogma after showing no adverse effects in outcomes. We hypothesize that the use of older donors will not impact survival due to significant improvement in donor–recipient management.

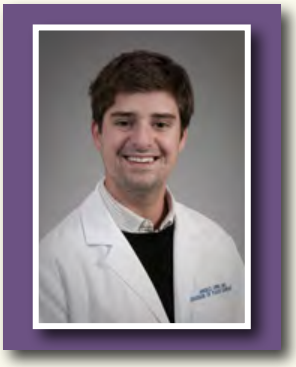
Methods: Retrospective cohort analysis using the United Network for Organ Sharing Database from February 2002 through December 2012, including non–hepatitis C infected adults (18 and older) who underwent primary orthotopic liver transplantation. We compared patient and graft survival between four cohorts based on donor's age (<60, 60–69, 70–79, >80) using the Kaplan–Meier estimator. Cox Proportional Hazards models were constructed to adjust for recipient and donor characteristics in order to estimate the risk associated with organs from older donors.

Results: We identified 35,788 liver transplant recipients. Both patient and graft survival are significantly inferior among recipients of older donors (>60) as compared to recipients of younger donors (<60) [Fig 1]. Of those recipients from donors over the age of 60, there is no significant difference in the outcome when comparing the three different age categories (60–69; 70–79; >80). The trend of older graft utilization has not changed over time. Multivariate regression revealed that all three categories of donor age >60 years old are significantly associated with worse patient and graft survival. MELD score is not an effect modifier of the association between donor age and survival.

Conclusions: The use of older liver grafts do have a negative impact in both patient and graft survival independent of the MELD score. In the current era of significant organ shortage, new strategies should be developed in order to increase the utilization and function of these grafts.

Figure 1. Patient and Graft Survival among Different Categories of Donor Age.





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A RADIOGRAPHIC ANALYSIS OF EXTRAOCULAR MUSCLE VOLUME CHANGES IN ORBITAL FLOOR FRACTURES

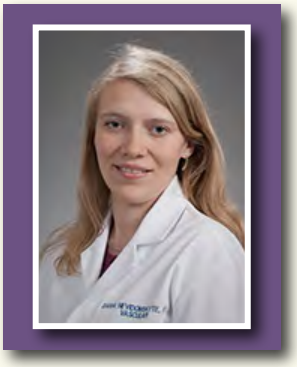
Lipira A, Snell B, Sood R, Hopper R

Background: Cross-sectional rounding of the inferior rectus (IR) muscle on coronal CT has been associated with development of late enophthalmos, and has been proposed as a relative indication for surgical treatment. The etiology of this shape change is controversial. Some believe rounding is caused by disruption of the fascial support system of the globe, while others propose it is due to intramuscular swelling or hemorrhage. Disruption of fascial support could change the appearance of the IR muscle by altering its shape, but would not necessarily change the volume, whereas edema/hemorrhage should cause volume increase. No previous study has assessed for muscular volume change in orbital floor fractures.

Methods: A retrospective study of 18 patients with unilateral orbital blowout fractures who underwent operative repair was performed. Each patient had preoperative and postoperative CTs available. EOM volume was calculated for the inferior, medial, superior, and lateral rectus muscles on pre- and post-operative CTs. Shape change was measured as a rounding ratio based on height:width ratios. Intrarater reliability was determined by measuring 5 subjects twice, and computing the intraclass correlation coefficient. Paired Student's t-test was used to test for significance in volume difference between injured and uninjured sides, and preoperative versus postoperative for each muscle. Linear regression was used to look for association between rounding and volume change.

Results: Measurements were highly reliable with an intraclass coefficient of 0.929 (95% CI 0891 – 0.958). There was no statistically significant difference in volume between the injured and uninjured inferior rectus on preoperative CT ($p = 0.418$). Higher rounding ratio was associated with greater increase in IR volume ($p = 0.02$). Inferior rectus volume was significantly greater in the injured side as compared to the uninjured side postoperatively ($p < 0.01$). Globally, EOMs tended to have smaller volumes on the postoperative CT than the preoperative CT.

Conclusions: We did not find a significant difference in volume between IR on the side of injury and the uninjured side, but did find that degree of rounding was associated with greater volume increase. This suggests that there is some intramuscular hemorrhage or edema that may accompany fascial disruption in more severe injuries. Except for the injured IR, other EOMs tended to be smaller on postoperative CT compared to preoperative, in both injured and uninjured sides. This suggests there may be some global swelling at time of injury, which decreases in the time prior to surgery.



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INFLUENCE OF GENDER OF ABDOMINAL AORTIC ANEURYSM REPAIR IN THE COMMUNITY

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Background: Women have been shown to experience inferior outcomes following intact and ruptured abdominal aortic aneurysm (AAA) treatment in endovascular (EVAR) and open surgical repair (OSR) groups. The goal of our study was to compare gender–specific presentation, management and early outcomes after AAA repair using a statewide registry.

Methods: We utilized the Washington State Vascular–Interventional Surgical Care and Outcomes Assessment Program (VI–SCOAP) registry data collected in 19 hospitals from July 2010 to September 2013. Demographics, presentation, procedural data and outcomes in elective and emergent AAA repair groups were analyzed.

Results: We identified 1231 patients (19.6% women) who underwent intact (86.4%) or ruptured AAA (13.6%) repairs. 972 (79.0%) had EVAR and 259 (21.0%) had OSR. Men and women were of equivalent age and had similar comorbidies, except women had less coronary artery disease (P<.01) and were more likely to suffer from chronic obstructive pulmonary disease (P=.05). Women had smaller aneurysm diameters (5.8 ± 1.1 vs 6.2 ± 1.8 cm, p < .01) at the time of presentation and men had slightly higher incidence of rupture at larger aneurysm size. Men were more likely to undergo EVAR, with significant differences in elective (82.1% vs 74.1%, P=.01), but not ruptured repair. Women had significantly higher mortality rates following elective EVAR (3.1% vs 0.6%, P=.01), but not after ruptured or elective open repair. Following elective EVAR women were less likely to be discharged to home after longer hospital stays (3 days vs 2 days, P<.01).

Conclusions: Despite presentation at a similar age, with a smaller aneurysm diameter, and similar medical comorbidities, women experience substantially worse hospital outcomes primarily driven by elective endovascular procedures. Utilization of endovascular techniques in women still remains lower compared to men. Improvement of elective outcomes in women will likely depend on technical advancements in repair techniques and management strategies that may differ between genders.

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CROWDSOURCING AS A NOVEL METHOD FOR THE EVALUATION OF POSTOPERATIVE OUTCOMES IN UNILATERAL CLEFT LIP REPAIR

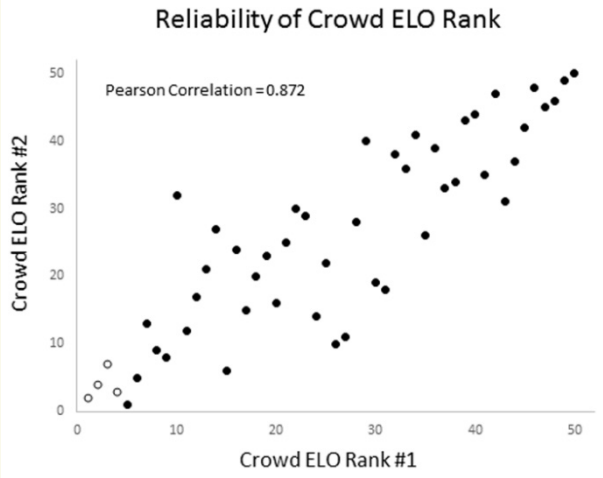
Oh E and Tse R

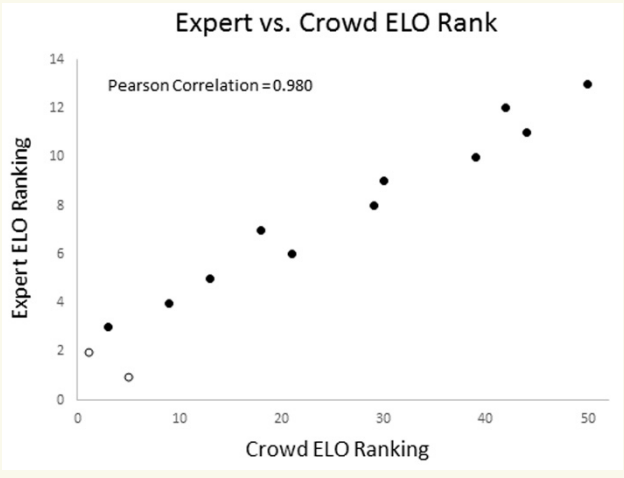
Background: Reconstruction of nasolabial cleft occurs over multiple stages and outcomes vary with time and growth. However, the lack of convenient and reliable methods to grade esthetic outcomes limits the ability to study results and optimize treatments. Crowdsourcing is a recently popularized method that solicits contributions from a large group to achieve a greater result. We hypothesized that Crowdsourcing could be used to reliably grade esthetic outcomes following unilateral cleft lip repair.

Methods: 50 de-identified photographs of 8-10 year old subjects were used (46 unilateral cleft lip, 4 control). Via an internet interface, anonymous, lay-person Crowd workers performed pairwise comparisons of the photographs to produce a rank order (ELO rank) with N=50 comparisons per image. The Crowds also performed Asher-McDade (A-M) scoring for each subject (n=38). Both surveys were repeated to assess reliability. Additionally, expert cleft surgeons performed analogous tasks on a smaller subset of subjects.

Results: We obtained over 2500 and 1900 evaluations within 2-4 hours during each ELO rank and A-M survey, respectively. ELO rank and A-M surveys were reproducible with a correlation coefficients of 0.872 and 0.988. We found high degree of correlation when comparing composite Expert and Crowd evaluations (ELO rank correlation=0.980). Expert analysis was ultimately not fully completed. Finally, we found that initial cleft severity was associated with worse nasal appearance with nasal form and symmetry most highly correlated with nasal appearance.

Conclusions: We assembled large numbers of lay-person of esthetic outcome assessments that were reliable and correlated well to Expert assessments. Despite smaller sample set, our Expert cohort was unable to finish the surveys after 3 months. Furthermore, our data highlight important patient factors associated with postoperative outcome. Crowdsourcing provides a rapid, convenient, objective, and valid way to assess esthetic outcomes.





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HIGH VARIABILITY IN OUTCOME REPORTING IN THE TREATMENT OF ACHALASIA

Rodriguez HA, Oelschlager BK, Pellegrini CA, Wright AS

Background: Laparoscopic Heller myotomy (HM) is considered the gold standard treatment for achalasia as it is thought to provide significant long-term relief of symptoms. Other available therapies include medical therapy, Botox injection, pneumatic dilation (PD) and the recently described Per-Oral Endoscopic Myotomy (POEM). These interventions aim to improve symptoms and quality of life. Several scoring systems and questionnaires have been developed in order to assess outcomes, however there is no standardized metric for defining success of treatment. We set out to describe the variability in reporting of outcomes in the treatment of achalasia.

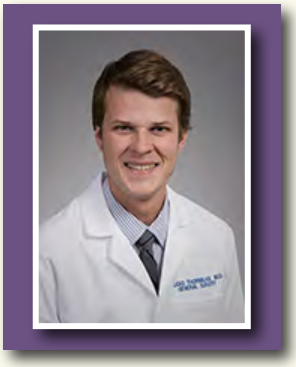
Methods: A MEDLINE and Pubmed search was performed using the keywords "achalasia", "achalasia long-term outcome" and "achalasia outcome." Studies that reported long-term outcomes were included. Reviews, meta-analyses and studies without follow-up (i.e. only showing perioperative data) were not included. Studies were screened for main outcome measures, achalasia scoring systems, and follow-up duration.

Results: Sixty-three studies were screened and 40 were deemed eligible. The majority (29) reported outcomes for HM. Five studies reported long-term outcomes of POEM, and 5 were comparative studies (POEM vs. HM, PD vs. HM). Full results are summarized in Table 1. All five POEM studies reported outcomes utilizing the Eckardt score, where only 2 HM used the same score.

Conclusions: Significant variability in reporting subjective and objective outcomes was noted within the included studies. This limits the ability to compare treatment strategies for achalasia. A standardized scoring system would help allow surgeons and patients to better choose between available treatment options.

Table 1.

	Reporting system(s) used			
Intervention	**Eckardt Score**	**Likert Scale**	**Percentage**	**Other**
HM	2	13	6	8
POEM	5	0	0	0
Comparative	3	1	0	1
PD	0	0	0	1



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PREOPERATIVE IMMUNONUTRITION AND ELECTIVE COLORECTAL RESECTION OUTCOMES – A PROPENSITY SCORE MATCHED ANALYSIS

Thornblade LW, Varghese Jr. TK, Bastawrous AL, Billingham RP, Fichera A, Florence MG, Johnson EK, Johnson MG, Thirlby RC, Flum DR

Background: Surgeons have long recognized the impact of malnutrition on surgical outcomes, but surgical stress is increasingly being recognized as a state of acute nutritional depletion, related in part to the altered metabolism of arginine. Immunonutrition supplements composed of arginine, omega–3 fatty acids, and nucleotides improve host defenses (T–lymphocyte function) through the provision of nutrients that correct arginine depletion. Although several randomized clinical trials and meta–analyses have demonstrated reduction in infections and other complications after surgeries gastrointestinal anastomoses, comparative effectiveness of these supplements in the community at large is not known. In May 2012, Washington (WA) State surgeons began participation in a public health initiative called Strong for Surgery that focused on optimizing health before elective surgery, and encouraged the use of evidence–based immunonutrition supplements in GI surgery.

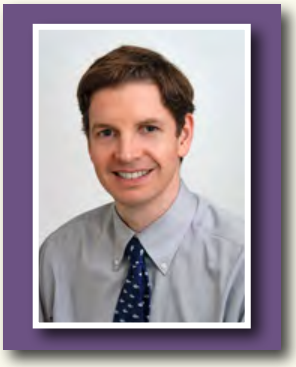
Methods: The use of preoperative immunonutrition was added to the Surgical Clinical Outcomes Assessment Program (SCOAP) registry in 2012. We studied a prospective cohort of all adult patients undergoing elective colorectal surgery at 55 WA hospitals participating in SCOAP from 2012 to 2015. Preoperative immunonutrition supplements were prescribed for patients three times daily for five days for those participating in the Strong for Surgery program. Immunonutrition use, clinical and demographic risk factors were assessed. Composite adverse event rate (operative reintervention, infection, anastomotic leak and/or death), and length of stay were evaluated using descriptive and comparative statistics. Patients who did and did not receive preoperative immunonutrition supplements were matched using propensity–score analysis.

Results: 8,680 patients (mean age 61.2, 55.5% female) underwent elective colorectal resection (56.7% colon) for a range of diagnoses (34.8% cancer, 24.1% diverticulitis) and 627 received preoperative immunonutrition. CAE were significantly less common among those who received immunonutrition (7.0% vs. 9.5%, p=0.04). Characteristics of those receiving immunonutrition were significantly different from those who did not (Table). After propensity score matching (346 pts/group), CAE was noted in 7.2% of those who received immunonutrition vs 11.6% (p=0.05) with an unadjusted OR of 0.60 (0.35–1.01). Mean length of stay was 5.8 days after immunonutrition vs 6.9 days (p<0.01).

Table: Unmatched patient characteristics

	Immuno (n= 627)	No Immuno (n=8053)	p–value
% female	51.0	55.8	0.02
age (mean)	58.8	61.3	<0.001
ASA (mean)	2.43	2.37	0.02
% smokers	14.1	21.2	<0.01
albumin (mean)	3.8	3.7	<0.01
% cancer	43.3	34.2	<0.001
% prior colon/ pelvic surgery	45.2	40.2	0.01
% S4S hospital	99.8	79.6	<0.001

Conclusions: Concurrent to a statewide public health initiative that encouraged the use of immunonutrition, its use before elective colorectal surgery was associated with improved outcomes. These findings from the community at large reinforce results from randomized trials and suggest that immunonutrition may be an effective surgical quality improvement intervention.



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MELANOCORTIN–1 RECEPTOR POLYMORPHISM R163Q IS PROTECTIVE AGAINST COMPLICATED SEPSIS AFTER TRAUMA

Seaton M, O'Keefe G, Wurfel M, Parent B, Sood RF, Muffley L, Gibran NS

Background: Nosocomial infection is an important cause of morbidity and mortality after trauma. In addition to clinical factors, several single nucleotide polymorphisms (SNP) have been associated with the risk of sepsis. The melanocortin–1 receptor (MC1R) is an anti–inflammatory mediator that may be involved in the immune response after trauma. The purpose of this study was to determine if functional MC1R SNPs are associated with complicated sepsis after trauma.

Methods: The IRB–approved prospective study (2003–2005) enrolled patients admitted to the trauma ICU at Harborview Medical Center. Patients were excluded if they were in the ICU for less than 48 hours, were expected to die from their injuries, or had isolated traumatic brain injuries. Clinical data was obtained from a trauma registry and electronic medical records. DNA was isolated from discarded venous blood and genotyped for 8 common functional MC1R SNPs using TaqMan® Real–Time PCR Assays.

Results: A total of 1,961 subjects were enrolled. To control for common genetic background, only Caucasian subjects (n=1,246) with complete clinical data were included in the analysis (Table). In multivariate logistic regression that adjusted for age, sex, injury severity score, BMI, and mechanism of injury, R163Q was inversely associated with complicated sepsis (OR 0.41, p=0.001). To further adjust for genetic background, we examined a subgroup of 511 Caucasian subjects with available genome–wide genotyping data (Table). In this subgroup, the association between R163Q and complicated sepsis remained significant when adjusting for principal component analysis and the above clinical factors (OR 0.30, p=0.004).

Conclusions: R163Q is associated with lower odds of complicated sepsis after trauma. In vitro studies have shown that wild–type MC1R activates both MAPK and cAMP signaling, and R163Q is unique among MC1R SNPs in that it attenuates MAPK but not cAMP signaling. Agonists that change MC1R signaling may be beneficial in injury victims at high risk for complicated sepsis.

Characteristics	Caucasian subjects	Caucasian subjects with GWAS data
Total	1246	511
Age, years	39 (22–530)	43 (25–55)
Male	869 (70%)	369 (72%)
Injury severity score ≥ 15	1013 (81%)	449 (88%)
≥1 unit pRBC transfusion	762 (61%)	420 (82%)
BMI	26 (22–29)	27 (23–31)
Mechanism of injury		
Blunt	1107 (89%)	465 (91%)
Penetrating	76 (6%)	21 (4%)
Burn	63 (5%)	25 (5%)
Outcomes		
Sepsis	497 (40%)	337 (66%)
Complicated sepsis	290 (23%)	234 (46%)
Mortality	113 (9%)	85 (17%)

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SPEECH AND SURGICAL OUTCOMES IN INTERNATIONAL ADOPTEES WITH CLEFT PALATE

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Background: International adoptees with cleft palate undergo initial palatoplasty at an older age than non–adoptees. The effect of this delay in treatment is unknown. This study compares post–palatoplasty speech and surgical outcomes of adopted to non–adopted patients and examines the influence of age at initial palatoplasty.

Methods: Speech and surgical outcomes were examined for non–syndromic patients with Veau type 3 or 4 clefts repaired at our institution since 2007. Adoptees repaired abroad were excluded. Univariate analysis was used to examine the relationship of adoption status with speech outcomes, oronasal fistulization, and secondary speech surgery. Multivariate analysis clarified the independent contributions of adoption and age at palatoplasty.

Results: 45 adoptees and 111 non–adoptees met inclusion criteria. Adoptees underwent initial palatoplasty a mean of 1 year later than non–adoptees, and were significantly more likely than non–adoptees to develop moderate/severe velopharyngeal insufficiency (VPI). Oronasal fistulas and secondary speech surgery occurred at similar rates in both populations. Older age at initial palatoplasty was a significant predictor of moderate/severe VPI, and secondary speech surgery.

Conclusions: While adoptees are more likely than non–adoptees to develop moderate/severe VPI, this finding could accounted for by the older age at which adoptees undergo palatoplasty. The superior speech and surgical outcomes for earlier repairs would argue for surgical intervention on unrepaired cleft palates soon after adoption.

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ESTABLISHING EQUIPOISE: NATIONAL SURVEY OF THE TREATMENT OF PEDIATRIC PARA–PNEUMONIC EFFUSION AND EMPYEMA

Richards MK, McAteer JP, Hoffman LR, Kronman MP, Shaw DW, Goldin AB

Background: Despite two published, randomized trials of treatment for pediatric para–pneumonic effusion and empyema (PPEE), studies show that management approaches continue to vary. This variability exists between hospitals, physician specialties and even providers within the same group. The purpose of our study was to examine the differences in utilization of antibiotics, type and timing of intervention and follow–up. Our goal was to establish equipoise to design an intervention trial that would help formulate consensus guidelines.

Methods: To evaluate physician opinions regarding PPEE management practices, we composed a survey based on the input of a nationwide, multidisciplinary focus group that established content validity. Specialties represented included pediatric surgery, hospital medicine, infectious disease, intensive care, interventional radiology and pulmonology. The survey was disseminated to the following professional groups: International Pediatric Endosurgery Group, American Pediatric Surgical Association, Society of Pediatric Interventional Radiologists, American Academy of Pediatrics Hospitalist and Critical Care groups and the American Thoracic Society.

Results: Seven hundred forty–one physicians responded. Denominator data were unavailable given potential overlap between surveyed organizations and our effort to preserve anonymity. Of the 741 respondents, 315 (50.9%) were surgeons, 92 (14.9%) hospitalists, 86 (13.9%) pulmonologists, 75 (12.1%) intensivists and 36 (5.8%) interventional radiologists. A majority cared for pediatric patients (97.3%) in either free–standing children's hospitals or a pediatric wing of an adult hospital (79.7%). Additionally, most (97.2%) actively cared for PPEE patients. While only 20% had a written guideline or hospital policy, 74% reported having a standard approach to PPEE management. The most common absolute indication for PPEE drainage reported was radiographic mediastinal shift (67.2%) followed by loculations on imaging (74.4%) and persistent or worsening work of breathing (45.0%). There were significant differences among specialties in the preferred first–line drainage method: surgeons preferred either chest tube (CT) placement with fibrinolytics (39.6%) or video–assisted thoracoscopic surgery (VATS) (39.2%), interventional radiologists and intensivists preferred CT placement alone (41.9% and 34.3% respectively) and pulmonologists favored VATS (32.9%) ($p<0.001$). Most respondents were willing to participate in a randomized trial that would initially include antibiotics either alone (60.8%) or with one of the following: CT placement (91.1%), CT with fibrinolytic therapy (91.9%), VATS and CT placement (90.0%), or thoracentesis (63.8%). Seventy–five percent of respondents did not feel that the published evidence is clear as to the best intervention.

Conclusions: The findings of this survey indicate lack of consensus opinion regarding the optimal treatment of PPEE and, as a result, management approaches currently vary. The information acquired in this survey indicates equipoise between different treatment options, including how and when to intervene in PPEE and the duration of treatment. Moreover, there appears to be widespread willingness to participate in a randomized trial. These findings will help inform the design and execution of a randomized, pragmatic clinical trial to optimize PPEE management.

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FIREWORK–RELATED INJURIES: PATTERNS, OUTCOMES, AND RISK FACTORS

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Background: Fireworks carry inherent dangers and injuries from them are seen in hospitals around the world. We aim to determine injury patterns, treatment outcomes, and risk factors associated with firework–related injuries treated at Harborview Medical Center.

Methods: Patients with firework–related injuries were identified using the Harborview Trauma Registry. We conducted a retrospective chart review of demographics, diagnosis, and treatment of firework–injured patients between 2005 and 2015. Patients were included regardless of treating specialty, treatment modality, or inpatient status.

Results: 392 patients had firework–related injuries. They were 88% males and 12% females. 73% identified as White or Caucasian, 4% Black or African American, 3% Asian, 5% Native American or American Indian, 9% Hispanic or Latino, 3% Pacific Islander, 4% Alaskan Native. Mean age was 24.6 years old. 75% were admitted to the hospital (10% ICU, 65% floor). Mean length of stay was 5 days. 46% required surgery. Of these, 46% required a single surgery, 54% multiple surgeries (mean 3.5 surgeries). Regarding mechanism of injury, 78% were active users of the fireworks, 20% bystanders, and 2% unknown. Body areas injured were: eyeball(s) 29%, face 31%, neck 7%, brain 1.5%, trunk 17%, upper arm(s) 19%, leg(s) 29%. 60% had an injury to the hand and/or wrist (28% bilateral).

103 patients had operative firework–related hand injuries. 6 underwent complete hand amputation through wrist or forearm. 16 patients (16%) had bilateral injuries. 86 patients (83%) in the group sustained thumb ray injuries and there were: 76 thumb fractures, 10 thumb soft tissue–only injuries, 51 thumb carpometacarpal (CMC) joint fracture dislocations, and 50 thumb fractures outside the thumb CMC joint. 25 patients had both thumb CMC joint fracture dislocations as well as additional thumb fractures. 23 patients required thumb revision amputation, 3 through the CMC joint. Among patients with thumb injuries, the number of surgeries for acute reconstruction ranged 1 to 7 (mean 1.6). Acutely, 56 patients (65%) required 1 surgery, 12 patients (14%) required 2 surgeries, and 16 patients (19%) required 3 or more.

Conclusions: Firework–related injuries can be life–changing and continued efforts toward injury prevention are warranted. Thumb injuries from fireworks result from high–energy avulsion, hyperextension, and hyperabduction, frequently injuring the thumb, destabilizing the thumb CMC joint, and seriously damaging the first webspace. The first webspace requires particular consideration as deep injury may result in adduction contracture and require secondary reconstruction with tissue outside the zone of injury if not prevented. Then next phase of our study is to complete a telephone interview to assess risk factors for injury and to obtain patient–reported outcomes data.

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DIAGNOSING SURGICAL SITE INFECTION USING WOUND PHOTOGRAPHY: A SCENARIO–BASED STUDY

Sanger PC, Simianu VV, Armstrong CAH, Hartzler A, Lordon RJ, Lober WB, Evans HL

Background: Surgical site infections (SSI) are the most common post–operative complication, with most occurring after hospital discharge. Many SSIs result in potentially preventable readmissions, in part because patients and providers lack tools to discover these infections early. Likewise, patients are often advised to seek urgent evaluation when there is uncertainty about an infection through telephone contact. Mobile health approaches incorporating patient–generated wound photos are being increasingly adopted; our goal was to determine how adding these photos to existing data sources modifies provider decision–making.

Methods: A national sample of providers with expertise in surgical infections responded to a web–based survey with a range of scenarios that included surgical history, physical exam and a description of wound appearance. Each participant completed at least 2 scenarios, selected using stratified randomization from a pool of 16 real patient scenarios, to ensure that each participant received a balanced sample of SSI/non–SSI and ambiguous/non–ambiguous cases. All participants reported diagnosis, diagnostic confidence, and management recommendations, first without, and then with accompanying wound photos. At each step, providers ranked the most important elements contributing to their decision. Primary endpoints were changes in diagnostic accuracy, diagnostic confidence, and management decisions with the addition of wound photos. Changes in continuous and binary variables were assessed using paired t–test and McNemar's test, respectively.

Results: Eighty–three subjects completed a median of 5 scenarios (IQR 4–7). Most participants were MDs (N=72, 87%) in academic surgical specialties (N=70, 84%). Addition of photos improved overall diagnostic accuracy across all scenarios from 67% to 78% ($p<0.001$), especially in non–SSI scenarios (79% to 92%, $p<0.001$), and increased specificity from 77% to 92% ($p<0.001$) but did not significantly increase sensitivity (55% to 65%, $p=0.16$). Photos increased diagnostic confidence from 5.9/10 to 7.4/10 ($p<0.001$). Overtreatment (recommending antibiotics, same day visits or ED visits) among non–SSI patients decreased from 48% to 16% ($p<0.001$) while undertreatment (*not* receiving antibiotics, same day clinic visit, or ED visit) among SSI patients did not appreciably change (28% to 23%, $p=0.20$) with addition of photos.

Conclusions: Addition of wound photos to existing data as available via chart review and telephone consultation with patients improved diagnostic accuracy and confidence, and prevented overtreatment of patients without SSI. Mobile health technologies to capture wound photos and other key data from patients during the post–discharge period have the potential to facilitate patient–centered care, and improve care coordination and clinical outcomes.

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Research Interests: Surgical outcomes, appropriateness

Faculty Mentor
David R. Flum, MD, MPH

THE RELIABILITY OF A STANDARDIZED REPORTING SYSTEM FOR THE DIAGNOSIS OF APPENDICITIS

Simianu VV, Shamitoff A, Hippe DS, Godwin BD, Shriki JE, Drake FT, O'Malley R, Maximin S, Bastawrous S, Moshiri M, Lee JH, Cuevas C, Dighe M, Bhargava P, Flum DR

Background: Computed tomography (CT) is a fast and ubiquitous tool to evaluate intra-abdominal organs and diagnose appendicitis. However, traditional CT reporting does not necessarily capture the degree of uncertainty, and indeterminate findings are still commonly reported. The purpose of this study was to evaluate the reproducibility of a standardized CT reporting system for appendicitis across a large population and the system's impact on radiologists' certainty in diagnosing appendicitis.

Methods: Using a previously described standardized reporting system, eight radiologists retrospectively evaluated CT scans in a cohort of 561 patients imaged for possible appendicitis (2010–2014). 159 of these scans were selected at random to be over-read by a second reviewer. Reproducibility of reporting and certainty in the diagnosis of appendicitis was compared between the radiologists, and correlation made with clinical diagnoses.

Results: Appendicitis occurred in 20% of patients (mean age 38, 67% male). Using the standardized report, radiologists were highly accurate at identifying appendicitis (AUC=0.968, 95%CI: 0.95, 0.99). Inter-reader agreement was >80% for most objective findings, and certainty in diagnosing appendicitis was high and reproducible (AUC=0.955 and AUC=0.936 for primary readers and over-readers, respectively). In the subgroup of patients with previously "indeterminate" reports, 57% (24 of 42) were assigned the correct diagnosis using the standardized report (Table 1).

Conclusions: Using a standardized reporting system resulted in high reproducibility of objective CT findings for appendicitis and achieved high diagnostic accuracy in an at-risk population. Predictive tools based on this reporting system may further improve communication about certainty in diagnosis and guide patient management, especially when CT findings are indeterminate.

Table 1. Diagnostic performance of certainty scale.

	All Exams (N=237)				Indeterminate Exams (N=42)			
Certainly Scale	Clinical Appendicitis (N=113)	Clinical Not Appendicitis (N=124)	AUC (95% CI)	P-value	Clinical Appendicitis (N=17)	Clinical Not Appendicitis (N=25)	AUC (95% CI)	P-value
1: Appendicitis definitely absent	1 (1)	63 (51)	0.968 (0.95–0.99)	<0.001	0 (0)	7 (28)	0.846 (0.73–0.93)	<0.001
2: Appendicitis unlikely	3 (3)	41 (33)			0 (0)	8 (32)		
3: Indeterminate	9 (8)	14 (11)			8 (47)	7 (28)		
4: Appendicitis likely	20 (18)	6 (5)			6 (35)	3 (12)		
5: Appendicitis definitely present	80 (71)	0 (0)			3 (18)	0 (0)		

CI = confidence interval; PPV = positive predictive value;
**Values are no. (%) and are not weighted for the sampling design.*

Ravi F. Sood, MD, MS
General Surgery, R3

Faculty Mentor
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Research Interests: Scarring biology and epidemiology, abdominal wall reconstruction

RESPIRATORY COMPLICATIONS FOLLOWING ABDOMINAL WALL RECONSTRUCTION: ANALYSIS OF THE NATIONWIDE INPATIENT SAMPLE DATABASE

Sood RF, Lipira AL, Neligan PC, Louie O, Gibran NS

Background: Patients undergoing abdominal wall reconstruction are known to be at increased risk of post-operative respiratory complications, but epidemiologic data on risk factors are scarce. The purpose of this study was to identify clinical factors associated with respiratory complications following abdominal wall reconstruction.

Methods: We conducted a retrospective cohort study of adults undergoing ventral hernia repair with component separation from 2004 through 2011 using the Nationwide Inpatient Sample (NIS) database. Exposures included patient demographics (age, gender, and race/ethnicity) and comorbidities (chronic lung disease, coagulopathy, congestive heart failure, diabetes mellitus, hypertension, kidney disease, liver disease, and obesity). Respiratory complication was defined as respiratory failure/insufficiency, ARDS, pulmonary edema, pneumonia, and/or respiratory arrest. Association testing was based on multivariate regression.

Results: Of 2,452 patients undergoing abdominal wall reconstruction, 57% were female, with median age of 57 years and median length of stay 6 days. Post-operative respiratory complications occurred in 300 (12.2%) patients, and 23 (0.9%) patients died. In multivariate analysis, age (RR/year 1.02, 95% CI: 1.01–1.03), male gender (RR 1.41, 95% CI: 1.05–1.96), chronic lung disease (RR 1.79, 95% CI: 1.44–2.23), coagulopathy (RR 3.65, 95% CI: 2.64–5.05), congestive heart failure (RR 2.08, 95% CI: 1.51–2.88), and obesity (RR 1.51, 1.21–1.89) were independently associated with increased risk of respiratory complications. Development of respiratory complications was associated with significantly increased length of hospital stay (adjusted mean difference 11.9 days, 95% CI: 8.9–14.8 days) and mortality (crude risk difference 7.3%, 95% CI: 4.3–10.2%).

Conclusions: Respiratory complications following abdominal wall reconstruction are associated with significantly longer hospital stay and increased mortality. We report clinical risk factors that may aid in risk stratification and guide patient optimization prior to elective abdominal wall reconstruction.

Laura K. Tom, MD
Plastic Surgery, R5

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Kari A. Keys, MD

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Medical School: Yale University
Research Interests: Patient reported outcomes, cost analysis

IMPLANT–ASSOCIATED COMPLICATIONS OF THE STAGED AUTOLOGOUS BREAST RECONSTRUCTION PATHWAY: A SINGLE CENTER'S EXPERIENCE

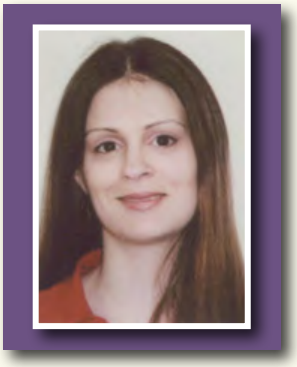
Tom LK, LoMonaco JC, Chong HJ, Colohan SM, Louie O, Said HK, Neligan PC, Gougoutas AJ

Background: The staged autologous (SA) breast reconstruction paradigm refers to the temporary placement of a tissue expander at the time of mastectomy as an intermediate, first stage reconstruction. While this paradigm may preserve mastectomy skin in patients requiring post–mastectomy–radiation therapy (PMRT), it also carries with it all potential prosthetic complications, some of which may delay adjuvant cancer therapies. This study aims to determine the rate of these implant–associated complications.

Methods: All patients who underwent SA reconstruction at our institution between 2011–2014 were retrospectively identified. Outcome measures included rates of implant–associated complications, preservation of existing mastectomy skin envelope and delay of adjuvant therapies. Descriptive statistical analysis was performed.

Results: 70 patients meeting criteria were identified, yielding a total of 103 tissue expanders placed. Rationales for SA reconstruction were as follows: 7/70 (10%) in anticipation of known PMRT, 45/70 (65%) with ambiguous PMRT requirements and 18/70 (25%) because of logistical difficulties precluding immediate reconstruction. 22/70 (31%) of patients required PMRT. 28/70 (41%) of patients experienced at least one complication including delayed wound healing, cellulitis, expander puncture, seroma or expander infection, necessitating expander removal of 6/103 (5.8%) expanders. 2/70 (3%) experienced a delay of adjuvant therapies secondary to expander–associated complications. 4/19 (21%) of patients requiring PMRT required lower pole skin resection despite expander placement.

Conclusions: The SA reconstruction paradigm preserves mastectomy skin in the majority of autologous reconstructions. An overall complication rate of 41%, however, merits the consideration of alternative reconstruction pathways, particularly in patients at high risk of PMRT. Patient discomfort / inconvenience associated with serial expansions, as well as other difficult–to–quantify parameters including consumption of clinic resources should also be considered before adoption of this paradigm.



Galit Ankri–Eliahoo, PhD
Vascular Research Fellow

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Research Interests: Collateral artery development, medical imaging, angiogenesis

REDUCED EXPRESSION OF $p27^{kip1}$ AFFECTS COLLATERALIZATION AND ANGIOGENESIS

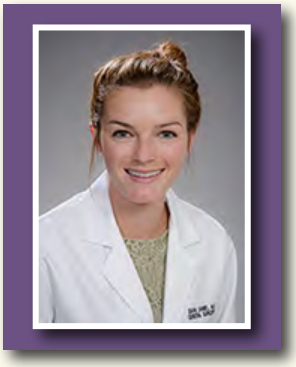
Ankri–Eliahoo G, Fu G, Cox TC, Tang GL

Objectives: $p27^{kip1}$, a gene affecting human response to arterial injury, improves blood flow after hindlimb ischemia through enlargement of novel bridge collateral pathway. We previously showed that improved blood flow was dependent on local arterial wall cells rather than bone marrow derived cells and that $p27^{-/-}$ vascular smooth muscle cells (VSMC) migrate more and express more matrix metalloproteinase 2 (MMP2) mRNA. We hypothesized that genetic dosage of p27 would affect collateralization but not angiogenesis. We also hypothesized that matrix metalloproteinase inhibition would affect $p27^{-/-}$ (ko) blood flow recovery less than $p27^{+/+}$ (wt) mice.

Methods: The left femoral artery of $p27^{+/-}$ (het), ko and wt female mice or ko and wt female mice receiving doxycycline (a nonspecific MMP inhibitor) chow was ligated. The mice were followed with weekly footpad laser Doppler perfusion imaging (LDPI) for 28 days. MicroCT scans were performed on both hindlimbs after sacrifice after injection of intra–arterial Barium sulfate. Movat's pentachrome and WGA lectin staining were performed on wt and ko histological hindlimb sections. Isolated ko, het and wt VSMC were used in cell migration assays without and with an MMP2 specific inhibitor.

Results: Het mice had intermediate blood flow recovery in comparison to ko and wt mice as measured by LDPI. Doxycycline inhibited blood flow recovery in both ko and wt mice, although ko mice still revascularized better than wt mice (0.3±0.01 vs 0.23±0.002 and 0.45±0.04 and 0.31±0.04 without doxycyline respectively). WGA staining showed that calf capillary/muscle fiber ratio was significantly higher in ko mice compared to wt mice (2.38±0.4 vs. 1.67±0.3, $p<0.001$). Collateral wall width was 133±27% higher in ko than in wt mice ($p<0.02$). In vitro studies showed that ko VSMC migration was less affected by MMP2 inhibition than het and wt migration (64.5±2.7 vs 39±4.7 and 31±2.5 and 91±12 vs 58±10, and 60±11 without MMP2 inhibitor respectively).

Conclusions: Reduced expression of p27 increases collateralization and enhances angiogenesis. This effect may be secondary to increased MMP2 expression with decreased p27 dose.



Sara K. Daniel, MD
General Surgery, R1

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Faculty Mentor
Venu G. Pillarisetty, MD

SMOOTH MUSCLE ACTIN EXPRESSION BY MYOFIBROBLASTS IN PANCREATIC CANCER CORRELATES WITH DENSITY OF IMMUNE INFILTRATE AND TUMOR HYPOXIA FOLLOWING NEOADJUVANT THERAPY

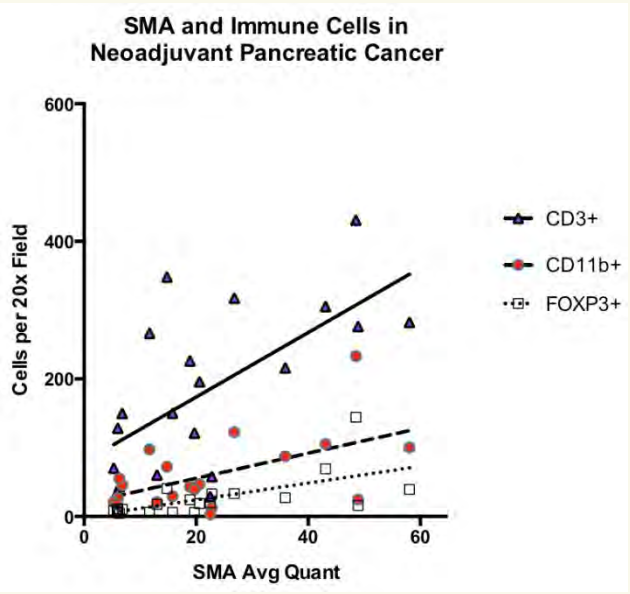
Daniel SK, Jalikis F, Jiang Y, Jiang X, Chang JH, Pillarisetty VG

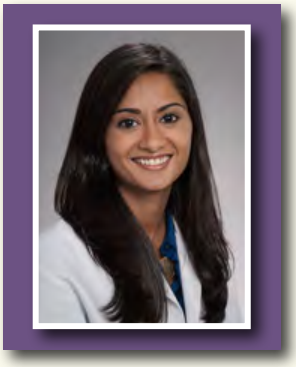
Background: Elucidation of the cancer–stroma interaction may hold the key for treating pancreatic ductal adenocarcinoma (PDA), one of the most rapidly lethal human cancers. Previous studies have demonstrated that the tumor microenvironment, composed of immune cells, myofibroblasts and extracellular matrix, plays a role in cancer development, progression and response to treatment. In addition, hypoxia, a defining feature of PDA, contributes to tumor progression. Successful multimodal neoadjuvant therapy has been shown to alter the immunoregulatory balance of the tumor microenvironment. We aimed to determine the correlation between myofibroblast density, immune cell infiltrate and tumor–induced hypoxia in PDA following neoadjuvant therapy.

Methods: We performed immunohistochemistry (IHC) for alpha smooth muscle actin (SMA) and hypoxia–inducible factor–1–alpha (HIF–1α) in a set of primary PDA upon which we have previously done an extensive characterization of their immune infiltrate. Samples included both, untreated (n=18) and neoadjuvant–treated cancers (n=20). Results were interpreted using a pathologist–graded visual score, as well as computer–assisted image analysis.

Results: Stromal SMA expression in PDA was moderate (n=13) to high (n=14) in the majority of the 38 cases. Quantification of SMA expression using image capture and analysis software strongly correlated with visual SMA scoring ($r=0.83$, $p<0.0001$). A direct relationship between nuclear HIF–1α expression by carcinoma cells and SMA expression by stromal myofibroblasts was noted. In addition, there was a tight correlation between SMA and CD3 (T cells; $r=0.64$, $p=0.003$), FOXP3 (regulatory T cells; $r=0.62$, $p=0.004$), and CD11b (myeloid cells; $r=0.55$, $p=0.01$) in neoadjuvant treated tumors.

Conclusions: Expression of SMA in stromal myofibroblasts in PDA following neoadjuvant therapy correlates with hypoxia and induction of a broad immune infiltrate including large numbers of potentially immunosuppressive regulatory T cells and myeloid cells. Stromal characteristics and the balance between inflammatory and regulatory signaling may be important in determining response to neoadjuvant therapy.





Sarasi K. Desikan, MD
Vascular Surgery, R3

Faculty Mentor
Niten Singh, MD

Hometown: Little Rock, AR
Medical School: University of Arkansas for Medical Sciences
Research Interests: Treatment of ruptured aortic aneurysms, vascular surgery education

THE INCIDENCE OF ISCHEMIC COLITIS AFTER REPAIR OF RUPTURED ABDOMINAL AORTIC ANEURYSMS IS DECREASING IN THE ENDOVASCULAR ERA

Desikan SK, Singh N, Steele SR, Tran N, Quiroga E, Danaher P, Garland BT, Starnes BW

Background: Ischemic colitis (IC) is a well–described complication of ruptured abdominal aortic aneurysms (rAAA). The purpose of this study was to compare the incidence of IC in patients with rAAA undergoing open (OR) vs. endovascular aneurysm repair (EVAR) at a single institution. In addition, we analyzed the incidence of ischemic colitis pre– and post– implementation of a formal rupture AAA protocol (rEVAR protocol).

Methods: A retrospective analysis of prospectively collected data on all patients presenting with rAAA to our institution between Jan 2002 and Oct 2013 was performed. Variables were analyzed for association with IC. Comparisons were made using Pearson's chi–squared test or Fisher exact test for categorical variables, Student t–test for continuous variables, and logistic regression. Significance was set at $p<o.o5$.

Results: 303 patients with rAAA presented over the 10 year study period. 191 patients underwent open repair and 89 patients underwent endovascular repair. 23 patients died either in the emergency department, en route to the operating room, or after choosing comfort care. Predictive factors for IC on univariate analysis included EBL, corresponding need for resuscitation, and duration of procedure. Of patients who underwent open repair, the rate of ischemic colitis was 21% (40/191). This was significantly higher than patients who underwent EVAR, 7% (6/89), $p<0.05$. Implementation of our formal rEVAR protocol decreased the incidence of IC significantly from 37% (36/97) to 6% (10/157), $p<0.001$. On multivariate analysis, duration of operation and implementation of the rEVAR protocol were independently associated with IC. The type of intervention did not influence 30 –day mortality in patients with IC. However, only 17% (1/6) of patients who had IC following EVAR required colectomy vs. 48% (19/40) of patients with IC following OR ($p=0.21$).

Conclusions: The incidence of ischemic colitis has decreased significantly in the endovascular era, but continues to portend a poor prognosis. Implementation of a formal, multidisciplinary rEVAR protocol in our institution was associated with a decrease in incidence of IC.

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NOTES

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

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