DEPARTMENT OF SURGERY
THE OHIO STATE UNIVERSITY WEXNER MEDICAL CENTER


# 26th Annual Department of Surgery Research Conference

Thursday, May 13, 2021

The Ohio State University
Wexner Medical Center

Welcome to the 26th annual (and second virtual) Ohio State University Department of Surgery Research Conference! This conference is designed to bring students, residents, fellows, faculty and guests together to share and discuss results of research relevant to surgery. It's also an opportunity for a variety of students training with faculty in the Department of Surgery (DOS)—including medical students, residents, graduate students and postdoctoral research trainees—to develop their scientific communication skills.

Each year, the Department of Surgery invites a leader in surgery to visit The Ohio State University and get to know the students and faculty in the department through a variety of activities, including participation as a faculty judge at the annual DOS Research Conference. This year, we are delighted to welcome Martha Zeiger, MD, FACS, director of the Surgical Oncology Program with the National Cancer Institute at the National Institutes of Health in Bethesda, Maryland, as our guest.

We received a number of exceptional abstract submissions this year, reflecting a broad collection of basic/translational, clinical, health services and surgical education research topics. Faculty members of the Department of Surgery reviewed and scored the abstracts and made selections for oral and poster presentations based on the quality of the science, novelty and diversity of the topic. Several of the conference presenters are either currently enrolled in or graduates of the College of Medicine Master of Medical Science program or other Ohio State advanced degree programs. Some of the presenters are current or former National Institutes of Health T32-supported research trainees.

Again, welcome. We hope these conference interactions will stimulate new ideas, projects and collaborations.

Ginny L. Bumgardner, MD, PhD
The Ohio State University
Associate Dean for Research Education
Professor of Surgery
Comprehensive Transplant Center
Director, DOS Research Training Program
Director, Master of Medical Science Program
Program Director/PI, NIH T32 AI106704 “Advanced Research Training in Immunology for Surgical Trainees”
Program Director/PI, NIH NCATS TL1TR002735







**Martha Zeiger, MD, FACS**

Martha Zeiger, MD, FACS, is an internationally renowned endocrine surgeon and scientist who has been a leader in developing molecular diagnostics for thyroid cancer. She completed her undergraduate degree at Brown University and her medical degree at the Robert Larner College of Medicine at the University of Vermont. Dr. Zeiger did her surgical training at Maine Medical Center and her surgical oncology fellowship at the NCI/NIH. Prior to joining academia, Dr. Zeiger spent six years in the U.S. Navy as a general medical officer, commander and surgeon in San Diego, Hawaii and Bethesda, Maryland.

In 1993, Dr. Zeiger joined the faculty at the Johns Hopkins School of Medicine, where she established a busy endocrine surgery section, endocrine surgery fellowship and directed an NIH-funded molecular biology laboratory. At Johns Hopkins, she held the position of associate dean for Postdoctoral Affairs. She left Johns Hopkins in 2017 to become the S. Hurt Watts Professor and Chair of the Department of Surgery at the University of Virginia. In 2019, Dr. Zeiger received the Braverman Distinguished Award from the American Thyroid Association (ATA) as someone who has “demonstrated excellence and passion for mentoring fellows, students and junior faculty and has a long history of productive thyroid research.” That same year, Dr. Zeiger served as president of the ATA. She was also president of the American Association of Endocrine Surgeons. Dr. Zeiger is currently the director of the Surgical Oncology Program at the National Cancer Institute with the National Institutes of Health.

Her research focuses on hTERT gene expression regulation, molecular marker diagnostic panel development and molecular biological aspects of thyroid cancer development. Dr. Zeiger also leads a team studying and designing future pathways for the professional development of surgeon-scientists in the United States.

AGENDA

Virtual Event via Zoom | Thursday, May 13

## Welcome and Introduction of Visiting Professor

8 a.m.

Timothy Pawlik, MD, PhD, MPH
Professor and Chair, Department of Surgery
The Urban Meyer III and Shelley Meyer Chair for Cancer Research Surgeon in Chief

## Introduction to the Conference

Ginny L. Bumgardner, MD, PhD
Professor of Surgery, Division of Transplantation
Associate Dean for Research Education, The Ohio State University College of Medicine
Director, Master of Medical Science Program
Director, Department of Surgery Research Training Program

## Judges

Martha Zeiger, MD, FACS, Director of the Surgical Oncology Program, NCI/NIH
Matthew Kalady, MD, Professor of Surgery, Ohio State Department of Surgery
Carrie Sims, MD, PhD, Professor of Surgery, Ohio State Department of Surgery
Hua Zhu, PhD, Professor of Surgery, Ohio State Department of Surgery

**Moderator:** Sessions 1 and 2 moderated by Ginny L. Bumgardner, MD, PhD

Biographies of the conference presenters begin on page 53.

## Session I: Oral Presentations

8:10 – 9:15 a.m.

***Differences in Myeloid-Derived Suppressor Cell Populations in Patients With Ulcerated vs. Nonulcerated Melanoma Receiving Immune Checkpoint Blockade.*** **Steven Sun, MD, MS** – Faculty Advisor: William Carson III, MD
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***Does Delay to Surgery Impact Sentinel Lymph Node Status Among Patients With Melanoma?*** **D. Brock Hewitt, MD, MPH, MS** – Faculty Advisor: Carlo Contreras, MD
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***Phenylacetaldehyde Inhibits Proliferation of Colorectal Cancer by Inducing Cell Cycle Arrest and Apoptosis Through Inhibition of PI3K/AKT/mTOR Pathways.*** **Cheng Kong, MS** – Faculty Advisor: Matthew Kalady, MD
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***Clinical Outcomes of Retroperitoneal Sarcoma Resection Requiring Vascular Reconstruction.*** ***Emma Clark, MD, and*** **Ammu Vijayakumar, MD, MS** – Faculty Advisors: Jean Starr, MD, and Valerie Grignol, MD
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***Tumor Necrosis Impacts Prognosis of Patients Undergoing Resection for T1 Intrahepatic Cholangiocarcinoma: Implications for Modification of 8th AJCC T classification.*** **Diamantis Tsilimigras, MD** – Faculty Advisor: Timothy Pawlik, MD, PhD, MPH
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***Real-Time Monitoring of the Patient Experience During Neoadjuvant Therapy Using a Customized Smartphone Application: Proof of Feasibility.*** **Christina Monsour, BS** – Faculty Advisor: Jordan Cloyd, MD
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## Break

9:15 – 9:30 a.m.

## Session II: Oral Presentations

9:30 – 10:30 a.m.

***Establishing the Minimal Clinically Important Difference for the Hernia-Related Quality of Life Survey (HerQLes).*** **Savannah Renshaw, BSPH** – Faculty Advisor: Benjamin Poulose, MD, MPH
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***Embryologic Origins of Ascending Aortic Aneurysms Associated With Notch1 Haploinsufficiency.*** **Ruth Ackah, MD** – Faculty Advisor: Vidu Garg, MD
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***Impact of MG53 in Wound Healing Following Muscle Injury.*** **Dathe Benissan-Messan, MD, MS** – Faculty Advisor: Jianjie Ma, PhD
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***MG53-Mediated Control of REDD2 Plays Important Roles in Exercise-Mediated Activation of Autophagy in Skeletal Muscle, and Compromised MG53/REDD2 Signaling Contributes to Age-Related Decline of Muscle Function.*** **Kyoung-Han Choi, PhD** – Faculty Advisors: Hua Zhu, PhD; Jae-Kyun Ko, PhD; and Jianjie Ma, PhD
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***Obesity Is Associated With Increased Mortality Following Admission to the ICU With Surgical Sepsis.*** **Anahita Jalilvand, MD, PhD** – Faculty Advisor: Jonathan Wisler, MD, MS
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***NETosis Is Required for S100A8/A9-Induced Granulopoiesis After Myocardial Infarction.*** **Gopalkrishna Sreejit, PhD** – Faculty Advisor: Prabhakara Nagareddy, PhD
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## Judged Posters

***Effect of a Resident-Student Coaching Program: A Durable Method to Enhance Surgical Clerkship Students' Practice of Health Systems Science.*** **Ruth Ackah, MD** – Faculty Advisors: Amber Traugott, MD, and Xiaodong Chen, PhD
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***Do All High-Volume Surgeons at High-Volume Hospitals Have Optimal Outcomes Following Elective High-Risk Operations?*** **Christopher Aquina, MD, MPH** – Faculty Advisor: Aslam Ejaz, MD, MPH
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***United States National Trends in the Use of Neoadjuvant Therapy Prior to Cancer Surgery.*** **Christopher Aquina, MD, MPH** – Faculty Advisor: Jordan Cloyd, MD
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***Neutrophil Pyroptosis Delays Corneal Wound Healing.*** **Peng Chen, MD, PhD** – Faculty Advisor: Hua Zhu, PhD
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***Early Recruitment of Neutrophils to the Heart Is Orchestrated by Catecholamine Demargination.*** **Albert Dahdah, PhD** – Faculty Advisor: Prabhakara Nagareddy, PhD
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***Association of Medicaid Eligibility With Timing To and Outcomes From Surgery for Diverticulitis.*** **Adrian Diaz, MD, MPH** – Faculty Advisor: Hari Nathan, MD, PhD, University of Michigan
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***Legal Determinants of Health: Historic Housing Policy and Modern Day Surgical Outcomes. Adrian Diaz, MD, MPH*** – Faculty Advisor: Andrew Ibrahim, MD, MSc, University of Michigan
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***Rural Hospitals Are Not Associated With Worse Postoperative Outcomes for Colon Cancer.*** **Adrian Diaz, MD, MPH** – Faculty Advisor: Timothy Pawlik, MD, PhD, MPH
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***Impact of Medicaid Expansion on Pancreatic Cancer Care: A Difference-in-Difference Analysis.*** **Ahmad Hamad, MD** – Faculty Advisor: Allan Tsung, MD
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***Outcomes Following a Rectal and/or Simultaneous vs. Liver-First Approach for Synchronous Rectal Liver Metastasis: An Analysis of the US Rectal Cancer Consortium.*** **Ahmad Hamad, MD** – Faculty Advisor: Aslam Ejaz, MD, MPH
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***Trends in Achieving Optimal Outcomes Following Complex Gastrointestinal Surgery: Are Patients More Likely to Achieve a Textbook Outcome?*** **Madison Hyer, MS** – Faculty Advisor: Timothy Pawlik, MD, PhD, MPH
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***Cigarette Smoking Aggravates Atherosclerosis Through Induction of S100A8/A9 Protein Release From Neutrophils.*** **Robert Jaggers, MS** – Faculty Advisor: Prabhakara Nagareddy, PhD
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***Impact of Post-Discharge Phone Calls on Non-Urgent Hospital Returns < 30 Days Following Primary Bariatric Surgery.*** **Dahlia Kenawy, MD** – Faculty Advisor: Sabrena Noria, MD, PhD
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***Myocardial Infarction Induces Mitochondrial tsRNAs Associating With Reduced RNH1.*** **Jongsoo Kim, PhD** – Faculty Advisor: Hua Zhu, PhD
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***MG53 Activates Wnt Signaling Pathway in Injured Limbal Stem Cell.*** **Kyung Lee, PhD** – Faculty Advisors: Hua Zhu, PhD; Jae-Kyun Ko, PhD; and Jianjie Ma, PhD
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***Robotic Surgery Does Not Improve Oncologic Quality of Proctectomy in Obese Population.*** **Max Magallanes, MD** – Faculty Advisor: Syed Husain, MBBS
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***Room for Improvement: A Single-Institution Experience With the Trephination (Gip's) Procedure for Treating Pediatric Pilonidal Disease.*** **Gregory Metzger, MD, MS** – Faculty Advisors: Katherine Deans, MD, MHSc, and Peter Minneci, MD, MHSc
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***Complications After Complex Gastrointestinal Cancer Surgery: Benefits and Costs Associated With Inter-Hospital Transfer Among Medicare Beneficiaries.*** **Priya Pathak, MBBS, MPH** – Faculty Advisor: Timothy Pawlik, MD, PhD, MPH
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***Investigating Length of Stay Per Total Body Surface Area Relative to Burn Mechanism Within the Pediatric Injury Quality Improvement Collaborative.*** **Kelli Patterson, DO, MS** – Faculty Advisor: Rajan Thakkar, MD
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***Role of Insurance in Postoperative Outcomes and Quality of Life Following Ventral Hernia Repair.*** **Savannah Renshaw, BSPH** – Faculty Advisor: Courtney Collins, MD, MS
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26TH ANNUAL RESEARCH CONFERENCE

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***Clinical Burden of ICU Admissions in Patients With Previous Resection of Pancreatic Cancer.*** **Daniel Rice, BS** – Faculty Advisor: Timothy Pawlik, MD, PhD, MPH
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***Near-Infrared Autofluorescence of Adrenal Glands.*** **Steven Scoville, MD, PhD** – Faculty Advisors: John Phay, MD; Barbra Miller, MD; and Priya Dedhia, MD, PhD
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***Aggressive Attempts at Limb Salvage Are Associated With Improved Survival.*** **Carly Sobol, BS** – Faculty Advisor: Michael Go, MD, MS
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***An Analysis of Five-Year Outcomes of Drug-Coated Endovascular Interventions.*** **Lauren Taylor, BS** – Faculty Advisors: Timur Sarac, MD; Said Atway, DPM; and Michael Go, MD, MS
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***Intraoperative Patient Safety Teaching in Laparoscopic Cholecystectomy: Eliciting Teaching Opportunities and Development of a Rubric.*** **Michael Villarreal, MD, MBA** – Faculty Advisor: Emily Huang, MD, MAEd
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***Predictors of Successful Long-Term Follow-Up After Ventral Hernia Repair.*** **Michael Villarreal, MD, MBA** – Faculty Advisor: Benjamin Poulose MD, MPH
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***Real-World Performance of the Hernia Recurrence Inventory to Measure Recurrence After Ventral Hernia Repair.*** **Michael Villarreal, MD, MBA** – Faculty Advisor: Benjamin Poulose MD, MPH
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***Long Non-Coding RNA Camirt Plays a Sentinel Role in Aging-Related Heart Failure Via Interaction With Phb2 to Modulate Mitophagy Signaling in the Heart.*** **Xiaoliang Wang, MD, PhD** – Faculty Advisor: Chuanxi Cai, PhD
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***The Role of Mitsugumin 29 in Skeletal Muscle Regeneration.*** **Frank Yi, BS** – Faculty Advisors: Jianjie Ma, PhD, and Hua Zhu, PhD
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## Research Conference Concluding Remarks

10:30 a.m.

Ginny L. Bumgardner, MD, PhD

# Abstracts
## Oral Session I



## Differences in Myeloid-Derived Suppressor Cell Populations in Patients With Ulcerated vs Nonulcerated Melanoma Receiving Immune Checkpoint Blockade

*Steven H. Sun,* MD, MS; Gabriella Lapurga; Brooke Benner, PhD; Himanshu Savardekar; Mallory DiVincenzo, DVM; David Abood; Andrew Stiff, MD, PhD; Megan Duggan, PhD; Erin Nagle; J. Harrison Howard, MD; Manisha H. Shah, MD; Kari L. Kendra, MD; William E. Carson III, MD*

**Introduction:** Myeloid derived suppressor cells (MDSC) are a subset of cells that inhibit innate anti-tumor immunity and promote an immunosuppressive tumor microenvironment. MDSC quantity correlates with tumor burden and survival in cancer patients and contributes to immune therapy resistance. The purpose of this study is to highlight differences in MDSC populations in patients with melanoma as they receive immune checkpoint therapy for advanced disease.

**Methods:** Patients with melanoma (n=128; 84 non-ulcerated, 44 ulcerated) were consented to participate in an IRB-approved clinical registry and provided blood samples. Sample timepoints were at the initiation of immune checkpoint therapy, and prior to receiving cycles 2 and 3. Samples were processed and analyzed for MDSC and subsets, monocytic (M-MDSC), granulocytic (PMN-MDSC), via flow cytometry. Patient demographics were compiled and correlated to the flow cytometry data. Statistical analysis was performed using unpaired and paired t tests across and within patient cohorts.

**Results:** Total MDSC percentages increased following the first cycle of immune checkpoint blockade (10 to 25%, p<0.0001). MDSC levels in patients who had complete or partial response began to taper (10% to 26% to 25%), whereas MDSC levels in those who had progressive disease on immunotherapy continued to increase (11% to 16% to 19%). Collectively, PMN-MDSC decreased significantly after immunotherapy (19% to 10%, p=0.0423). When stratified by ulcerated status of the primary tumor, patients with non-ulcerated melanoma had a significant decrease in PMN-MDSC after two cycles of immune checkpoint blockade (BL: 17% to BC3: 7%, p=0.0024), whereas this was not seen in patients with ulcerated melanoma (15% to 12%, p=0.79). Patients with a history of an ulcerated primary and progression of metastatic disease while on immunotherapy had a significant increase in M-MDSC over the course of immunotherapy (BL: 30% to BC3: 57%, p=0.0023), which was not seen in patients with non-ulcerated primaries (BL: 40% to BC3: 39%, p=0.25), or those with clinical response to immunotherapy.

**Conclusions:** MDSC levels stabilize in responders but continue to rise in non-responders. Differences in MDSC levels are seen between those with ulcerated vs non-ulcerated tumors. Thus, the growth signals that underlie the ulcerated state may also affect the immune profile during immune therapy.

**Supported by the National Institute of Allergy and Infectious Diseases of the National Institutes of Health under Award Number T32AI106704 (Advanced Research Training in Immunology for Surgery Trainees), August 2019 – July 2021.*

# Does Delay to Surgery Impact Sentinel Lymph Node Status Among Patients With Melanoma?

*D. Brock Hewitt, MD, MPH, MS; Joal D. Beane, MD; Valerie P. Grignol, MD; Carlo M. Contreras, MD*

**Introduction:** Following melanoma diagnosis, various factors can delay therapy, including the COVID-19 pandemic. In this study, we examine the significance of surgical delay on sentinel lymph node (SLN) status in melanoma patients.

**Methods:** Using the National Cancer Database, we examined surgical delay, defined as time from biopsy to surgical excision, for patients diagnosed with cutaneous melanoma who underwent tumor resection and SLN biopsy. Patients with clinically positive nodes were excluded. Logistic regression models were constructed to adjust for pertinent clinical factors.

**Results:** From 2012-2017, 21,153 patients were included and 21.2% (n=4,486) experienced a surgical delay >45 days. Patients experiencing prolonged surgical delay were older (age>75 years), lived farther from their reporting hospital, had Medicaid or were uninsured, or had multiple comorbidities (all P<0.05). Metastatic SLN were more likely in younger patients (age<55), ulcerated tumors, and tumors ≥ 1mm (P>0.001). In adjusted analyses, the odds of SLN metastasis increased by 1% per day of surgical delay (OR 1.01; 95%CI 1.00-1.01; P=0.003) and by 19% for surgical delay >45 days (OR 1.19; 95%CI 1.02-1.39; P=0.026). Surgical delay >45 days was associated with increased risk of SLN metastasis in the following scenarios: non-ulcerated tumors (OR 1.23; 95%CI 1.04-1.46; P=0.017), age 65-74 years (OR 1.46; 95%CI 1.06-2.02; P=0.019), or thickness 1.00-1.99 mm (OR 1.27; 95%CI 1.00-1.60; P=0.048).

**Conclusions:** Tumor ulceration, thickness, and patient age confer increased risk of SLN metastasis when surgical delay occurs. In light of COVID-19 related delays in diagnosis and treatment, particular patients appear to benefit from timely SLN biopsy.



26TH ANNUAL RESEARCH CONFERENCE

# Phenylacetaldehyde Inhibits Proliferation of Colorectal Cancer by Inducing Cell Cycle Arrest and Apoptosis Through Inhibition of PI3K/AKT/mTOR Pathways

*Cheng Kong, MS; Sylvain Ferrandon, PhD; Matthew F. Kalady, MD*

**Introduction:** Phenylacetaldehyde (PAA), a product of phenylalanine metabolism, is secreted by microbiota and has been shown to have anticancer properties in breast cancer. As the colorectal microbiome is diverse and influences the colorectal epithelium, we hypothesized that PAA could impede colorectal cancer (CRC).

**Methods:** CRC cell lines and CRC-patient derived organoids were cultured and treated with PAA, then evaluated for viability, proliferation, cell cycle distribution, and cell death *in vitro*. We interrogated the mechanistic pathways induced by PAA treatment using qPCR arrays and western blot.

**Results:** PAA inhibits the viability and colony formation of CRC cell lines and organoids in a concentration-dependent manner. We found that 50uM PAA decreases viability by 20% and 70% in HCT116 and RKO, respectively. In two distinct patient-derived organoid lines, we observed a decrease of 30% and 70% of viability. We highlighted that PAA treatment induces a G1 cell cycle arrest. After three days of treatment, PAA at a concentration of 50uM induces 10% and 30% of cell death in HCT116 and RKO, respectively. Investigation on patient-derived organoids showed that PAA inhibits CRC progression by regulating PI3K/AKT/mTOR pathways.

**Conclusions:** The naturally occurring metabolite PAA inhibits CRC and increases cell death through the PI3K/AKT/mTOR pathways. This novel finding warrants further exploration as a potential therapeutic agent.

# Clinical Outcomes of Retroperitoneal Sarcoma Resection Requiring Vascular Reconstruction

*Ammu Vijayakumar, MD, MS; Emma Clark, MS; Joal Beane, MD; Jean Starr, MD; Valerie Grignol, MD*

**Introduction:** Retroperitoneal sarcomas frequently present with multi-organ involvement and invasion including major vasculature. The oncologic benefit of a complex resection must be balanced against morbidity. We sought to evaluate the outcomes of vascular reconstruction in patients with retroperitoneal sarcomas.

**Methods:** An institutional database was used to identify patients with retroperitoneal sarcomas and vascular involvement (VI) between 1997-2020. Patients who underwent vascular resection and reconstruction (VRR) were compared to those who underwent tumor resection only without reconstruction (TRO). Chi-squared and two-tailed t-tests were used to compare categorical and continuous variables, respectively.

**Results:** 66 patients were identified to have VI with or without vascular reconstruction. Forty-six had TRO and 20 patients underwent VRR. Vessels resected and reconstructed were inferior vena cava (n=2), aorta (n=6), iliacs (n=14), renal (n=10) and visceral (n=2). Significantly more patients in the VRR group had leiomyosarcoma as their histologic subtype (65 vs 24%, p=0.004), the next most common histology was well-differentiated liposarcoma. VRR patients had significantly smaller tumors than TRO (9.3 cm vs 19 cm, p<0.05). Graft patency was 100% on long term follow-up (mean follow-up 35 months [0-205]). Post-operative complications were few (2 VRR vs 4 TRO, p=0.29) however, intraoperative blood transfusion was higher in the VRR group (3.4 pRBCs VRR vs 1.8 pRBCs TRO, p=0.098). There was no difference between the VRR and TRO groups regarding R0/R1 resection (R0 p=0.402, R1 p=0.594). Overall survival was 46.8 months [0-205 months] and recurrence free survival was 19.9 months [1.3-79.2 months]. There was no significant difference in survival between the groups (p=0.59).

**Conclusions:** Vascular reconstruction affords long term patency of grafts with similar oncologic outcomes to those without reconstruction.





# Tumor Necrosis Impacts Prognosis of Patients Undergoing Resection for T1 Intrahepatic Cholangiocarcinoma: Implications for Modification of 8th AJCC T Classification

*Diamantis I. Tsilimigras, MD; J. Madison Hyer, MS; Alfredo Guglielmi, MD; Luca Aldrighetti, MD; Matthew Weiss, MD; Todd W. Bauer, MD; Sorin Alexandrescu, MD; George A. Poultsides, MD; Shishir K. Maithel, MD; Hugo P. Marques, MD; Guillaume Martel, MD; Carlo Pulitano, MD; Feng Shen, MD; Olivier Soubrane, MD; Bas Groot Koerkamp, MD; Itaru Endo, MD, PhD; Timothy M. Pawlik, MD, PhD, MPH*

**Introduction:** Tumor necrosis has been associated with unfavorable prognosis among patients with hepatocellular carcinoma and hilar cholangiocarcinoma. The prognostic impact of tumor necrosis among patients undergoing resection for intrahepatic cholangiocarcinoma (ICC) remains ill-defined.

**Methods:** Patients who underwent curative-intent resection for ICC between 2000-2017 were identified using an international multi-institutional database. The association of tumor necrosis (absent, moderate [<50%] and extensive [≥50%]) with clinicopathologic characteristics and the impact on overall (OS) and recurrence-free survival (RFS) were examined.

**Results:** Among 757 patients who underwent resection for ICC, tumor necrosis was present in 384 (50.7%) patients (no necrosis: n=373, 49.3%, < 50% necrosis: n=291, 38.4%, ≥ 50% necrosis: n=93, 12.3%). Tumor necrosis was associated with unfavorable clinicopathologic characteristics, including tumor size > 5 cm (necrosis vs no necrosis; 67.4% vs 57.6%), CA19-9 > 200 ng/mL (35.5% vs 26.0%), liver capsule involvement (43.7% vs 19.8%) and poor/undifferentiated tumor grade (32.8% vs 21.8%) (all p<0.05). Tumor necrosis was associated with worse OS (5-year OS; no necrosis: 39.3% vs < 50% necrosis: 34.7% and ≥ 50% necrosis: 24.0%, p=0.03) and RFS (5-year RFS: no necrosis: 25.7% vs < 50% necrosis: 13.9% and ≥ 50% necrosis: 18.8%, p<0.001). After stratifying by T stage, tumor necrosis was able to further stratify prognosis among patients with T1a ICC (5-year RFS; T1a & no necrosis: 46.7% vs T1a & necrosis: 36.1%, p=0.02), and T1b ICC (5-year RFS; T1b & no necrosis: 31.1% vs T1b & necrosis: 11.2%, p=0.006), but was not associated with outcomes among patients with more advanced T2-T4 disease. Patients with T1a ICC & tumor necrosis had similar RFS as individuals with T1b ICC and no tumor necrosis (5-year RFS; T1a & necrosis: 36.1% vs T1b & no necrosis: 31.1%, p=0.66) (Figure)

**Conclusions:** Tumor necrosis was associated with worse prognosis among patients with T1 ICC. A modified AJCC T classification that incorporates tumor necrosis for T1 ICC should be considered to further stratify outcomes of patients with early T-stage ICC.

# Real-Time Monitoring of the Patient Experience During Neoadjuvant Therapy Using a Customized Smartphone Application: Proof of Feasibility

*Christina Monsour, BS; Angela Sarna, BS; Lena Schreiber, MS; Emily Huang, MD; Des D'Souza, MD; Peter Kneuertz, MD; Debasish Sundi, MD; Heena Santry, MD; Jordan Cloyd, MD*

**Introduction:** The delivery of non-surgical cancer therapies prior to surgical resection, known as neoadjuvant therapy (NT), is increasing for most solid organ cancers. Limited data is available on the patient experience or health-related quality of life (hrQOL) of patients undergoing NT. Given the limitations of traditional paper-based surveys administered at regularly scheduled physician appointments, we customized a smartphone app to prospectively measure the patient experience during NT.

**Methods:** A customized version of the SeamlessMD mobile application was developed with engagement from patient and physician stakeholders. Participants were eligible if >18, English-speaking, owned a smartphone, and had not yet initiated NT. All recruitment, consenting, downloading/configuring the app, and patient counseling occurred remotely by research personnel. Previously validated surveys were "pushed" directly through the app: hrQOL was measured using FACT at baseline and monthly while surveys measuring treatment burden and care coordination were collected once. Participants were also encouraged to use the mood tracker, symptom tracker, and free-text journaling as often as possible. The study period continued until surgery was performed or cancer was determined inoperable.

**Results:** Between September 2020 and February 2021, of the 99 patients screened, 86 were contacted, and 45 enrolled in the study. The mean age was 61, and 51% were female. The most common cancer types were 44% hepatobiliary, 38% colorectal, 13% esophageal, 2% bladder, 2% gastric. Among all participants, hrQOL surveys were completed at baseline 32/44 (73%), one month 26/35 (74%), two months 11/26 (42%), and three months 5/20 (25%). 38 patients (84%) utilized the free-text journaling at least once and the average number of journal entries per participant was 12. Despite the observational nature of the study, positive therapeutic aspects of the program (journaling, education, feeling not alone, etc.) were frequently cited at completion of the study.

**Conclusions:** Preliminary results from this prospective observational cohort study suggest that real-time monitoring of the patient experience during NT can be obtained using a customized smartphone application. Modifications of the study protocol to be compliant with Covid-19 requirements enabled patient enrollment and data collection to be feasible entirely remotely. Analysis of the mature data should clarify opportunities to improve the patient experience and hrQOL during NT.



26TH ANNUAL RESEARCH CONFERENCE

# Abstracts
## Oral Session II

# Establishing the Minimal Clinically Important Difference for the Hernia-Related Quality of Life Survey (HerQLes)

*Savannah Renshaw, BSPH; Anand Gupta, MBBS, MPH; Benjamin Poulose, MD, MPH*

**Introduction:** The Hernia Related Quality of Life Survey (HerQLes) is widely used to assess quality of life (QoL) after hernia repair. The minimal clinically important difference (MCID) of this survey is unknown. This study aimed to establish the MCID for HerQLes.

**Methods:** Using data collected between 2013-2019 from the Americas Hernia Society Quality Collaborative, we calculated HerQLes summary scores (0=worst QoL, 100=best QoL) for ventral hernia repair (VHR) patients preoperatively and 1-year after operation. MCID was calculated using the distribution-based method of standard error of measurement. Multivariate regression was used to identify factors associated with exceeding MCID at 1 year, marking a significant QoL increase.

**Results:** 1,817 patients were identified (50.2% female), with mean age 57.9 (± 12.4) undergoing open (75.1%), laparoscopic (7.2%), robotic (12.1%), and combined (5.6%) approaches. MCID was identified as a change in HerQLes of at least 15.6 points. Mean 1-year post-op score was 74.9 (SD ± 26.2), which exceeded the MCID threshold ($p<0.001$) compared to mean baseline score of 46.1 (SD ± 27.8). Patients with lower baseline QoL showed higher gains 1 year after VHR (Table). Patients with increasing hernia width had higher odds of exceeding MCID at 1 year post-op (OR 1.04 (95% CI: 1.02, 1.06), $p<0.01$), as did patients with ASA class 4 compared to class 1 (OR 8.9 (95% CI: 1.9, 42.1), $p<0.01$).

**Conclusions:** Using MCID can help identify patients who may significantly improve their QoL after VHR, as well as help power clinical trials with QoL as the primary outcome.





# Embryologic Origins of Ascending Aortic Aneurysms Associated With Notch1 Haploinsufficiency

*Ruth Ackah, MD; Uddalak Majumdar, PhD; Sathiyanarayanan Manivannan, PhD; Patricia McCallinhart, Cody Magnuson, Aaron Trask, Brenda Lilly, Vidu Garg, MD*

**Introduction:** Ascending aortic aneurysms (AscAA) have an annual incidence of 9-16 per 100,000 people and are a leading causes of death in the US. AscAA are associated with aortic dissection and rupture leading to significant morbidity and mortality due to a lack of symptoms and limited non-surgical therapies. AscAA are frequently found with congenital heart defects (CHD), specifically bicuspid aortic valve (BAV) and tetralogy of Fallot (TOF). However, the molecular mechanism of CHD-associated AscAA is poorly understood. Mutations in NOTCH1 have been linked to BAV and TOF and we previously described a novel mouse model in which Notch1 haploinsufficiency is sufficient to cause AscAA. Here, we investigate the embryonic origins of AscAA in this murine model.

**Methods:** To study the role of *Notch1* in AscAA, we utilized *Notch1+/-* mice in a predominantly 129S6 background, as these mice develop pathological evidence of AscAA by 9 months of age with 100% penetrance. Single cell RNA-Seq analysis was performed on the cardiac outflow tract (OFT) from E12.5 *Notch1+/-* and WT littermate embryos to determine if there were abnormalities in SMC development in *Notch1+/-* mice. Atomic force microscopy was used to assess the stiffness of smooth muscle cells isolated from the ascending and descending thoracic aorta.

**Results:** Single cell RNA Seq analysis of the *Notch1+/-* mouse outflow tract identified cardiac cell populations, including endocardial, myocardial, epicardial, mesenchymal and SMCs in WT and *Notch1+/-* OFTs. However, a marked reduction in cell numbers were noted in SMCs and mesenchymal cells in *Notch1+/-* compared to WT. Pseudotime analysis of mesenchymal cells marked by Sox9 demonstrated SMC-differentiation defects in *Notch1+/-* embryos compared to WT. Atomic force microscopy, demonstrated that smooth muscle cells (SMCs) isolated from the ascending and descending aorta of *Notch1+/-* mice display increased stiffness as measured by Young's modulus when compared to wildtype (WT) mice.

**Conclusions:** Our data suggests that differentiation defects of SMC-precursors during development contribute to abnormal SMCs in the *Notch1+/-* adult aorta predisposing to AscAA.

# Impact of MG53 in Wound Healing Following Muscle Injury

*Dathe Benissan-Messan,* MD, MS; Jianjie Ma, PhD*

**Introduction:** Muscle regeneration following injury occurs through Pax7 cells and results in neomyogenesis. TRIM family proteins are known for their anti-inflammatory properties. MG53 in particular, is expressed in skeletal muscles and has previously been demonstrated to have anti-fibrotic properties as well regenerative properties in other wound models. Here, we evaluate the impact of MG53 in the wound environment following volumetric muscle loss injury.

**Methods:** VML surgery consisting in the removal of 20% of the tibialis anterior (TA) muscle of C57BL/6J mice was carried out in MG53 knock out (n=12), MG53 wild type (WT) (n=12) and tPA-MG53 (n=12). Six animals per groups were sacrificed at day 3 and day 7 to evaluate the impact of MG53 in the acute wound environment. Histological and biochemical analysis evaluating myokines and cytokine level were conducted. Comparison of groups were carried out using t-test.

**Results:** A reduced level of fibrosis following muscle injury was associated with an elevated level of MG53. A rise of MG53 following injury was accompanied by an increased in Pax 7 cells noted in all mice genotypes 3 days following injury with a return to baseline levels of Pax 7 cells by day 7 following injury. TGFb levels were the highest in KO animals 3 days following injury and the lowest in tPA-MG53 animal 7 days following injury. Skeletal muscle IL-6 levels were the lowest in tPA-MG53 animals 7days following injury. CD11b level expression was the highest in tPA-MG53 mice at days 3 and 7.

**Conclusions:** The regenerative properties and anti-inflammatory activity of MG53 occurs through a modulation of the wound microenvironment and lead to a modulation of the inflammatory response and a decrease in fibrosis following muscle injury through a TGFb mediated mechanism.

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# MG53-Mediated Control of REDD2 Plays Important Roles in Exercise-Mediated Activation of Autophagy in Skeletal Muscle, and Compromised MG53/REDD2 Signaling Contributes to Age-Related Decline of Muscle Function

*Kyoung-Han Choi, PhD; Ju Hwan Cho, PhD; Jongsoo Kim, PhD; Kyung Eun Lee, PhD; Hua Zhu, PhD; Jae-Kyun Ko, PhD; and Jianjie Ma, PhD*

**Introduction:** Muscle aging is associated with reduced regenerative capacity and progressive accumulation of dysfunctional intracellular proteins and damaged organelles. Exercise can delay muscle aging by inducing metabolic adaptation and autophagy activation, a cellular process whereby damaged intracellular organelles are selectively removed. Elucidating the molecular underpinnings of exercise-induced activation of autophagy and searching for muscle-specific means to improve the quality control mechanisms for skeletal muscle represent an important area of geriatric research. MG53 is a muscle-specific member of the TRIM family protein containing ubiquitin E3-ligase activity with an essential role in cell membrane repair. Here we present novel findings with the identification of REDD2 as an E3-ligase substrate for MG53 that participates in modulation of autophagy in muscle physiology and aging.

**Methods:** We performed biochemical and cellular analyses using real-time PCR, Western blotting, co-immunoprecipitation, and live cell imaging to evaluate the expression levels of REDD2, MG53 and autophagy marker proteins such as LC3 and p62, and detection of MG53-mediated ubiquitination of REDD2 in C2C12 myoblast cells and HEK293 cells. Young wild-type (3-5 month), aged wild-type (24-26 Month), and young *mg53-/-* C57BL/6 mice were used to observe exercise-induced autophagy in muscles. The endurance treadmill exercise was performed at 16 m/min for 3 hours with 5 min rest every 30 min running. After exercise skeletal muscles were collected after recovery and protein extracts were analyzed by Western blotting for MG53, REDD2, LC3 and GAPDH proteins.

**Results:** Biochemical assays showed MG53 can interact with REDD2 and induce ubiquitination and proteasome-dependent degradation of REDD2. In C2C12 cells with knockout of MG53, persistent elevation of REDD2 and excessive accumulation of autophagosomes were observed under starvation condition. High resolution live cell imaging revealed decreased autophagy efflux in cells with overexpression of REDD2 and such effects could be mitigated by co-expression with MG53. When young wild type mice were subjected to endurance running, autophagy activation in skeletal muscle was associated with transient elevation of REDD2 which returned to basal level after exercise. However, the *mg53-/-* mice showed more elevation of REDD2 which sustained over the 24 hr period after exercise. Strikingly, the beneficial effects of exercise on autophagy activation were severely compromised in the *mg53-/-* mice. Similar to the young *mg53-/-* mice, the aged wild type mice showed compromised response to exercise-induced autophagy activation.

**Conclusions:** MG53-mediated control of REDD2 signaling represents a novel physiological component of autophagy activation and execution in skeletal muscle. Targeting MG53/REDD2/autophagy is a potential means to improve muscle function associated with aging or disease.

# Obesity Is Associated With Increased Mortality Following Admission to the ICU With Surgical Sepsis

*Anahita Jalilvand,* MD, PhD; Megan Ireland, BS; Scott Strassels, PhD; Jon Wisler, MD*

**Introduction:** Many large studies have demonstrated a protective association between obesity and survival following sepsis, giving rise to the "obesity paradox" phenomenon. However, the majority of this literature has focused on patients admitted with non-surgical causes of sepsis. Obesity is a well-established risk factor for surgical morbidity. Therefore, the primary objective of this study was to evaluate the association between obesity and mortality following admission to the surgical ICU (SICU) for patients with surgical sepsis.

**Methods:** A retrospective review of all patients admitted to the SICU was conducted at a single tertiary care center between 2014 and 2019 (n=1489). Patients were grouped into obese (BMI ≥ 30 kg/m$^2$, n=810) and non-obese (BMI <30 kg/m$^2$, n=621). Exclusion criteria included BMI <18.5 kg/m2 and SOFA <2. Demographic, comorbidity, and clinical data were compared between groups. Sepsis severity was characterized using SOFA score, vasopressor use and lactate. Respiratory failure, invasive ventilation, renal replacement therapy (RRT), overall and ICU LOS, and 90-day mortality were compared. Cox regression analysis was used to determine independent predictors of 90-day mortality. Multivariable regression was utilized to determine predictors of respiratory failure, need for RRT, and increasing SICU LOS. A p value <0.05 was considered statistically significant.

**Results:** Age and racial composition were comparable between groups. Patients with obesity were more likely to have type II diabetes (T2DM) (35.6% vs 21.4%, p <0.0005) and congestive heart failure (CHF) (10.1% vs 6.6%, p = 0.02) but less likely to present with moderate-severe liver disease (MS-LD) (5.6% vs 8.4%, p = 0.04). The median SOFA was not different between cohorts. Patients with obesity were more likely to experience respiratory failure (75.6% vs 67.5%, p=0.001), require RRT (21.5% vs 11.6%, p<0.0005), and have longer median SICU LOS (8 (3.5-17.5) days vs 6 (2.7-14.5) days, p=0.0003). 90-day mortality was significantly higher in obese patients (33.8% vs 23.8%, p<0.0005). After controlling for age, sex, SOFA, CHF, T2DM, and MS-LD, obesity was associated with a 31% increase in 90-day mortality compared to non-obese patients (HR: 1.3, 95th CI: 1.1 – 1.6), and remained an independent predictor for developing renal failure (OR: 2.3, 95th CI: 1.7-3.1), respiratory failure (OR 1.5, 95th CI: 1.1-1.9) and increasing SICU LOS (β 1.8, 95th CI: 0.3-3.3).

**Conclusion:** Following admission to the SICU, obesity was associated with increased 90-day mortality, incidence of respiratory and renal failure, and ICU LOS after controlling for baseline comorbidities and sepsis severity. This suggests that the obesity paradox may not be applicable within the context of surgical sepsis. Further studies are needed to elucidate the impact of obesity on sepsis-induced immune dysregulation and what implications it has on the management of critically ill surgical patients.

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# NETosis Is Required for S100A8/A9-Induced Granulopoiesis After Myocardial Infarction

*Gopalkrishna Sreejit, PhD; Robert M. Jaggers, MS; Albert Dahdah, PhD; Jillian Johnson, BS; Ahmed Abdel-Latif, PhD; Andrew J. Murphy, PhD*

**Introduction:** Myocardial infarction (MI) provokes a massive systemic inflammatory response characterized by enhanced infiltration of neutrophils to the ischemic heart via granulopoiesis in the bone marrow. We recently discovered that S100A8/A9 is released by infiltrating neutrophils in the infarct to induce granulopoiesis by interacting with TLR4 on naïve neutrophils, priming the NLPR3-inflammasome for release of IL-1β which then leads to increased granulopoiesis. However, the mechanism of S100A8/A9 release from the infiltrating-neutrophils remain unclear. We hypothesized that neutrophils release S100A8/A9 via NETosis, a form of cell-death that involves extrusion of decondensed chromatin along with its entire granular content including S100A8/A9.

**Methods & Results:** To validate this hypothesis we found that neutrophils sorted from mouse heart 24 hours post-MI were enriched for genetic signature for an Nox-independent NETosis, dominated by Padi4. Furthermore, we found a robust increase in citrullination of histone moieties, colocalization of S100A8/A9 with H3Cit, and increased S100A8/A9 levels in the heart as early as 6 hours after MI. Depletion of Padi4 in the mouse myeloid cells by bone marrow transplantation studies was also associated with suppressed granulopoiesis, fewer neutrophils in the blood and heart, and reduced cardiac and serum S100A8/A9 after MI. To validate these findings in humans, we measured various markers of NETosis and found a marked increase in serum double-stranded DNA, MPO (myeloperoxidase) elastase, which paralleled S100A8/A9 levels in STEMI patients from the time of admission through post-revascularization by percutaneous coronary intervention.

**Conclusions:** Taken together we propose that interventions to reduce NETosis and/or S100A8/A9 release particularly during the acute inflammatory phase could represent a departure from the status quo in managing post-MI inflammation and the subsequent heart failure.

# Abstracts
## Judged Posters





## Effect of a Resident-Student Coaching Program: A Durable Method to Enhance Surgical Clerkship Students' Practice of Health Systems Science

*Ruth Ackah, MD; Theresa Wang, MD; Marianna Oppenheimer-Velez, MD, MS; Amber Traugott, MD; Alan Harzman, MD; Amalia Cochran, MD; Xiaodong (Phoenix) Chen, PhD*

**Introduction:** Health Systems Science (HSS) is becoming a pillar of medical education and influencing students' ultimate career interest. However, many barriers challenge medical students' learning and practice of HSS. Thus, we developed a novel resident-student coaching intervention for surgery clerkship students. This study aims to investigate the feasibility of implementing a resident-coaching intervention designed to improve students' HSS mastery during the surgery clerkship.

**Methods:** We pilot-tested a resident-student coaching intervention on two cohorts of third-year medical students who rotated in surgery from January to October of 2020. A survey aimed to measure self-reported HSS self-efficacy and overall experience with the coaching program using a 5-point Likert scale was administered to clerkship students after the intervention. A previously administered learner-needs assessment completed by the majority of third-year medical student class (172/197) was used to serve as a benchmark. Descriptive statistics were used to analyze the data and weighted averages were used to analyze confidence levels. Pre- and post-intervention results were compared using Student's T-test.

**Results:** A total of 77 students and 28 resident-coaches participated in the study with 71.4% (55/77) completion of the post-intervention exit-survey. Resident-coaches had an average of 2.3 students (range: 1-3) and met an average of 1.9 (CI 0.99-2.8) times during the clerkship. Many student-resident pairs used multiple methods of communication, including email (45%), texting (15%), phone calls (20%), and virtual meetings such as Zoom (40%). Overall, students indicated a positive benefit to having a resident-coaches (3.5/5; CI: 2.9-4.1). Approximately 85% of students reported academic support as the largest benefit gained from their coaches. Compared with benchmark data, post-coaching intervention results revealed a 5% increase in student level of confidence in the following areas: efficacy in navigating themselves through the healthcare system, identifying team expectations, and their roles within the healthcare team

**Conclusions:** This study demonstrates that the implementation of a surgical rotation-specific resident coaching program has the potential to provide feasible and effective means to bridge medical students' HSS learning through enhancing students' HSS self-efficacy, providing useful tools for navigation, and by enriching their insight into their role within the healthcare system.

# Do All High-Volume Surgeons at High-Volume Hospitals Have Optimal Outcomes following Elective High-Risk Operations? The Short Answer is No

*Christopher T. Aquina, MD, MPH; Adan Z. Becerra, PhD; Jordan M. Cloyd, MD; Allan Tsung, MD; Timothy M. Pawlik, MD, PhD, MPH; Aslam Ejaz, MD, MPH*

**Introduction:** A hospital volume-outcome relationship has been established for high-risk operations. However, variation in outcomes across high-volume surgeons at high-volume hospitals is currently unknown.

**Methods:** The Medicare 100% Standard Analytic File (2013-2017) was queried for 12 elective high-risk operations (esophagectomy, lung resection, pancreatectomy, hepatectomy, colectomy, proctectomy, nephrectomy, cystectomy, coronary artery bypass grafting [CABG], aortic valve replacement, mitral valve repair, and open abdominal aortic surgery). High-volume surgeons/hospitals were defined by top quartile of procedure volume. Mixed-effects multivariable logistic regression analyses assessed the association between high procedure volume and major complications and 90-day mortality.

**Results:** Among 548,241 high-risk operations, high-volume surgeons were significantly associated with lower risk-adjusted complication rates for all procedures except hepatectomy and open abdominal aortic surgery ($P<0.05$) and lower 90-day mortality for all procedures ($P<0.05$) compared to non-high-volume surgeons. Despite this association, for the average-risk patient at the average high-volume hospital, there was a 2-3-fold difference in the risk-adjusted complication rate between the best and worst-performing high-volume surgeon for most operations (esophagectomy: 24–55%; lung resection: 6.9–15%; pancreatectomy: 12–31%; hepatectomy: 14–19%; colectomy: 5.8–16%; proctectomy: 13–21%; nephrectomy: 11–24%; cystectomy: 23–39%; CABG: 14–35%; aortic valve replacement: 17–34%; mitral valve repair: 17–44%; open abdominal aortic surgery: 33–53%). Additionally, there was wide variation in risk-adjusted 90-day mortality across high-volume surgeons at high-volume hospitals for esophagectomy (2.9–9.9%), pancreatectomy (1.6–4.9%), and open abdominal aortic surgery (3–8.8%).

**Conclusions:** Despite a surgeon volume-outcome relationship, there is wide variation in complication and mortality rates across high-volume surgeons at high-volume hospitals. Quality measures should be continuously monitored across surgeons and hospital systems.





# United States National Trends in the Use of Neoadjuvant Therapy Prior to Cancer Surgery

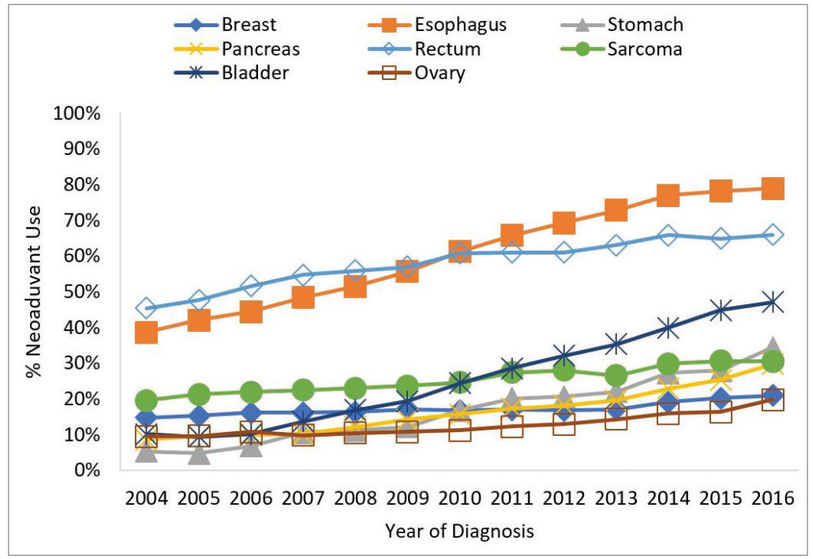
*Christopher T. Aquina, MD, MPH; Aslam Ejaz, MD, MPH; Allan Tsung, MD; Timothy M. Pawlik, MD, PhD, MPH; Jordan M. Cloyd, MD*

**Introduction:** A major contributor to improved oncologic survival is an emphasis on multimodal therapies. Neoadjuvant therapy allows for early treatment of micrometastatic disease, improved patient selection with favorable tumor biology for surgery, tumor downstaging, and improved completion rates of multimodal therapy compared to adjuvant therapy. However, whether these potential benefits have translated into increased adoption of neoadjuvant therapy remains unknown.

**Methods:** Patients diagnosed with primary breast, esophageal, gastric, pancreatic, rectal, extremity sarcoma, bladder, or ovarian cancer between 2004-2016 who underwent curative-intent resection were identified within the National Cancer Database. Trends in the use of neoadjuvant therapy, including chemotherapy, radiotherapy, and hormone therapy, were analyzed using tests for trend and mixed-effects multivariable logistic regression analyses.

**Results:** Across 2,292,734 cancer resections (breast=1,828,577; esophagus=46,210; stomach=33,024; pancreas=61,514; rectum=130,424; extremity sarcoma=32,908; bladder=42,955; ovary=117,122), there was a significant increase in neoadjuvant therapy use from 2004-2016 across each cancer type ($P<0.001$ for all) (Figure). After controlling for patient, oncologic, and treatment hospital characteristics, the adjusted odds of neoadjuvant therapy increased over time for each cancer type with year of diagnosis entered as a categorical variable. Similar results were observed with year of diagnosis entered as a numeric variable (breast: odds ratio [OR]=1.03, 95% confidence interval [CI]=1.02-1.04; esophagus: OR=1.29, 95% CI=1.27-1.30; stomach: OR=1.26, 1.24-1.27; pancreas: OR=1.15, 95% CI=1.14-1.17; rectum: OR=1.11, 95% CI=1.10-1.11; extremity sarcoma: OR=1.08, 95% CI=1.07-1.10; bladder: OR=1.24, 95% CI=1.22-1.25; ovary: OR=1.10, 95% CI=1.09-1.11; all $P<0.001$).

**Conclusions:** Across Commission on Cancer-accredited centers, neoadjuvant therapy use increased significantly across eight different cancer types from 2004-2016, even after controlling for patient, cancer, and hospital-related factors. Future studies should focus on understanding the mechanisms behind these trends, improving the quality of evidence for each cancer type, and optimizing patient-centered research on neoadjuvant therapy.



# Neutrophil Pyroptosis Delays Corneal Wound Healing

*Peng Chen, MD, PhD*

**Introduction:** Corneal wound healing is a complex process requiring orchestration of multiple cell types and cytokines. Rapid re-epithelialization with minimal neovascularization (CNV) is critical for successful corneal healing. Inflammation plays an important role in tissue repair and wound healing process. However, detailed cellular and molecular mechanisms of corneal wound healing remains elusive.

**Methods:** Animal procedures were approved by IACUC of The Ohio State University. *GsdmD-/-* mice were kindly provided by Dr. Vishva M. Dixit from Genentech, Inc. C57bL/6J mice were purchased from The Jackson laboratory. Alkali induced cornea wounding was performed following our previous publication. Clinical fibrosis and neovascularization scores were determined with a portable slit lamp. Fourteen days after injury, mice were sacrificed and corneas were dissected for immunostaining.

**Results:** We found that neutrophil infiltrated rapidly to cornea after alkali injury, and reach the peak around 24 hours after injury. The cleaved GsdmD was also observed at 12 to 24 hours after injury, indicating pyroptosis is involved in corneal wound healing. Depletion of neutrophil by Gr-1 antibody injection into mice circulation almost completely abolished pyroptosis observed at 24 hrs after injury. In addition, neutrophil depletion accelerated corneal wound healing. Furthermore, we found that corneal would healing were significantly enhanced in *GsdmD-/-* mice as compared to WT mice. The *GsdmD-/-* mice also showed reduced CNV at 10 days after injury. To confirm the role of neutrophil in corneal wound healing, we performed bone marrow (BM) transplantation experiments. The mice received BM cells from *GsdmD-/-* mice showed significantly accelerated wound healing than the mice received BM from WT mice. Furthermore, disulfiram (a pyroptosis inhibitor) was used to treat the mice before and after injury. Consistently, comparing the mice treated with saline, the mice treated with disulfiram showed significantly accelerated corneal wound healing. At 24 hours after injury, the mice treated with disulfiram had much higher expression level of ΔNP63α (a limbus stem cell marker) in the cornea, suggesting the mechanism of enhanced re-epithelialization. Moreover, the cleavage of GSDMD and caspase 1 were fully inhibited by treating with disulfiram. We also confirmed this finding *in vitro* treatment of disulfiram can fully inhibit LPS & Nigericin induced caspase1 and GSDMD cleavage in THP-1 differentiated macrophages.

**Conclusions:** After alkali injury, neutrophil infiltrated rapidly to cornea for initial reparative function. However, the infiltrated neutrophil will undergo pyroptosis, which causes severe inflammation, delay corneal wound healing and promote CNV. Directly depleting the neutrophil, knock out GsdmD or treat the mice with GsdmD inhibitor, might be effective means to promote corneal wound healing.



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# Early Recruitment of Neutrophils to the Heart Is Orchestrated by Catecholamine Demargination

*Albert Dahdah, PhD; Gopalkrishna Sreejit, PhD; Robert Jaggers, MS; Jillian Johnson, BS*

**Introduction:** Myocardial infarction (MI) is one of the leading causes of death in the modern world. MI induces a rapid and robust inflammatory response characterized by infiltration of different leukocyte cell types to the infarcted heart. Attracted by the cell debris, danger associated molecular patterns and cytokines, neutrophils are the first cells to arrive at the infarcted tissue. They generate excess amounts of ROS and proteolytic enzymes that exacerbates local tissue injury. Not surprisingly, the number of neutrophils in the circulation is directly correlated to both the infarct size and decline in left ventricular ejection fraction (LVEF). We previously have demonstrated that recruitment of neutrophils to the infarct releases specific alarmins (S100A8/S100A9) which in turn stimulates NLRP3 Inflammasome-IL-1□-dependent granulopoiesis in the bone marrow (BM). Although granulopoiesis is initiated as early as 6 hours, it is not clear if de novo generation of neutrophils is the exclusive source of neutrophils at the infarct. Because the marginated pool of neutrophils is almost the same size of circulating pool, we hypothesized that demargination of neutrophils from the vascular wall could contribute predominantly to the source of infiltrated neutrophils particularly during the early hours after MI.

**Methods:** Using a mouse model of the permanent ligation of the left anterior descending artery (LAD) and flow cytometry, we first examined the neutrophil response to identify the peak time of granulopoiesis after MI. We also measured the markers of demargination including F-actin, Adam17 and CD62L expression. We next constructed dose response curves (neutrophilia) to dexamethasone and nor-epinephrine, the 2 well-known neutrophil demarginating agents. We performed total body irradiation to deplete the neutrophil progenitor cells in the BM/spleen and studied the effect of MI on neutrophil infiltration to the heart. Finally, we studied the mechanisms of demargination by focusing on catecholamine stress.

**Results:** Induction of MI results in rapid recruitment of neutrophils to the heart as early as 6 hours following MI, reaching the summit at around 24 hours. We found a marked increase in all the markers of demargination. To confirm that the source of neutrophils recruited in the first few hours was not due to granulopoiesis but demargination, we performed BM depletion studies by exposing mice to whole-body irradiation. This led to complete depletion of the granulocyte-monocyte progenitors from the BM/spleen as early as 6 hours post-irradiation. When BM depleted mice were given MI, we observed a similar number of neutrophils in the hearts of both the irradiated and non-irradiated mice suggesting that granulopoiesis was not the main source of neutrophils during the initial recruitment. To confirm that demargination (which represents nearly 50% of total blood neutrophils) is the main source of neutrophils, we first irradiated mice and then induced MI with one group of mice receiving dexamethasone. As expected, the mice treated with dexamethasone did not show further increase in the number of infiltrated neutrophils indicating that most of the neutrophils were already mobilized (via demargination) by MI and that, there were no more neutrophils left for dexamethasone to mobilize. To identify the underlying signaling mechanisms, we measured the levels of epinephrine and norepinephrine (NE) after MI and found a robust increase in the circulation that also overlapped with demargination. Since catecholamine stress (like dexamethasone) is known to promote demargination, we treated mice with inhibitor of NE synthesis or beta-adrenergic receptor blocker and studied the effect of MI on neutrophil infiltration to the heart. Both strategies decreased neutrophil recruitment to the heart suggesting that MI-induced catecholamine stress is the main trigger for neutrophil accumulation in the heart.

**Conclusions:** Neutrophil recruitment to the ischemic heart is one of the leading inflammatory signals during MI. Uncontrolled infiltration of neutrophils to the infarct, particularly during the early hours may cause more harm than benefit to MI patients. Our data suggest that strategies aimed at preventing demargination of neutrophils by targeting catecholamine stress could result in lower tissue damage and better resolution of injury. However, further studies are required to confirm if targeting catecholamine stree immediately after MI will result in better cardiac functional outcomes (i.e LVEF).

# Association of Medicaid Eligibility With Timing To and Outcomes From Surgery for Diverticulitis

*Adrian Diaz, MD, MPH; Kathryn Taylor, MD; Usha Nuliyalu, MPH; Justin Dimick, MD; Hari Nathan, MD PhD*

**Introduction:** Medicaid dual eligibility has been used as a measure of social risk stratification among Medicare beneficiaries, as socially vulnerable patients have been shown to have worse outcomes and greater post-discharge needs. This study aimed to assess time to surgery, postoperative outcomes, and spending variation by dual eligibility status among Medicare patients with diverticulitis.

**Methods:** Using 100% Medicare claims data, we identified fee-for-service Medicare patients and those patients dually eligible (DE) for both Medicare and Medicaid undergoing colectomy for diverticulitis from 2014-2018. We calculated risk-adjusted, price-standardized payments for the surgical episode from admission through 30 days post discharge and evaluated admission type (i.e., elective vs non-elective), postoperative outcomes, and postacute care (PAC) utilization.

**Results:** Of the 126,644 Medicare beneficiaries undergoing colectomy for diverticulitis, 17,455(14%) were DE. DE patients had higher odds of having non- elective surgery (OR 1.69, $CI_{95\%}$ 1.62-1.76) and higher odds of having an ostomy (OR 1.22, $CI_{95\%}$ 1.17-1.28). Compared to Medicare beneficiaries, patients that are DE had higher odds of having a postoperative complication (OR 1.41, $CI_{95\%}$ 1.36-1.47), mortality (OR 1.45, $CI_{95\%}$ 1.34-1.57), and readmission (OR 1.49, $CI_{95\%}$ 1.43-1.56). DE patients had lower odds of being discharged home (OR 0.41 95% CI 0.40-0.43). Average total episode spending was $3,498 ($3,166 to $3,830) greater among DE patients, with the index hospitalization and PAC spending contributing 46% and 40% of the variation, respectively. Even when only comparing patients who had an elective operation and did not receive an ostomy or experience any postoperative complications, the average total episode spending was $1,813 ($CI_{95\%}$ $1,582 to $2,044) greater for DE patients with the index hospitalization and PAC spending contributing 43% and 45% of the variation, respectively.

**Conclusions:** Among Medicare beneficiaries, DE patients were more likely to have a non-elective colectomy and have an ostomy following their operation. Subsequently, DE are more likely to have higher probability of having adverse postoperative outcomes and greater postacute care utilization. DE status was associated with higher average total episode spending with the index hospitalization and post-acute care attributing about equally to spending variation. With increasing recognition of the impact of social determinants of health (SDOH) on outcomes and utilization, a patient's DE status may provide an accessible way to identify increased risk attributable to SDOH and intervene to optimize outcomes and mitigate costs.





# Legal Determinants of Health: Historic Housing Policy and Modern Day Surgical Outcomes

*Adrian Diaz, MD, MPH; Rachel O'Reggio, MPH; Marc Norman, MUP; Jyothi R. Thumma, MPH; Justin B. Dimick, MD, MPH; Andrew M. Ibrahim, MD MSc*

**Introduction:** In 1933 the United States Government Home Owners Loan Corporation used racial composition of neighborhoods to determine creditworthiness and labeled them "Best," "Still Desirable," "Definitely Declining" and "Hazardous." Although efforts have been made to reverse these racist policies that structurally disadvantage Black Americans, the lasting legacy on modern day healthcare outcomes is uncertain.

**Methods:** We performed a cross-sectional retrospective review of 380,486 Medicare beneficiaries' admissions (mean age 71.3 years; 54.0% women) between 2012 and 2018 who underwent one of five of common surgical procedures across 293,316 unique neighborhoods historically labeled by the Home Owners Loan Corporation (HOLC). Using a multivariable logistic regression model accounting for patient factors (e.g., age, gender, procedure and health comorbidities) and modern day measure of deprivation (i.e., ADI), we determined the 30-day mortality rates for each neighborhood and by race.

**Results:** Mortality increased in a stepwise fashion across HOLC neighborhoods. Overall, 30-day postoperative mortality was 5.0% in "Best" neighborhoods, 5.4% in "Still Desirable", 5.6% in "Definitely Declining" and 5.8% in "Hazardous" (Best vs. Hazardous OR:1.20(1.13-1.29); p<0.001). The same stepwise increase was present for each procedure individually. Mortality rates also increased significantly in a stepwise manner across neighborhoods for White (5.1% to 5.9%, p<0.001) and Black (5.2% to 6.4%, p = 0.002) racial groups. After controlling for modern day deprivation by the Area Deprivation Index (ADI), patients from previously redlined neighborhoods had significantly higher mortality compared with patients from neighborhoods with a similar ADI but that were historically graded as "best". Specifically, patients from historically "best" neighborhoods that are now in the average quintile of ADI had a 5.7% (95% CI: 5.27-6.08) mortality compared to 6.5% (95% CI: 6.14-6.79) for patients in historically "hazardous" neighborhoods now in the best quintile of ADI.

**Conclusions:** Patients residing in neighborhoods previously redlined or labeled "Hazardous" were more likely to experience death within 30 days of surgery compared to those performed in "Best" neighborhoods. These findings persisted even after adjusting for modern day neighborhood characteristics, which underscore the long lasting and far-reaching effect of structural racism. Furthermore, these findings raise concern about policies that reward or penalize hospitals based on their outcomes without taking into account possible structural disadvantages within certain communities.

# Rural Hospitals Are Not Associated With Worse Postoperative Outcomes for Colon Cancer

*Adrian Diaz, MD, MPH; Shan Lansing, MD; Madison Hyer, MS; Diamantis Tsilimigras, MD; Timothy M. Pawlik, MD, PhD, MPH*

**Introduction:** Regionalization of high-risk operations has been proposed as a means to improve postoperative surgical outcomes. There has been concern, however, that regionalization may hinder access to surgical care. In particular, patients living in rural areas may be disproportionally affected by regionalization of care to urban centers, leading to disparities in access. The objective of the current study was to characterize postoperative outcomes among patients living in rural areas who underwent colon cancer surgery at rural versus non-rural hospitals.

**Methods:** Medicare beneficiaries who underwent colon resection for cancer between 2013-17 were identified using the Medicare Inpatient Standard Analytic Files. Patients and hospitals were designated as rural based on rural-urban continuum codes. Risk-adjusted postoperative outcomes and hospitalization spending were compared among patients undergoing resection at rural versus non-rural hospitals.

**Results:** Among 3,982 patients who resided in a rural county and underwent colon resection for cancer, mean age was 76.3(SD: 7.1) years and 1,459(36.6%) patients underwent operative procedure at a rural hospital. On multivariable analyses, no differences in postoperative outcomes were noted among Medicare beneficiaries undergoing colon resection for cancer at non-rural versus rural hospitals. Specifically, the risk adjusted probability of experiencing a postoperative complication at a non-rural hospital was 16.2% (95%CI 14.8%-17.5%) versus 16.3% (95%CI 14.3%-18.3%) at a rural hospital (OR 1.01, 95%CI 0.80-1.29); 30-day mortality (non-rural:3.0%, 95%CI 2.3%-3.7% vs. rural:4.0%, 95% CI 2.8%-5.0%) was also comparable. In addition, price standardized, risk-adjusted expenditures were similar at non-rural ($18,610, 95%CI $18,037-$19,183) and rural ($19,010, 95%CI $18,630-$19,390) hospitals.

**Conclusions:** Among rural Medicare beneficiaries who underwent a colon resection for cancer, there were no differences in postoperative outcomes among non-rural versus rural hospitals. These findings serve to highlight the importance of policies and practice guidelines that secure safe, local surgical care allowing rural clinicians to accommodate strong patient preferences while delivering high quality surgical care.



26TH ANNUAL RESEARCH CONFERENCE

# Impact of Medicaid Expansion on Pancreatic Cancer Care: A Difference-in-Difference Analysis

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**Introduction:** The Affordable Care Act (ACA) increased insurance coverage for low-income individuals, which should potentially lead to better access to care and improved oncological outcomes. This study seeks to evaluate the impact of Medicaid expansion (ME) on care for pancreatic ductal adenocarcinoma (PDAC).

**Methods:** Patients who were uninsured or on Medicaid and diagnosed with PDAC between 2004 and 2017 were queried from the National Cancer Database (NCDB). Two different expansion cohorts were included: early expansion states and 2014 expansion states. For early expansion states, the time period of pre-expansion was 2004-2009 and post-expansion was 2010-2017. As for the 2014 expansion states, the pre-expansion period was from 2004-2013 and post-expansion period was from 2014-2017. Patients in non-expansion states formed the control group. A difference-in-difference (DID) analysis was used to assess the association of ME with stage of diagnosis, treatment and survival for each expansion cohort.

**Results:** In both early and January 2014 expansion states, there was an increase in overall Medicaid coverage (Early: DID=0.29, 2014: DID=0.37; P<0.001), in particular for non-Hispanic Black and Hispanic Black patients (Non-Hispanic Black: Early: DID=0.11, 2014: DID =0.11; P<0.001, Hispanic-Black: 2014: DID= 0.20; P=0.003). There were no differences in early stage diagnosis (Early: DID= 0.02, 2014: DID= -0.02; P>0.05). There was an increase in the number of patients receiving surgery (Early: DID=0.05; P=0.001, 2014: DID=0.03; P=0.029) but no difference in time to surgery among patients receiving surgery upfront (Early: DID=1.75, 2014: DID=0.38; P>0.05). There was no difference in 30-day readmission post-surgery (Early: DID= 0.003; 2014: DID= -0.00007; P>0.05) or 90-day mortality (Early: DID= -0.007, 2014: DID= -0.035; P>0.05). Moreover, there was no difference in receipt of chemotherapy (Early: DID=0.01, 2014: DID= 0.005; P>0.05) or time to chemotherapy for patients receiving neoadjuvant chemotherapy (Early: Early: DID=9.62, 2014: DID= 0.01; P>0.05). Finally, there was no difference in receipt of palliative care among stage IV patients in both cohorts (Early: DID= -0.004, 2014: DID=0.004; P>0.05).

**Conclusions:** This study suggests that after ME, PDAC patients were more likely to be insured and had increased access to surgical care. Future, studies should evaluate the implications of improved surgical access on clinical outcomes such as mortality.

# Outcomes Following a Rectal and/or Simultaneous vs. Liver-First Approach for Synchronous Rectal Liver Metastasis: An Analysis of the US Rectal Cancer Consortium

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**Introduction:** The sequence of surgical approach for patients with rectal cancer and synchronous liver metastases (RC-SLM) remains controversial. We sought to compare short- and long-term outcomes between a liver-first (LF) and rectal-first and/or simultaneous (RF/S) approach among patients with RC-SLM.

**Methods:** Patients who underwent resection for RC-SLM between 2007-2017 were identified using the US Rectal Cancer Consortium. Short- and long-term outcomes were compared based on sequence of surgical approach (LF vs. RF/S).

**Results:** Among 169 patients with RC-SLM, approximately two-thirds of the cohort underwent a RF/S (n=109, 64.5%) versus a LF approach (n=60, 35.5%). LF patients were slightly older (59±12 years) compared to RF/S patients (55±12 years; P=0.04), however there was no difference in gender, tumor size or location, or number of liver lesions between the two groups (all P>0.05). Most patients received chemotherapy prior to any surgical resection (LF: n=44, 74.6% vs. RF/S: n=79, 73.1%; P=0.84), however a higher percentage of RF/S patients (n=72, 66.1%) received neoadjuvant chemoradiation compared to LF patients (n=30, 50%; P=0.04). At the time of liver resection, LF patients more commonly underwent a major hepatectomy (n=18, 47.4%) compared to RF/S patients (n=16, 28.1%) (P=0.04). Following rectal surgery, post-operative morbidity was similar between the two groups (LF: 56.3% vs. RF/S: 52.7%; P=0.69), however LF patients had a higher proportion of major (≥3 Clavien-Dindo grade) complications (59.3% vs 39.6% P=0.03). There was no difference in length of stay (RF/S: 6 days, IQR: (5,10) vs. LF: 6 days, IQR:(4,1); P=0.95) or 90-day readmission rates (RF/S: 18% vs. LF: 7%; P=0.64). After controlling for all factors, disease-free (DFS) (HR:1.38, 95%CI: 0.69-2.73) and overall survival (OS) (HR: 0.99, 95%CI: 0.53-1.84) was similar between groups (both P>0.05).

**Conclusions:** Patients undergoing a LF or RF/S approach for RC-SLM have similar short and long-term outcomes at high-volume multidisciplinary centers. Future research should focus on identifying which patients benefit most from a RF/S versus LF approach.





# Trends in Achieving Optimal Outcomes Following Complex Gastrointestinal Surgery: Are Patients More Likely to Achieve a Textbook Outcome?

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**Introduction:** Limited evidence exists as to how indications and outcomes among cancer patients undergoing complex gastrointestinal surgery have impacted outcomes over time. Recently, the use of composite quality measures such as “textbook outcome” has been proposed as potentially superior to individual outcomes. We sought to examine changes in the rates of “optimal” textbook outcomes among patients undergoing resection of pancreatic, liver, or colon cancer.

**Methods:** Medicare beneficiaries who pancreatic, liver or colon resection for a malignant indication between 2004-2016 were identified using SEER-Medicare. Rates of textbook outcome (i.e., no complication/extended length of stay/90-day morality/90-day readmission) were assessed over time. Factors associate with achieving textbook outcomes were examined.

**Results:** Among 94,329 patients, 6,765 (7.2%), 1,985 (2.1%), and 85,579 (90.7%) individuals underwent resection for primary pancreatic, hepatic, or colon cancer, respectively. Over time, patients were younger (median age: 2004-2007, 77 yrs vs. 2008-2011, 77 yrs vs. 2012-2016, 75 yrs) ($p<0.05$). Overall, a total of 53,464 (56.7%) of patients achieved a textbook outcome; achievement of textbook outcome varied by procedure (pancreatectomy: 48.1% vs. hepatectomy: 55.2% vs. colectomy: 57.4%, $p<0.001$). Of note, the proportion of patients achieving a textbook outcome increased over time (2004-2007, 53.3% vs. 2008-2011, 56.5% vs. 2012-2016, 60.1%) (5-year increase: OR 1.16 95%CI 1.13-1.18) ($p_{trend}<0.001$). The improvement in TO over time was noted for all three surgical procedures (pancreatectomy: $p_{trend}<0.001$ vs. hepatectomy: $p_{trend}=0.0201$ vs. colectomy: $p_{trend}<0.001$) (Figure). Achieving a TO was independently associated with decreased hazards of death among (HR 0.44, 95%CI 0.43–0.45).

**Conclusions:** Roughly 1 in 2 patients undergoing complex gastrointestinal surgery for a malignant indication achieved a textbook outcome. Textbook outcome rates increased over time and textbook outcomes were associated with better long-term outcomes.

# Cigarette Smoking Aggravates Atherosclerosis Through Induction of S100A8/A9 Protein Release From Neutrophils

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**Introduction:** Cigarette smoking (CS) is one of major preventable risk factors of atherosclerosis and the ensuing cardiovascular complications such as myocardial infarction and stent thrombosis. Although, the deleterious effect of CS on cells in the lung including epithelial, alveolar, and immune system are well-characterized, the mechanistic link between inflammation in the lung and atherosclerosis remain unclear. Since neutrophils are amongst the first responders to CS-induced insult in the lung, we hypothesize that either neutrophils or its cytoplasmic cargo (e.g. S100A8/A9) may serve as a molecular link between inflammation in the lung and its spillover effects on myeloid progenitors in the bone marrow/spleen resulting in enhanced myelopoiesis and thus, atherosclerosis.

**Methods:** To study the effect of regular cigarette smoke (CS) on systemic inflammatory response, first, we exposed healthy Wild-type (WT) and S100A9$^{-/-}$ mice to 4 weeks of CS while measuring the effect of CS on leukocyte number (blood, lungs) and production (BM and spleen). Next, we exposed atherosclerosis-susceptible, *Ldlr*$^{-/-}$ mice on a Western-style diet to CS to study the effect of CS on atherosclerosis lesion development. To analyze the contribution of S100A8/A9 in atherosclerosis development, we performed bone marrow transplantation (BMT) using BM from WT or S100A9$^{-/-}$ mice and examined the effect of CS on myelopoiesis and atherosclerosis. Finally, to determine whether CS induced-inflammation was mediated by cells within the lung or systemic absorption of CS constituents, we treated mice with CS condensate (CSC) orally over the same period. At the end of each experiment mice were euthanized, tissues were collected and prepared for flow cytometry analysis. We used ELISA to measure plasma levels of cytokines. En face staining and histology assessed atherosclerotic lesions in Ldlr-/- mice.

**Results:** CS-exposure resulted in increased number of neutrophils in the lung and blood. This is likely mediated by neutrophil-derived S100A8/A9 via enhanced myelopoiesis in the spleen. When mice were treated with CSC by oral gavage, we observed increased neutrophils and S100A8/A9 in circulation but not in the lungs suggesting that the harmful constituents in the CS are promoting systemic inflammation. Increased number of neutrophils in *Ldlr*$^{-/-}$ but not in *Ldlr*$^{-/-}$ transplanted with BM from S100A9$^{-/-}$ mice was associated with an unstable lesion phenotype characterized by increased macrophage / lipid burden and decreased collagen.

**Conclusions:** CS exposure increases neutrophil and neutrophil-derived S100A8/A9 through enhancement of extramedullary myelopoiesis in the spleen. Elevation of S100A8/A9 levels contribute to the instability of atherosclerotic lesions likely by increasing the number of neutrophils in the lesion. CS causes systemic inflammation as shown by increased neutrophil and S100A8/A9 levels in circulation but not in the lungs of CSC gavaged mice. The study provides direct evidence of how smoking contributes to specific immune cell production and activation leading to exacerbation of atherosclerosis.





# Impact of Post-Discharge Phone Calls on Non-Urgent Hospital Returns < 30 Days Following Primary Bariatric Surgery

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**Introduction:** Quality of care delivery may improve patient outcomes post-bariatric surgery. We examined the quality of post-discharge phone calls (PhDC) to determine the impact on early non-urgent hospital returns (NUHR) following primary bariatric surgery.

**Methods:** A retrospective IRB-approved review was performed on patients (n=359) who underwent Roux-en-Y-gastric-bypass (RYGB) or sleeve-gastrectomy (SG) from 01-01-2019 to 12-31-2019. Reasons for NUHR included nausea/vomiting/dehydration, and/or superficial surgical site infections. Baseline demographics, comorbidities, psychiatric history, and PhDC were collected. PhDC were coded for completeness using a scoring system, with <90% quality receiving a score of ≤824 and ≥90% quality receiving a score of 825-900 (Table 1). Patients were stratified into a NUHR (n=65) versus control group (Never-returns [NR]; n=294). Primary analysis examined the impact of PhDC on NUHR. Sub-analysis examined the impact of call-quality (Table 1). Univariate analysis was performed using Chi-square, or Fisher's exact tests. Multivariate analysis (MVA) was used to determine predictors of NUHR. A p-value≤0.05 was statistically significant.

**Results:** Compared to the NR group, NUHRs were more likely to be younger (41.3+12.1 versus 45.0+10.8 years, p=0.024), with baseline anxiety (41.5% versus 23.5%, p=0.0029), and undergo RYGB (73.3% versus 57.8%, p=0.0307). Additionally, patients with no PhDC were more likely to have NUHR compared to those who were called (26% versus 15.2%, p=0.0417). There was no association with call-quality (p=0.3411). MVA demonstrated younger-age (OR=0.970,CI:0.946-0.996;p=0.0232), RYGB (OR=1.878,CI:1.023-3.447;p=0.0419), anxiety (OR=2.091,CI:1.174-3.727;p=0.0123), and no PhDC (OR=2.102,CI:1.168-3.782;p=0.0132) were independently associated with NUHRs.

**Conclusions:** PhDC, regardless of quality, may play a role in mitigating NUHRs, especially given the association of baseline anxiety characterizing our patient population. Future studies are aimed at examining non-clinical factors associated with NUHRs.

Table 1. Post-discharge phone call scoring system, with <90% quality defined as a score of <824 and >90% quality defined as a score of 825-900.

| Questions | Sub-questions | | | Total Score |
|---|---|---|---|---|
| **Is nausea controlled?** (Yes/No = 50 pts. Not asked = 0 pts.) | **Directions given?** (Directions given when indicated = 50 pts. Directions not given when indicated = 0 pts.) | | | 100 |
| **Amount of fluid intake?** (Amount indicated = 30 pts. No amount indicated = 0 pts.) | **Re-education given?** (Re-education provided when indicated = 35 pts. No re-education provided when indicated = 0 pts.) | **Specific directions given?** (Specified directions given when indicated = 35 pts. No directions specified when indicated = 0 pts.) | | 100 |
| **Amount of protein intake?** (Amount indicated = 30 pts. No amount indicated = 0 pts.) | **Re-education given?** (Re-education provided when indicated = 35 pts. No re-education provided when indicated = 0 pts.) | **Specific directions given?** (Specified directions given when indicated = 35 pts. No directions specified when indicated = 0 pts.) | | 100 |
| **Incisional pain?** (Yes/No = 40 pts. Not asked = 0 pts.) | **Tenderness at incision?** (Yes/No = 20 pts. Not asked = 0 pts.) | **Warmth at incision?** (Yes/No = 20 pts. Not asked = 0 pts.) | **Redness at incision?** (Yes/No = 20 pts. Not asked = 0 pts.) | 100 |
| **Generalized pain?** (Yes/No = 50 pts. Not asked = 0 pts.) | **Location of pain?** (Location indicated = 10 pts. Not asked = 0 pts.) | **Directions given?** (Directions given when indicated = 40 pts. Directions not given when indicated = 0 pts.) | | 100 |
| **Pain medications used?** (Pain medications indicated = 100 pts. Not asked = 0 pts.) | -- | | | 100 |
| **Normal bowel movement?** (Yes/No = 50 pts. Not asked = 0 pts.) | **Directions given?** (Directions given when indicated = 50 pts. Directions not given when indicated = 0 pts.) | | | 100 |
| **Walking?** (Yes/No = 50 pts. Not asked = 0 pts.) | **Directions given?** (Directions given when indicated = 50 pts. Directions not given when indicated = 0 pts.) | | | 100 |
| **Dyspnea?** (Yes/No = 50 pts. Not asked = 0 pts.) | **Directions given?** (Directions given when indicated = 50 pts. Directions not given when indicated = 0 pts.) | | | 100 |

# Myocardial Infarction Induces Mitochondrial tsRNAs Associating With Reduced RNH1

*Jongsoo Kim, PhD; Bingchuan Geng, MD, PhD*

**Introduction:** Myocardial infarction (MI) is a leading cause of death worldwide. New therapies and diagnostic markers are needed for this devastating disease. As a recently emerging class of non-coding small RNAs, tRNA-derived small RNAs (tsRNAs) have been shown to play versatile roles in fundamental biological processes and are causatively involved in pathophysiological conditions including cancers, stem cells maintenance, metabolic disorders and epigenetic inheritance. However, the biogenesis and functions of tsRNAs in cardiovascular biology and diseases remain largely unknown.

**Methods:** In a mouse myocardial infarction model, here we found a surge upregulation of tsRNAs within 24h in the infarct zone as compared with those in the non-infarct zone. In addition, Western blotting analysis and immunostaining were performed to determine the expression of key factors in tsRNA regulation by using human and mouse infarct myocardium.

**Results:** While genomic tRNA-derived tsRNAs didn't alter, mitochondrial-derived tRNAs are dramatically increased in infarcted heart as compared to non-infarcted heart. Moreover, the expression of RNH1 (ribonuclease/angiogenin inhibitor 1, (an inhibitor of angiogenin (Ang), the key ribonuclease that cleaves tRNAs into tsRNAs)), as a play the inhibition of ribonuclease, is decreased in infarct myocardium in both human and mouse samples.

**Conclusions:** Our findings suggested mt-tsRNAs might serve as a potential biomarker and novel therapeutic target to treat myocardial infarction.





# MG53 Activates Wnt Signaling Pathway in Injured Limbal Stem Cell

*Kyung Eun Lee, PhD; Peng Chen, MD, PhD*

**Introduction:** The cellular regulation of corneal wound healing remains largely unknown. Corneal wound healing involves repair of the epithelial layer, migration of epithelial cells and fibroblasts for wound closure, and stimulation of limbal stem cells for tissue regeneration. In previous report, injury to mg53-/- corneas exhibit phenotypes of limbal stem cell deficiency (LSCD). Wnt signaling is a proliferative and self-renewing signal that regulates stem cell pool control and is also known to be activated in the injured tissues. The present study was designed to test whether MG53 is involved in the activation of Wnt signaling in injured corneal limbus stem cells.

**Methods:** An *in vivo* lineage tracing experiment was performed to trace K14-brainbow cells in injured wild type, *mg53-/-*, and tPA-MG53 mice which secretes MG53 continuously to dissect the role of MG53 on the limbal stem cells of the injured corneas. These mice were established by breeding of R26R-confetti and $K14^{cre\text{-}ERT}$, which were then bred with *mg53-/-* or tPA-MG53 mice. In order to induce the injury in the lineage tracing experiment, corneal injury was induced by DMSO, intravital fluorescent imaging was checked every 24hrs, and increased fluorescence signal was quantified. In addition, in vivo alkaline-induced eye injury was performed to induce pathophysiological condition. Real-time quantitative PCR was performed to detect Wnt genes, Lgr5, and MG53 in the cornea and limbus of mice.

**Results:** We found that K14-brainbow cell migration was reduced in the *mg53-/-* mice and increased in the tPA mice compared to wild type mice after injury. Next, we screened Wnt genes, and Lgr5 in the cornea and limbus using real time quantitative PCR. Under physiological conditions, the expression of Wnt5b, Wnt16, and Lgr5 was higher in the limbus than in the cornea. After *in vivo* alkaline-induced corneal injury to the wild-type mouse, we found that MG53, Lgr5 highly increased in the injured limbus at 6hrs, 12hrs post injury compared to uninjured limbus, but at 24hrs after injury, the expression levels reduced to the same level as uninjured limbus. In addition, Wnt5b highly increased in the injured cornea compared to uninjured cornea at 6hr, 12hrs, but at 24hrs post injury, the expression level reduced to the same level as uninjured cornea. However, when alkaline injury was induced in the *mg53-/-* mice, we found that Wnt5b, Lgr5 were not altered in the injured cornea and limbus compared to uninjured cornea and limbus.

**Conclusions:** These results suggest that there is an injured signal in the cornea, MG53 can activate Wnt5b in the injured cornea, stimulate the Wnt signaling pathway of the limbal stem cell, and increase the expression of Lgr5, and leads to proliferate limbal stem cells. It could provide a pool of epithelial cells to regenerate the corneal epithelial cells.

# Robotic Surgery Does Not Improve Oncologic Quality of Proctectomy in Obese Population

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**Introduction:** Obesity presents technical challenges for rectal cancer surgery and increases the risk for post-operative complications.[1,2] Robotic surgery has similar or improved clinical outcomes when compared to laparoscopic surgery in colorectal cancer.[3] Furthermore, a meta-analysis by Wee et al suggests that colorectal robotic surgery is associated with a shorter length of stay and decreased re-admission rates in patients with obesity. [4] Yet, there is little research on robotic surgery in patients with obesity and contemporaneous rectal cancer. While it is already believed that a robotic approach provides advantages for pelvic surgery in patients with obesity, there is a paucity of data on the effect of a robotic approach to rectal cancer in terms of oncologic quality metrics. Robotic surgery has been shown to preserved bladder and sexual function in some randomized studies.[5, 6] While this is likely attributable to more precise dissections, it not known whether this translates to improved oncologic resections in obese patients with rectal cancer. We hypothesized that a robotic approach would result in improved oncologic quality metrics compared to laparoscopic or open approaches in patients with obesity. This study evaluated the effect of surgical approach on the ability to obtain a high quality oncologic resection for rectal cancer in patients with obesity.

**Methods:** We utilized the American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP) database from 2016-2017 to conduct a retrospective cohort study. We identified obese (BMI of ≥30 kg/m2) patients who underwent proctectomy for rectal cancer by combining the general data set and the proctectomy data set. The primary end point was margin status (distal + radial) while controlling for confounding factors that influence margin status: gender, clinical T stage, tumor location, and BMI. A secondary endpoint was harvest of >12 lymph nodes. Robotic, laparoscopic, and open approaches were analyzed. Statistical analyses were performed using Chi-square testing, univariate, and multivariate analysis. Odds ratios and Wald 95% confidence intervals were calculated using SAS software.

**Results:** A total of 2229 patients with BMI of ≥30 kg/m2 underwent proctectomy during the study period. Margin status was available for 1112 patients, which were included in the final analysis. Characteristics of the different cohorts are shown in the table. Male patients were more likely to undergo robotic resection (p=0.0001). The majority of patients with lower third rectal tumors (193 of 480, 40%) underwent open resection. The majority of patients with tumors in the upper third of the rectum (78 of 165, 47%) underwent laparoscopic resection. After controlling for potential confounders, the odds of having a positive margin for laparoscopic resection compared to open were 0.45 (p=0.0506), laparoscopic compared to robotic resection were 0.42 (p=0.0567), and open compared to robotic resection were 0.93 (p=0.843). There was no difference in the ability to harvest >12 lymph nodes between any surgical approach (robotic 80%, laparoscopic 83%, open 9%; p=0.31).

**Conclusions:** In a large national administrative database, robotic proctectomy in patients with BMI of ≥30 kg/m2 does not improve oncologic surgical metrics compared to laparoscopic or open approaches. In fact, our study suggests that laparoscopic approach may yield better resection margins in obese patients after controlling for a variety of factors known to influence margin status. While selecting a surgical approach is a highly dynamic process, this study does not support prioritizing robotic resection for rectal cancer in obese patients and this decision should be based on surgeon experience and skill set.



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# Room for Improvement: A Single-Institution Experience With the Trephination (Gip's) Procedure for Treating Pediatric Pilonidal Disease

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**Introduction:** Pilonidal disease is common amongst adolescent males and females and often leads to recurrent symptoms and life-altering morbidity. Studies have failed to show a clear advantage for any single treatment strategy, leading to a heterogeneous assortment of treatment options and a wide variation in provider approach. Traditionally, surgery included wide excision of the involved area, but recurrence was not infrequent and complication rates were high. A minimally invasive (trephination) approach was described by Gip's in 2008 and has since been widely adopted by many surgeons. The aim of this study was to explore outcomes of the minimally invasive approach to pilonidal disease by evaluating wound healing and disease recurrence following surgical trephination.

**Methods:** A retrospective cohort study of all patients that underwent the trephination (Gip's) procedure as part of standard of care for the treatment of pilonidal disease from November 1, 2019 to November 1, 2020 was performed. Patient demographics, individual risk factors, and any previous treatment related to pilonidal disease were identified and recorded. Post-operative outcome measures included development of a chronic wound, signs of recurrent disease, and need for re-operation.

**Results:** A total of 19 patients underwent the trephination procedure at a mean age of 16.4 years of age. An average of 3.7 pits were excised and there were no reported intraoperative complications. Following trephination, 26.3% of patients were healed at 30-days, with just over 40% showing complete healing by 6-months. The recurrence rate was 16.1% at 6-months and approximately 15% of patients required a second surgery.

**Conclusions:** The use of the trephination procedure has grown in recent years as surgeons explore less invasive alternatives to the more extensive operations traditionally used to treat pilonidal disease. Early results for trephination at our institution shows a high rate of post-operative healing complications, leading to frequent office procedures and re-operation. Given the impact on quality of life for those that are affected, it is important that future research be directed toward discovery of the best practices for treating this challenging disease.

# Complications After Complex Gastrointestinal Cancer Surgery: Benefits and Costs Associated With Inter-Hospital Transfer Among Medicare Beneficiaries

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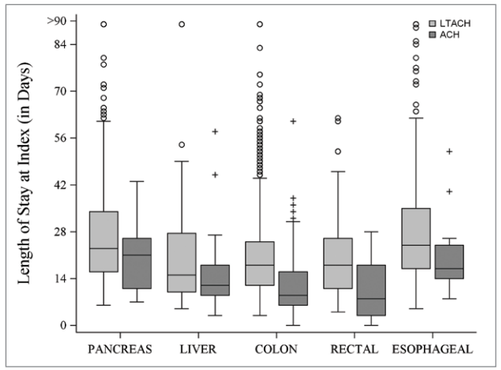
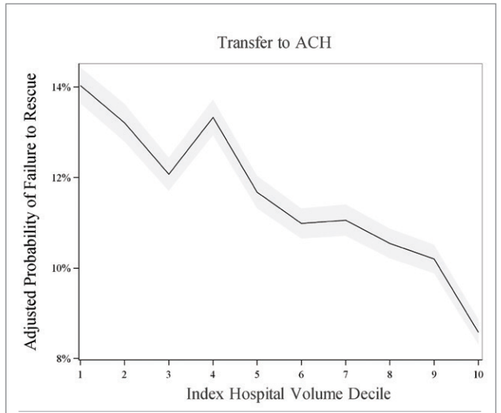
**Introduction:** Interhospital transfer (IHT) may help reduce failure-to-rescue (FTR) by transferring patients to centers with a higher level of expertise than the index hospital. We sought to identify factors associated with an IHT and examine if IHT was associated with improved outcomes after complex gastrointestinal cancer surgery.

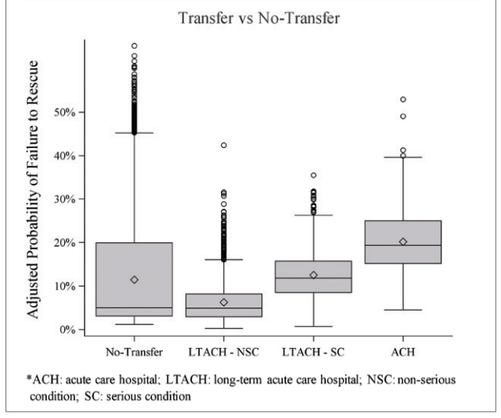
**Methods:** Medicare Inpatient Standard Analytic files were utilized to identify patients with ≥1 postoperative complication following resection for esophageal, pancreatic, liver, or colorectal cancer between 2013-2017. Multivariable logistic regression was used to examine the association of different factors with the chance of IHT, as well as the impact of IHT on failure-to-rescue (FTR) and expenditures.

**Results:** Among 39,973 patients with ≥1 postoperative complication, 3,090 (7.7%) patients were transferred to a secondary hospital. The median LOS at the index hospital prior to IHT was 10 days (IQR, 6-17 days). Patients who underwent IHT more often had experienced multiple complications at the index hospital compared with non-IHT patients (57.7% vs. 38.9%) (p<0.001). Transferred patients more commonly had undergone surgery at a low-volume index hospital (n=218, 60.2%) compared non-IHT (n=10,351, 25.9%) patients (p<0.001). On multivariate analysis, hospital volume remained strongly associated with transfer (OR 5.81; 95%CI 4.11-8.23; p<0.001), as did multiple complications (OR 2.01, 95%CI 1.57-2.59). The incidence of FTR was much higher among IHT patients (20.2%) versus non-IHT patients (11.5%) (OR 1.51, 95%CI 1.12-2.05)(p<0.001). Medicare expenditures were higher among patients who had IHT ($72.1k USD; IQR, $48.1k- $116.7k) versus non-IHT ($38.5k USD; IQR, $28.1k-$59.2k USD) (p<0.001).

**Conclusions:** Approximately 1 in 13 patients had an IHT after complex gastrointestinal cancer surgery. IHT was associated with high rates of FTR, which was more pronounced among patients who underwent surgery at an index low-volume hospital. IHT was associated with higher overall CMS expenditures.








# Investigating Length of Stay Per Total Body Surface Area Relative to Burn Mechanism Within the Pediatric Injury Quality Improvement Collaborative

*Kelli N. Patterson, DO, MS; Amanda Onwuka, PhD, MPH; Kyle Z. Horvath, MPH; Renata Fabia, MD, PhD; Sheila Giles, RN; Daniel Marx, MHSA, MSN, CPN; Pablo Aguayo, MD; Susan Ziegfeld, RN; Alejandro Garcia, MD; F. Dylan Stewart, MD; Jennifer Fritzeen, RN; Randall S. Burd, MD, PhD; Lisa Vitale, RN; Justin Klein, MD; Rajan K. Thakkar, MD*

**Introduction:** Pediatric burn care requires highly specialized treatment however further research is needed to provide standardization and quality improvement metrics. Studies on length of stay (LOS) per total body surface area (TBSA) burn in pediatric patients have been performed at single institutions and based on ranges of TBSA burn. A LOS to TBSA burn ratio of 1 has also been widely accepted but not validated over time across numerous institutions. The objective of this study is to describe the current relationship of LOS per TBSA burn and LOS per TBSA relative to burn mechanism with the use of multi-institutional pediatric burn data.

**Methods:** Data from the Pediatric Injury Quality Improvement Collaborative (PIQIC) were obtained for 1291 patients across five pediatric burn centers from July 2018-September 2020. LOS/TBSA burn ratios were calculated for each patient. Descriptive statistics, as well as generalized linear regression models modelling characteristics associated with LOS/TBSA ratio, are described.

**Results:** Among the 1291 injuries, the most common burn mechanism was by scald (62.9%), followed by contact (16.3%) and flame (13.3%). The average LOS/TBSA burn ratio across all cases was 1.2 days (SD 2.2). In adjusted models, scald burns and chemical burns had similar LOS/TBSA burn ratios of 0.7 and 0.8, respectively. While all other burns had a significantly higher LOS/TBSA burn ratio (p<0.0001). LOS/TBSA burn ratios were similar across races, with the exception of Hispanics who had a significantly higher ratio (1.5, p<0.001).

**Conclusions:** These data establish a multi-institutional ratio for the overall performance in managing 1291 pediatric burn patients from July 2018-September 2020. It demonstrates a LOS per TBSA ratio of 1.2 across PIQIC centers and provides evidence on the variance in LOS per TBSA burn relative to the sustained burn mechanism. Sociodemographic differences are also demonstrated. Further collaborative data analysis will allow us to recognize specific patterns and outcomes in pediatric burn care, which is essential for the implementation of quality improvement standards.

# Role of Insurance in Postoperative Outcomes and Quality of Life Following Ventral Hernia Repair

*Savannah Renshaw, BSPH; Rosevine Azap, BS; Anand Gupta, MBBS, MPH; Courtney Collins, MD, MS, FACS*

**Introduction:** Access to care and barriers to achieving health equity remain persistent and prevailing issues in the U.S. Insurance is often regarded as a surrogate marker of socioeconomic status, and previous studies have identified insurance type as a predictor of emergent repair in a variety of surgical specialties. However the impact of insurance type on postoperative outcomes following ventral hernia repair (VHR) remains unknown.

**Methods:** The 2013-2020 Abdominal Core Health Quality Collaborative (ACHQC) database was used to identify patients aged 18-64 undergoing ventral hernia repair (VHR) who had private or Medicaid insurance. Patients with no health insurance were also included. Using insurance type, the cohort was divided into 3 groups: private, public (Medicaid), and uninsured (self-pay). Multivariate logistic regression analyses were used to assess the impact of insurance type on 30-day postoperative outcomes, including complications, emergency department (ED) visits, readmission, reoperation, and changes in quality of life from baseline to 1-year using the Hernia-Related Quality of Life Survey (HerQLes).

**Results:** A total of 17,036 patients undergoing VHR were included in the study, out of which 13,980 (85.8%) had private insurance, 2,451 (8.4%) had public, and 605 (5.8%) were uninsured. Following adjustment for demographics (age, gender, race), comorbidities (hypertension, diabetes, smoking), and clinical characteristics (emergent, ASA class, approach), having public insurance or being uninsured was associated with increased odds of experiencing postoperative complications, compared to those who were privately insured (public: OR 1.3, p<0.01; self-pay: OR 1.67, p<0.01). Baseline quality of life was significantly different among groups, with publicly insured and self-pay patients presenting with -7.64 points lower and -5.72 points lower, respectively (public: 95% CI: -9.99, -5.28; self-pay: 95% CI: -10.69, -0.75; p<0.01).

**Conclusions:** Our study demonstrates that public and self-pay insurance are associated with worse postoperative outcomes compared to those with private insurance. In an effort to promote health equity, healthcare providers need to assess how parameters beyond physical presentation may impact a patient's health.



26TH ANNUAL RESEARCH CONFERENCE

# Clinical Burden of ICU Admissions in Patients With Previous Resection of Pancreatic Cancer

*Daniel R. Rice, BS; J. Madison Hyer, MS; Diamantis Tsilimigras, MD; Timothy M. Pawlik, MD, PhD, MPH*

**Introduction:** Pancreatic adenocarcinoma is a leading cause of cancer-related death in the United States. Intensive care use (ICU) has increased among patients with cancer, and ICU utilization may be more common among surgical patients with cancer – especially among individuals undergoing complex operative procedures such as pancreatectomy. We sought to define disease and demographic factors associated with ICU admissions among patients with pancreatic cancer, as well as characterize trends in mortality among hospital ICU survivors.

**Methods:** The Surveillance, Epidemiology, and End Results (SEER) – Medicare linked database was used to identify patients with a diagnosis of pancreatic cancer who underwent resection between 2004-2015. Multivariable analyses were conducted to identify factors associated with subsequent ICU admission, as well as mortality among hospital survivors.

**Results:** Among 6,422 Medicare beneficiaries who underwent resection of pancreatic cancer, 2,386 (37.1%) had an ICU admission following surgery; ICU utilization was most common at the time of the index surgical hospitalization (n=4,646; 72.3%). Patients with an ICU admissions were more likely to be younger (10-year increase OR 0.83, 95%CI 0.77-0.89), male (OR 1.17, 95%CI 1.05-1.30) and undergo resection at a teaching hospital (OR 1.19, 95%CI 1.05-1.36). Among patients who had an ICU admission, while the majority of patients survived to hospital discharge (n= 2,106; 88.3%), a large subset of patients (n=1,296; 54.3%) died within 6 months. In fact, among patients who underwent pancreatic resection and had a subsequent ICU admission, 1- and 5-year overall survival was only 31.8% and 11.0%, respectively. Ventilatory support during ICU admission was associated with marked increased odds of in-hospital mortality (OR 5.67; 95%CI 3.05-10.56); however, among patients who survived to discharge, history of ICU ventilatory support was not associated with 6-month (OR 1.81; 95%CI 0.77-4.26), 1- (OR 1.19; 95%CI 0.50-2.86) or 5-year (OR 1.01, 95%CI 0.29-3.41) survival (all p>0.05). Outcomes following ICU admission did not vary over the last decade. Specifically, among patients who underwent pancreatectomy, the proportion of patients who survived 6-months and 1-year from discharge following an ICU admission was 35.5% and 23.4% in 2004 versus 41.9% and 28.5% in 2015, respectively (both p>0.05). Following an ICU admission, patients discharged with home health care (OR 1.48, 95%CI 1.17-1.86) or to a skilled nursing facility (OR 1.91, 95%CI 1.43-2.54) had higher risk of death within a year of discharge versus patients discharged home with self-care (both p<0.05).

**Conclusions:** Over 1 in 3 patients with pancreatic cancer who underwent surgical resection had at least one subsequent ICU admission. While most patients survived the hospitalization, more than one-half of the patients died within 6 months of discharge and two-thirds died within 1-year of discharge. These data should serve to guide patient-provider discussions around prognosis relative to ICU use among patients with pancreatic cancer undergoing resection.

# Near-Infrared Autofluorescence of Adrenal Glands

*Steven Scoville, MD, PhD; Neel Rajan, BS; Tong Zhang, PhD; Barbra Miller, MD; Priya Dedhia, MD, PhD; John Phay, MD*

**Introduction:** After parathyroids were demonstrated to possess a natural near-infrared (NIR) autofluorescence, several groups have shown improved intraoperative identification, leading to two FDA-approved of devices. Adrenal glands are another endocrine organ that can be difficult to distinguish from their surrounding fat, particularly on the left side. Removing all adrenal tissues is particularly important during surgery for inherited syndromes or ACTH-dependent hypercortisolism. We hypothesized that adrenal tissue may also possess NIR autofluorescence.

**Methods:** We examined resected adrenal specimens with an NIR camera from patients undergoing robotic adrenalectomy between 1/1/2020 and 1/27/2021. None of the patients received a fluorescent dye. Images were analyzed with ImageJ software. Tissue was examined with an Olympus FV3000 confocal microscope.

**Results:** Resected tissue from 23 patients were examined, including pheochromocytomas (6), hyperaldosteronism (4), hypercortisolism (9), and a growing or suspicious mass (4). In all 23 cases, the adrenal gland demonstrated strong NIR autofluorescence. The intensity ratio compared to background from gross images revealed a ratio for normal adrenal tissue of 1.99 ± 0.5 compared to adjacent fat of 1.23 ± 0.2. Fluorescence from adrenal tumors was variable, but sectioned cortisol-producing tumors had the highest fluorescence of 3.14 ± 0.4. Microscopic imaging of normal adrenal tissue localized autofluorescence to the cytosol and extra-cellular space.

**Conclusions:** Normal adrenal tissue possesses a natural autofluorescence in the near-infrared spectrum which can be imaged real-time in the operating room. Use of NIR cameras may help in the identification and complete removal of all adrenal tissue during surgery.



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# Aggressive Attempts at Limb Salvage Are Associated With Improved Survival

*Carly Sobol, BS; LL Taylor, BS; VK Heh, PhD; J Underhill, MD; TP Sarac, MD; Michael Go, MD, MS*

Introduction: We sought to identify the impact of limb salvage attempts on survival in patients with chronic limb threatening ischemia (CLTI).

**Methods:** From 2013-2019, 353 limbs from 318 patients were treated. Limb salvage was prescribed for 223 limbs and primary amputation for 130. Demographics, comorbidities categorized per SVS reporting standards, clinical data, and mortality were retrospectively collected. T and chi-square tested differences between groups. Product-limit Kaplan-Meier estimated survival functions.

**Results:** Average age was 62.8, 31.4% were female, and 37.2% were black. 76.5% were diabetic, 34.1% smoked, 19.8% were dialysis-dependent, and 16.5% had unstable angina, symptomatic CHF, EF<25%, or MI within six months. WIfI stages 4, 3, 2, and 1 accounted for 44.5%, 27.2%, 15.8%, and 12.5%, respectively. Limb salvage patients were more likely to be female, older, and smokers; there were no differences between limb salvage and primary amputation patients with respect to race, diabetes, hypertension, renal status, hyperlipidemia, cardiac status, or pulmonary status. Within the limb salvage group, 18.8% had bypass, 81.2% had endovascular intervention, and two and five-year limb salvage was 78.0% and 66.2%.

Kaplan-Meier 75th percentile survival in the primary amputation and limb salvage groups was 24 and 30 months, respectively (Wilcoxon, P=0.046). Within the primary amputation group two and five-year survival was 70.4% and 58.2%, while two and five-year survival in the limb salvage group was 78% and 66.2%. When stratified by WIfI stage, there were no differences in survival between the primary amputation and limb salvage groups, with trends toward improved survival after limb salvage. Whereas stage 4 primary amputation patients had two and five-year survival of 64.9% and 50.6%, stage 4 limb salvage patients had two and five-year survival of 72.8% and 55.8% (P=0.25). Similarly, stage 3 primary amputation patients had two and five-year survival of 73.2% and 48.8%, while stage 3 limb salvage patients had a two and five-year survival of 83.6% and 80.1% (P=0.36).

There was no difference in survival between limb salvage or primary amputation patients who had dialysis dependence or severe cardiac comorbidities. Diabetic limb salvage patients did demonstrate a survival advantage over diabetic primary amputation patients (P=0.046).

**Conclusions:** Attempts at limb salvage, even in the setting of advanced CLTI or severe comorbidities, may be associated with improved survival. Patients in these categories should not be denied limb salvage based on perceived risk of mortality. Patient-centered outcomes such as quality of life and functional status should guide individualized decision-making.

# An Analysis of Five-Year Outcomes of Drug-Coated Endovascular Interventions

*Lauren L. Taylor, BS; Carly G. Sobol, BS; Victor K. Heh, PhD; Timur P. Sarac, MD; Said Atway, DPM; Michael R. Go, MD*

**Introduction:** A recent summary-level meta-analysis comprising randomized, controlled trials (RCTs) of drug-coated balloon and stent intervention identified excess late mortality in the drug-treated patients. We sought to identify trends in outcomes for patients with chronic limb threatening ischemia (CLTI) treated with endovascular intervention in a multidisciplinary limb salvage clinic, focusing on differences between drug-coated interventions (DCI) versus non-DCI.

**Methods:** From 2013-2019, 181 limbs from 160 patients had endovascular intervention for CLTI. Demographics, comorbidities, clinical data, mortality, patency, wound healing, and limb salvage were retrospectively collected. Two-sample independent t-tests were used to test differences between groups and chi-square tests were used for categorical variables. Product-limit Kaplan-Meier was used to estimate survival functions.

**Results:** Mean age was 64.9 years, 39.4% were female, and 40.3% were black. 80% were diabetic, 34.8% were current smokers, 21.1% were dialysis dependent, and 14.4% had unstable angina, symptomatic CHF, EF < 25%, or MI within 6 months. Isolated aortoiliac, femoropopliteal, tibial, and multilevel lesions accounted for 6.3%, 47.1%, 18.4%, and 28.2% of interventions, respectively. Interventions included POBA (66.9%), drug coated balloon (29.3%), bare metal stent (18.2%), drug eluting stent (6.6%), and atherectomy (30.9%).

Overall, five-year survival was 62.6%. 34.8% of limbs had drug-coated intervention (DCI) while 65.2% had non- DCI. There were no differences between DCI and non-DCI patients with respect to gender, race, age, tobacco use, diabetes, renal status, cardiac status, or pulmonary status.

There was no difference in survival between patients who had DCI versus those who had non-DCI (log-rank, P=0.148). One, two, and five-year survival for DCI patients were 86.8%, 78.8%, and 78.8%, while one, two, and five-year survival for non-DCI patients were 88.0%, 74.2%, and 57.4%.

However, patency was significantly improved in the DCI group (P=0.005). One, two, and five-year patency for DCI patients were 85.3%, 66.9%, and 45.1%, while one, two, and five-year patency for non-DCI patients were 57.4%, 49.6%, and 40.9%.

There was no difference in wound healing between DCI or non-DCI patients, though DCI was associated with an improvement in limb salvage (P=0.037).

**Conclusions:** Five-year survival after endovascular intervention for CLTI is low, likely reflecting overall cardiovascular risk. DCI was associated with improved patency and limb salvage, but no difference in survival or wound healing. DCI can be used safely to treat CLTI, but more data is needed to understand its impact on patient-centered outcomes such as wound healing.





# Intraoperative Patient Safety Teaching in Laparoscopic Cholecystectomy: Eliciting Teaching Opportunities and Development of a Rubric

*Michael E. Villarreal, MD, MBA; Clayton D. Rothwell, PhD*

**Introduction:** Surgeons emphasize the importance of safety, but miss instructional opportunities intraoperatively, creating a need for patient safety-focused intraoperative teaching interventions and evaluations. This study aimed to catalogue patient safety teaching opportunities during laparoscopic cholecystectomy (LC) using cognitive task analysis (CTA) to develop a rubric to guide observation and evaluation of patient safety-focused teaching.

**Methods:** One attending surgeon, a surgical resident, and a human factors specialist conducted CTAs with expert surgeons. Interviews were semi-structured and conducted via a modified task diagram method in which a published model of LC was expanded to add intraoperative patient safety aspects (e.g., injury prevention, risk management, complication detection). After interviews were completed and analyzed, the synthesized task model was reviewed with subjects.

**Results:** Four surgeons, three general and one hepatobiliary surgeon, ranging from 2-25 years' experience, at two institutions, were interviewed. CTA expanded the current LC task model from 19 major steps. An additional major step ("step zero") and 77 substeps were identified. Major steps with the most additions included dissection and intraoperative cholangiogram, with 15 and 10 substeps, respectively. The task model was converted into a rubric for evaluating intraoperative patient safety teaching, utilizing Bloom's taxonomy to document teaching complexity and specificity.

**Conclusions:** LCs are complex operations with many steps representing opportunities to teach intraoperative patient safety. Identification of these steps via CTA led to development of a rubric for evaluating intraoperative patient safety teaching. Future interventions for intraoperative teaching will be developed from this analysis (e.g., teaching scripts), and their efficacy evaluated using this rubric.

# Predictors of Successful Long-Term Follow-Up After Ventral Hernia Repair

*Michael Villarreal, MD, MBA; Savannah Renshaw, BSPH; Anand Gupta, MBBS, MPH*

**Introduction:** The Abdominal Core Health Quality Collaborative (ACHQC) was designed to improve quality through increased follow-up after ventral hernia repair (VHR). Obtaining follow-up is challenging in our U.S. healthcare system. This study aimed to identify characteristics predicting the likelihood for a patient to complete long-term patient-reported outcome (PRO) follow-up.

**Methods:** A multi-institutional comparative study was performed using data available from the ACHQC. Adult patients who underwent elective VHR were identified between 2014 and 2020. Patient demographics, comorbidities, clinical characteristics, and postoperative complications were evaluated. Multivariate logistic regression determined predictive factors for PRO completion up to 6 years after the initial operation.

**Results:** 28,871 patients were identified with 13,790 (47.8%) women and 24,175 (84.6%) White. Individuals insured through Medicare/ Medicaid (OR 0.76, 95% CI 0.71-0.83) or self-pay (OR 0.30, 95% CI 0.21-0.43) had decreased odds of PRO completion. Non-white race demonstrated a decreased likelihood of PRO completion. Hernia size (OR 1.04, 95% CI 1.03-1.05) did not predict the likelihood of survey completion over the six years, but use of mesh (OR 1.29, 95% CI 1.15-1.45), myofascial release (OR 1.65, 95% CI 1.49-1.83), and postoperative complications increased likelihood of completion.

**Conclusion:** Annual PRO follow-up is effective at gathering data beyond standard clinical follow-up and may have more utility in specific subgroups. Patients undergoing large, complex repair place greater emphasis on completing the follow-up survey, while patients from underrepresented racial and socioeconomic categories may require additional measures to maintain long-term follow up.





# Real-World Performance of the Hernia Recurrence Inventory to Measure Recurrence After Ventral Hernia Repair

*Michael Villarreal, MD, MBA; Savannah Renshaw, BSPH; Anand Gupta, MBBS, MPH*

**Background:** The Hernia Recurrence Inventory (HRI) has been accepted as a validated patient reported outcome (PRO) to assess recurrence after inguinal and ventral hernia repair (VHR). We aimed to further refine the validity evidence for HRI by assessing its real-world performance.

**Methods:** A multi-institutional comparative study was performed using data available from the Abdominal Core Health Quality Collaborative (ACHQC). Adult patients who underwent elective VHR and completed the HRI survey in addition to radiographic assessment of recurrence at one, two, or three years after repair were included. Multivariable regression was used to evaluate HRI association with recurrence.

**Results:** A total of 1,951 patients were identified with 1,061 (54.4%) women and 890 (45.6%) men, median age of 60 (IQR [18,90]), and average BMI 32.7 (SD=6.4) kg/m$^2$. Original hernias repaired in the sample had a mean width of 12.2 cm (SD=7.0). The overall sensitivity of the HRI was determined to be 0.63 (95% CI 0.53-0.73), with a specificity of 0.74 (95% CI 0.70-0.78), positive predictive value of 0.34 (95% CI 0.30-0.38), and negative predictive value of 0.92 (95% CI 0.90-0.94). The area under the curve of the receiver operating characteristic was 0.70.

**Conclusion:** The HRI can be used to assess ventral hernia recurrence with reasonable accuracy comparable to radiographic evaluation. Confirmation of recurrence when HRI is positive can help minimize false positive results. Utilizing the HRI can be an effective way to evaluate post-operative recurrence while avoiding the cost, time, travel, and risk required for traditional clinical or radiographic methods requiring in-person care.

# Long Non-Coding RNA Camirt Plays a Sentinel Role in Aging-Related Heart Failure Via Interaction With Phb2 to Modulate Mitophagy Signaling in the Heart

*Xiaoliang Wang, MD, PhD; Xiuchun Li, PhD; Hannah Ong, BS; Jae-Kyun Ko, PhD; Nuo Sun, PhD; Joseph Miano, PhD; Jianjie Ma, PhD; Chuanxi Cai, PhD*

**Introduction:** Mitochondrial dysfunction is an important risk factor for myocardial infarction and heart failure in elderly people. Mitophagy, a physiological process that controls the removal of damaged mitochondria, is compromised in aging or failing hearts. In this study, we examined the physiological role of a cardiac-specific lncRNA Camirt that can potentially modulate mitophagy in the heart.

**Methods:** RNA-seq analyses were conducted to identify cardiac specific lncRNAs in hearts derived from young and aging mice. RNA pull-down and RNA-binding protein immunoprecipitation assay were performed to study the lncRNA-protein interactome in the mouse heart. Real time qPCR was used to examine the expression of lncRNA in aging mouse and human hearts, and stress-induced chronic failing hearts. *Camirt* conditional (*flox*) knockout mice were created via CRISPR /Cas9 mediated genome engineering, and subjected to the longitudinal echocardiographic and survival studies after cross-bred with αMHC-Cre mice. Transmission electron microscopy were used to examine the mitochondrial morphology in both Camirt-cKO and control hearts. In vitro studies were conducted with overexpression and/or knockdown of Camirt in cultured neonatal cardiomyocytes or HL-1 cells.

**Results:** RNA-seq analysis and RT-PCR reveal an lncRNA is highly expressed in both mouse and human hearts, with undetectable levels in other vital organs. Furthermore, the expression of this lncRNA is decreased in aging mouse and human hearts, and failing mouse hearts induced by isoproterenol and doxorubicin. RNA pull-down and RNA immunoprecipitation (RIP) assays identify prohibitin-2 (Phb2), a known mitophagy receptor, as a binding partner for this lncRNA. Thus, we name this novel lncRNA as a cardiac-specific mitophagy-associated RNA transcript (Camirt). Mice with cardiac specific deletion of Camirt (Camirt-cKO) display progressive heart failure and die within 12 month after birth. RNA sequencing and gene ontology analysis revealed that genes involved in mitophagy signaling were significantly altered in the Camirt-cKO hearts compared with the littermate wild type mice. Electron microscopy analyses reveal excessive accumulation of mitolysosomes in cardiomyocytes derived from the Camirt-cKO mice. Annexin-V/PI staining showed an increased number of live cells and decreased number of apoptotic cells in NCMs with overexpression of Camirt following oxidative stress induced by 2-hour treatment of 1 mM H2O2. Increased autophagy (or mitophagy) activity was observed in HL-1 cells with stable overexpression of Camirt and in the presence of chloroquine (an inhibitor for the lysosome degradation). While reduced Camirt expression via shRNA knock-down leads to compromised autophagy (or mitophagy) activity in HL-1 cells. Further biochemical studies support the function of Camirt/Phb2 in maintenance of mitochondria function and mitophagy signaling under stress conditions.

**Conclusions:** Overall, our results suggested that Camirt plays a sentinel role in aging-related heart failure via interaction with Phb2 to modulate mitophagy signaling in the heart. Future studies will focus on elucidating the in vivo role and mechanisms of Camirt in modulation of mitophagy under natural aging or stress-induced pathologic conditions using the loss- or gain-of-function of Camirt mouse models.



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# The Role of Mitsugumin 29 in Skeletal Muscle Regeneration

*Frank Yi,* BS; Xinyu Zhou, PhD; Kristyn Gumpper, BS; Bingchuan Geng, PhD; Dathe Benissan-Messan, MD, MS; Kyoung-Han Choi, PhD*

**Introduction:** Mitsugumin 29 (MG29), a member of the synaptophysin-like family proteins, is a transmembrane protein primarily expressed in the t-tubule membranes of skeletal muscle. In the current study, we have found that MG29 co-localizes and interacts with Bridging Integrator-1 (Bin-1), a critical protein involved in t-tubule biogenesis. We examined the role of the MG29-Bin1 interaction during skeletal muscle regeneration by utilizing a cardiotoxin (CTX) induced model of skeletal muscle injury. We also studied the potential of MG29 as a potential target for therapeutic muscle regeneration by overexpressing it in an animal model of limb girdle muscular dystrophy.

**Methods:** In this study we performed co-immunoprecipitation of mouse skeletal muscle lysates and identified an interaction between MG29 and Bin-1. We used STORM high resolution microscopy to determine levels of co-localization of the two proteins as well as elucidate the skeletal muscle morphology of *mg29-/-* mice. We further studied the role of MG29 in skeletal muscle regeneration *in vivo* by injecting CTX directly into the gastroc muscle of wild type and *mg29-/-* mice. We tracked the recovery process of the mouse skeletal muscle by performing western blot of injected gastroc muscle and detected MG29 levels and Bin-1 post injury at 1, 3, 5 and 10 days. Immunofluorescent staining and western blots were performed to determine the dynamic roles of MG29 and Bin-1 during skeletal muscle regeneration. We overexpressed MG29 in A/J mice, a model of limb girdle muscular dystrophy through intravenous injection of AAV viral vector (AAV-MG29). We measured the contractility of these overexpressed mice compared to their non-injected controls with Aurora in-vivo contractility equipment.

**Results:** We found that MG29 binds to Bin-1 in mouse skeletal muscle based on upon co-immunoprecipitation assay. STORM microscopy showed a high level of co-localization of both MG29 and Bin-1 on the t-tubule of skeletal muscle. Immunofluorescent staining also revealed abnormal t-tubule morphology in *mg29-/-* mice. Western blotting showed Bin-1 increases during the recovery process in wild type mice but not as much in *mg29-/-* mice. We also observed that A/J control mice had less *in-vivo* contractile strength compared to their AAV-MG29 littermates.

**Conclusions:** From this study we have learned that Bin-1 and MG29 are interacting partners on the t-tubules of mouse skeletal muscle. We also characterized defective t-tubule structure and network in mg29-/- mice as well as a reduced capacity for muscle regeneration following CTX induced muscle injury. These findings show that MG29 and Bin-1 play a critical role in muscle biogenesis. We also found that MG29 overexpression improved muscle contractile function in limb girdle muscular dystrophy. Thus, targeting MG29 may be a potential target for modulation of therapeutic muscular regeneration.

**Funding: Frank Yi is supported by a pre-doctoral fellowship from the American Heart Association. We also appreciate NIH, DoD and AHA for supporting our team-based research.*

# Acknowledgement of Achievements

The Ohio State University Department of Surgery's Research Training Program prepares surgical trainees for careers in academic surgery through personalized research education, mentorship and career development. Our extensive program focuses on enhancing our trainees' critical thinking skills and developing their clinical and translational research competencies. The ultimate goal of the program is to train surgeons to perform and lead impactful translational, clinical and health services research and/or surgery education research that will enhance the care of surgical patients.

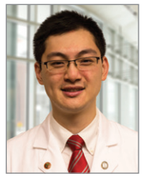
We wish to take this opportunity to acknowledge the achievements of our general surgery residents who have successfully completed one or more years in the Department of Surgery's Research Training Program. These individuals graduated from their respective degree programs this month, May 2021, and are returning to their clinical duties on July 1, 2021. Congratulations!

### Adrian Diaz, MD, MPH

**Degree Completed:** n/a
**Project:** Health Disparities, Health Quality and Policy
**Mentor:** Justin Dimick, MD, University of Michigan

### Gregory Metzger, MD, MS

**Degree Completed:** Master of Integrated Systems Engineering
**Project:** Leveraging the Principles of Cognitive Systems Engineering to Optimize Healthcare Delivery
**Mentor:** Michael Rayo, PhD



### Steven Sun, MD, MS

**Degree Completed:** Master of Medical Science
**Project:** Targeting Myeloid Derived Suppressor Cells to Improve Cancer Therapy
**Mentor:** William Carson III, MD





# Presenters

### Ruth Ackah, MD

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**Doctorate:** MD, Baylor College of Medicine, Houston, Texas
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**Undergraduate:** College of the Holy Cross, Worcester, Massachusetts
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**Doctorate:** MD, Rutgers Robert Wood Johnson Medical School, New Brunswick, New Jersey
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**Faculty Advisors:** Jordan Cloyd, MD, and Aslam Ejaz, MD, MPH

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**Doctorate:** MD, University of Nebraska, Omaha, Nebraska
**Doctorate:** PhD/Biomedical Science, in progress, The Ohio State University, Columbus, Ohio
**Research Interests:** Muscle regeneration, tissue engineering and wound healing
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### Peng Chen, MD, PhD

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**Faculty Advisor:** Hua Zhu, PhD

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**Hometown:** Seoul, South Korea
**Undergraduate:** BS/Biological Science, Korea Advanced Institute of Science & Tech, Daejeon, South Korea
**Doctorate:** PhD/Physiology, Rutgers Robert Wood Johnson Medical School, New Brunswick, New Jersey
**Research Interests:** Physiological role of MG53 with other proteins in some disease models
**Faculty Advisors:** Hua Zhu, PhD; Jae-Kyun Ko, PhD; and Jianjie Ma, PhD

### Emma Clark, MS

MED II Student, The Ohio State University College of Medicine
**Hometown:** Westerville, Ohio
**Undergraduate:** BS/Biology, The Ohio State University, Columbus, Ohio
**Graduate:** MS/Biomedical Informatics, University of Chicago, Chicago, Illinois
**Doctorate:** MD, in progress, The Ohio State University, Columbus, Ohio
**Research Interests:** Clinical outcomes in vascular surgery and surgical oncology
**Faculty Advisors:** Jean Starr, MD, and Valerie Grignol, MD

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### Albert Dahdah, PhD
Research Scientist
**Hometown:** Paris, France
**Undergraduate:** BS, University of Saint Joseph, West Hartford, Connecticut
**Master's:** MS, University of Paris, Paris, France
**Doctorate:** PhD, University of Paris, Paris, France
**Research Interests:** Immune system interactions with the host and pathogens
**Faculty Advisor:** Prabhakara Nagareddy, PhD

### Adrian Diaz, MD, MPH
Clinical Instructor House Staff, General Surgery
**Hometown:** Miami, Florida
**Undergraduate:** BS, Nova Southeastern University, Fort Lauderdale, Florida
**Master's:** MPH, Harvard T.H. Chan School of Public Health, Boston, Massachusetts
**Doctorate:** MD, Virginia Commonwealth University School of Medicine, Richmond, Virginia
**Research Interests:** Investigation of the intersection of health, delivery systems, geography and policy to optimize access, quality and value to surgical patients
**Faculty Advisor:** Timothy Pawlik, MD, PhD, MPH

### Ahmad Hamad, MD
Clinical Instructor House Staff, General Surgery
**Hometown:** Beirut, Lebanon
**Undergraduate:** BS, American University of Beirut, Beirut, Lebanon
**Masters:** MS/Medical Science, in progress, The Ohio State University, Columbus, Ohio
**Doctorate:** MD, American University of Beirut, Beirut, Lebanon
**Research Interests:** Clinical and translational science in HPB, pancreatic and gastric cancer, improving quality of life and patient survival
**Faculty Advisors:** Allan Tsung, MD, and Aslam Ejaz, MD, MPH

### D. Brock Hewitt, MD, MPH, MS
Fellow, Surgical Oncology
**Hometown:** Toronto, Ontario, Canada
**Undergraduate:** BS, Saint Louis University
**Master's:** MS, Northwestern Feinberg School of Medicine, Chicago, Illinois
**Master's:** MPH, University of Texas Health Sciences Center at Houston, Texas
**Doctorate:** MD, Texas Tech University Health Science Center, Texas
**Research Interests:** Cancer prevention, the role of technology in improving surgical outcomes in patients with cancer and surgical education
**Faculty Advisor:** Carlo Contreras, MD

### Madison Hyer, MS
Sr. Biostatistician CCC
**Hometown:** Peach County, Georgia
**Undergraduate:** Georgia College & State University, Milledgeville, Georgia
**Master's:** Medical College of Georgia, Augusta, Georgia
**Research Interests:** Machine learning
**Faculty Advisor:** Timothy Pawlik, MD, PhD, MPH

### Robert Jaggers, MS
Research Associate
**Hometown:** Fort Smith, Arkansas
**Undergraduate:** BS/Biology, University of Tulsa, Tulsa, Oklahoma
**Master's:** MS/Anatomy, Wright State University, Dayton, Ohio
**Research Interests:** Understanding mechanisms driving acute and chronic inflammation during cardiovascular disease
**Faculty Advisor:** Prabhakara Nagareddy, PhD







### Anahita Jalilvand, MD, PhD
Clinical Instructor House Staff, General Surgery
**Hometown:** Montreal, Quebec, Canada
**Undergraduate:** BS/Biochemistry and BA/French Literature, Loyola University, Chicago, Illinois
**Doctorate:** MD, Loyola University, Chicago, Illinois
**Doctorate:** PhD/Biomedical Sciences, The Ohio State University, Columbus, Ohio
**Research Interests:** Adipocyte immunology post bariatric surgery, minimally invasive surgery, disparities in bariatric surgery
**Faculty Advisor:** Jonathan Wisler, MD, MS

### Dahlia Kenawy, MD
Clinical Instructor House Staff, General Surgery
**Hometown:** Unionville, Pennsylvania
**Undergraduate:** BSE/Bioengineering, University of Pennsylvania, Philadelphia, Pennsylvania
**Doctorate:** MD, Albert Einstein College of Medicine, Bronx, New York
**Research Interests:** Minimally invasive surgery and device innovations
**Faculty Advisor:** Sabrena Noria, MD, PhD

### Jongsoo Kim, PhD
Postdoctoral Scholar
**Hometown:** Seoul, Republic of Korea
**Doctorate:** PhD/Biomedical Science, Hanyang University, Seoul, Republic of Korea
**Research Interests:** Small non-coding RNA
**Faculty Advisor:** Hua Zhu, PhD

### Cheng Kong, MS
Research Scholar
**Hometown:** Columbus, Ohio
**Doctorate:** PhD/Surgery, in progress, Tongji University, Shanghai, China
**Research Interests:** Overcoming resistance to treatment of colorectal surgery
**Faculty Advisor:** Matthew Kalady, MD

### Kyung Lee, PhD
Postdoctoral Scholar
**Hometown:** Seoul, Republic of Korea
**Doctorate:** PhD, Ewha Womans University, Life & Pharmaceutics, Seoul, Republic of Korea
**Research Interests:** Role of MG53 in injured cornea regeneration
**Faculty Advisors:** Hua Zhu, PhD; Jae-Kyun Ko, PhD; and Jianjie Ma, PhD

### Max Magallanes, MD
Clinical Instructor House Staff, General Surgery
**Hometown:** Rio Grande City, Texas
**Undergraduate:** BS/Neurobiology, University of Texas at Austin, Texas
**Doctorate:** MD, University of Texas Medical Center, Austin, Texas
**Research Interests:** Outcomes in colorectal surgery
**Faculty Advisor:** Syed Husain, MBBS

### Gregory Metzger, MD, MS
Clinical Instructor House Staff, General Surgery
**Hometown:** Pickerington, Ohio
**Undergraduate:** BS/Biochemistry, The Ohio State University, Columbus, Ohio
**Master's:** MS/Integrated Systems Engineering, The Ohio State University, Columbus, Ohio
**Doctorate:** MD, The Ohio State University, Columbus, Ohio
**Research Interests:** Health services research, health system performance
**Faculty Advisors:** Katherine Deans, MD, MHSc, and Peter Minneci, MD, MHSc

### Christina Monsour, BS
Project Coordinator
**Hometown:** St. Paul, Minnesota
**Undergraduate:** BS/Public Health/ Community Health Education & Promotion, University of Wisconsin, La Crosse, Wisconsin
**Research Interests:** Women's health, holistic wellness, cancer and preventive care
**Faculty Advisor:** Jordan Cloyd, MD

### Priya Pathak, MBBS, MPH

Research Volunteer

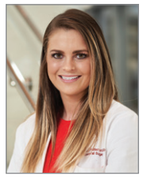
**Hometown:** Bhilai, Chhattisgarh, India

**Master's:** MPH, Johns Hopkins Bloomberg School of Public Health, Baltimore, Maryland

**Doctorate:** MBBS, Chhattisgarh Institute of Medical Sciences, Gol Bazar, India

**Research Interests:** Surgical outcomes, patient safety and quality

**Faculty Advisors:** Timothy Pawlik, MD, PhD, MPH



### Kelli Patterson, DO, MS

Clinical Instructor House Staff, General Surgery

**Hometown:** Dayton, Ohio

**Undergraduate:** BS, Eastern Michigan University, Ypsilanti, Michigan

**Master's:** MS, Wright State University, Dayton, Ohio

**Doctorate:** DO, Ohio University Heritage College of Osteopathic Medicine, Athens, Ohio

**Research Interests:** Pediatric surgery, specifically clinical and psychological outcomes related to pediatric trauma and critical care

**Faculty Advisors:** Katherine Deans, MD, MHSc; Peter Minneci, MD, MHSc; and Rajan Thakkar, MD

### Savannah Renshaw, BSPH

Project Coordinator

**Hometown:** Dayton, Ohio

**Undergraduate:** BS/Public Health, The Ohio State University, Columbus, Ohio

**Master's:** MS/Public Health and MS/Public Administration, in progress, The Ohio State University, Columbus, Ohio

**Research Interests:** Process and quality improvement, patient engagement and public health policy

**Faculty Advisors:** Benjamin Poulose, MD, MPH, and Courtney Collins, MD, MS

### Daniel Rice, BS

MED III Student, Lake Erie College of Medicine

**Hometown:** Cincinnati, Ohio

**Undergraduate:** BS/Health Sciences, University of Cincinnati, Cincinnati, Ohio

**Master's:** MS MEd, in progress, Lake Erie College of Osteopathic Medicine, Erie, Pennsylvania

**Doctorate:** DO, in progress, Lake Erie College of Osteopathic Medicine, Erie, Pennsylvania

**Research Interests:** Health services and outcomes in surgical oncology

**Faculty Advisor:** Timothy Pawlik, MD, PhD, MPH

### Steven Scoville, MD, PhD

Clinical Instructor House Staff, General Surgery

**Hometown:** Idaho Falls, Idaho

**Undergraduate:** Brigham Young University, Provo, Utah

**Doctorate:** MD, The Ohio State University, Columbus, Ohio

**Doctorate:** PhD, The Ohio State University, Columbus, Ohio

**Research Interests:** Cancer immunology

**Faculty Advisor:** John Phay, MD

### Carly Sobol, BS

MED III Student, The Ohio State University College of Medicine

**Hometown:** Dayton, Ohio

Undergraduate: BS/Neuroscience, The Ohio State University, Columbus, Ohio

**Doctorate:** MD, in progress, The Ohio State University, Columbus, Ohio

**Research Interests:** Clinical outcomes for patients with chronic limb-threatening ischemia and the intersection between the humanities and medicine

**Faculty Advisor:** Michael Go, MD, MS

### Gopalkrishna Sreejit, PhD

Research Scientist

**Hometown:** Alleppey, Kerala, India

**Master's:** MSc, Mahatma Gandhi University, Kottayam, Kerala, India

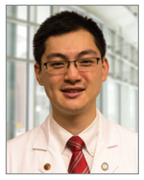
**Doctorate:** PhD, CDFD, Manipal University, Manipal, Jaipur, India

**Research Interests:** Role of neutrophils in initiating inflammation and resolution of inflammation after a myocardial infarction and sterile injury in general

**Faculty Advisor:** Prabhakara Nagareddy, PhD

26TH ANNUAL RESEARCH CONFERENCE

Presenters



### Steven Sun, MD, MS

Postdoctoral Fellow

**Hometown:** Ann Arbor, Michigan

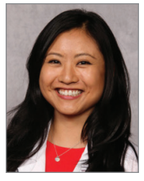
**Undergraduate:** BA/Anthropology and Biochemistry, Washington University, St. Louis, Missouri

**Master's:** MS/Medical Science, The Ohio State University, Columbus, Ohio

**Doctorate:** MD, University of Michigan, Ann Arbor, Michigan

**Research Interests:** Immune suppressive cell populations and how they affect the efficacy of immune checkpoint therapy

**Faculty Advisor:** William Carson III, MD



### Lauren Taylor, BS

MED III Student, The Ohio State University College of Medicine

**Hometown:** Fremont, California

**Undergraduate:** BS/Human Biology, University of Southern California, Los Angeles, California

**Doctorate:** MD, in progress, The Ohio State University, Columbus, Ohio

**Research Interests:** Advancing research in critical limb-threatening ischemia to improve clinical outcomes

**Faculty Advisors:** Michael Go, MD, MS, and Timur Sarac, MD

### Diamantis Tsilimigras, MD

Postdoctoral Research Fellow

**Hometown:** Kalamata, Greece

**Doctorate:** MD, University of Athens, School of Medicine, Athens, Greece

**Doctorate:** PhD, in progress, University of Athens, School of Medicine, Athens, Greece

**Research Interests:** Surgical oncology, HPB surgery, clinical outcomes and health services research

**Faculty Advisor:** Timothy Pawlik, MD, PhD, MPH

### Ammu Vijayakumar, MD, MS

Clinical Instructor House Staff, General Surgery

**Hometown:** Charlotte, North Carolina

**Undergraduate:** BS/Biology, BS/Microbiology, North Carolina State University, Raleigh, North Carolina

**Doctorate:** MD, University of North Carolina, Chapel Hill, North Carolina

**Research Interests:** Analyzing vascular surgery and surgical oncology clinical outcomes

**Faculty Advisors:** Jean Starr, MD, and Valerie Grignol, MD

### Michael Villarreal, MD, MBA

Clinical Instructor House Staff, General Surgery

**Hometown:** Fayetteville, North Carolina

Undergraduate: Baylor University, Waco, Texas

**Master's:** MBA, The Ohio State University, Columbus, Ohio

**Doctorate:** MD, University of Texas Medical Branch, Galveston, Texas

**Research Interests:** Clinical trial performance, surgery outcomes

**Faculty Advisors:** Emily Huang, MD, MAEd, and Benjamin Poulose, MD, MPH

### Xiaoliang Wang, MD, PhD

Postdoctoral Scholar

**Hometown:** Taiyuan, Shanxi, People's Republic of China

**Doctorate:** MD, Shanxi Medical University, Taiyuan, Shanxi, China

**Doctorate:** PhD/Physiology, Shanxi Medical University, Taiyuan, Shanxi, China

**Research Interests:** Mechanism and therapeutic strategies of ischemic heart disease

**Faculty Advisor:** Chuanxi Cai, PhD

### Frank Yi, BS

Graduate Research Associate

**Hometown:** Chicago, Illinois

**Undergraduate:** BS/Biochemistry, The Ohio State University, Columbus, Ohio

**Doctorate:** PhD/Biomedical Sciences, in progress, The Ohio State University, Columbus, Ohio

**Research Interests:** Skeletal muscle physiology and metabolic disease

**Faculty Advisors:** Jianjie Ma, PhD, and Hua Zhu, PhD

Notes





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