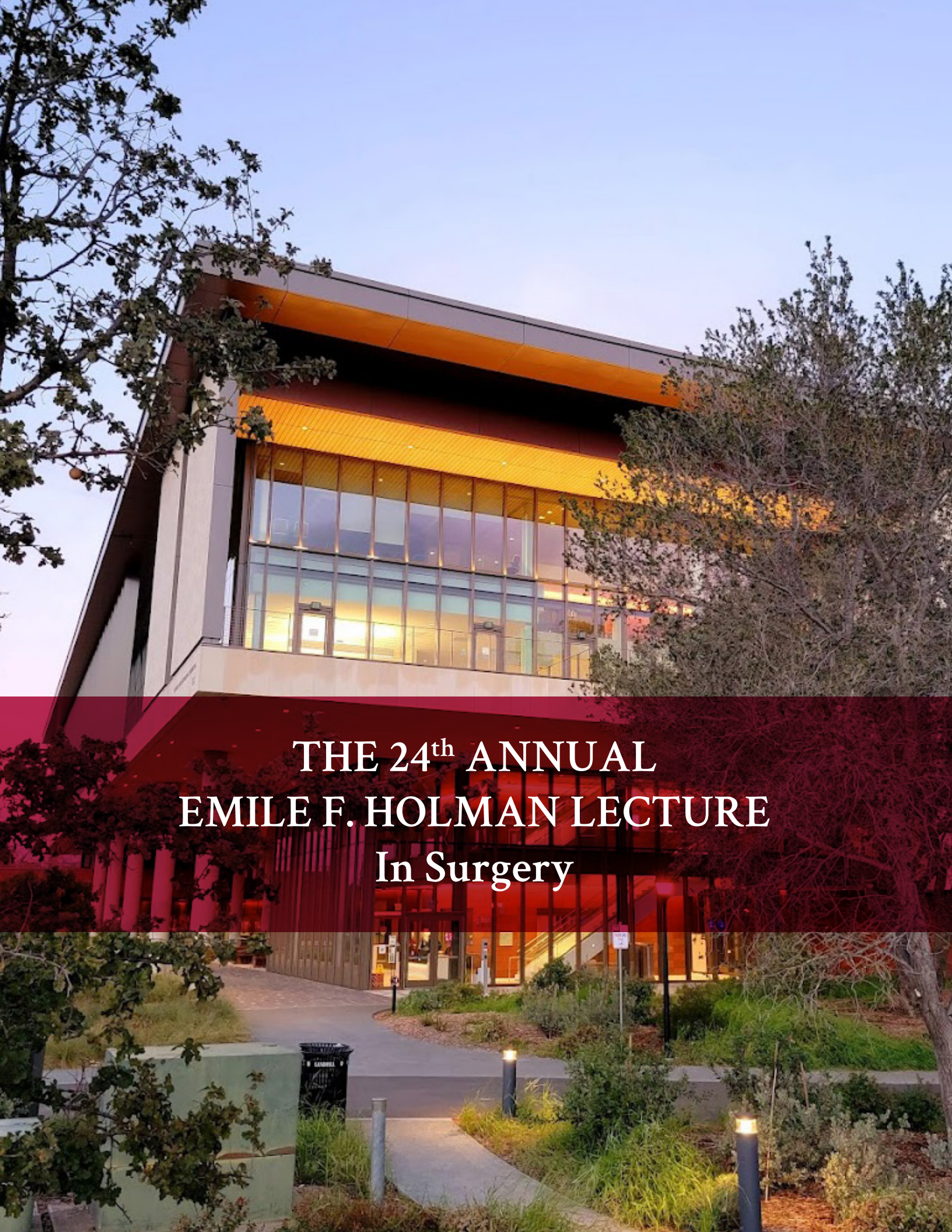


THE 24th ANNUAL EMILE F. HOLMAN LECTURE

In Surgery

The 24th Annual
Emile F. Holman Lecture In Surgery
and
14th Annual Resident Research Day

Friday, April 28, 2023

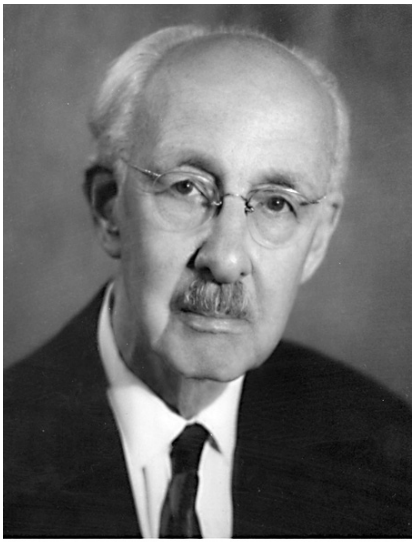
Stanford Center for Academic Medicine
Stanford University

10:30 AM – 12:00 PM	Poster Presentations *Center for Academic Medicine Courtyard*
12:00 PM – 1:00 PM	Lunch *Center for Academic Medicine Courtyard*
1:00 PM – 5:00 PM	Abstracts *Grand Rounds*
5:00 PM – 6:15 PM	Holman Lecture *Grand Rounds*
6:15 PM – 6:30 PM	Awards Ceremony - Best in Category *Grand Rounds*
6:30 PM	Holman Reception *Center for Academic Medicine* *Café Arbor & Wine Bar*

Stanford MEDICINE | Surgery

Emile Frederic Holman, MD

August 12, 1890 to March 19, 1977
Founding Chair – Department of Surgery
Stanford University



Emile Holman

Emile Frederic Holman, the son of a Methodist minister, was born in Missouri and then moved with his family as a teenager to southern California. He entered Stanford University as a math major in 1907; he dropped out for a semester to learn shorthand and typing in order to support himself. Upon his return, he performed stenographic work for Stanford's founding President, David Starr Jordan. After graduation, Holman stayed on as Secretary to President Jordan until 1914 when Holman went to Oxford as a Rhodes Scholar. Thereafter, began a key period of education at Johns Hopkins University.

Of some note, Sir William Osler wrote a letter recommending Holman for admission to The Johns Hopkins School of Medicine; Holman received his M.D. degree from Hopkins in 1918. He then became Assistant in Surgery in the Surgical Hunterian Laboratory, the research lab of the noted surgeon, William Stewart Halsted. He continued in Halsted's residency program until 1923, serving as the last resident surgeon at the time of Halsted's death in 1922. His loyalty to Professor Halsted was legendary; it was Holman who first brought the principles of the Halstedian residency to the west. In 1925 he returned to Stanford as Associate Professor of Surgery and in 1926 he was named head of the Department, a position he held for 29 years until his retirement from the faculty in 1955.

" ... as a scholar, innovator, teacher and clinical surgeon, he pioneered a truly academic surgical program at a time when there were few others west of the Mississippi." — William P. Longmire, Jr

Dr. Holman is perhaps best known for his pioneering work in vascular surgery and, in particular, the physiology of arteriovenous fistulas. This research won him the coveted Samuel D. Gross prize from the Philadelphia Academy of Surgery in 1930 and the Rudolph Matas Medal in Vascular Surgery from Tulane in 1954. He was elected a member of The Johns Hopkins Society of Scholars in 1970. His co-authors over the years are a literal compendium of the substantial physicians and surgeons of the 20th century. Less well known were his fundamental ideas and observations on skin grafting. In 1924 he published a paper of his early work in the identification and characterization of the phenomenon of rejection of transplanted skin (from a parent to a child), particularly the accelerated rejection of second transplants from the same donor. These observations were not pursued, though many believe formed the basis for Medawar's work a quarter of a century later. His astute observations were recognized at the International Congress of The Transplantation Society in 1972 nearly 50 years after his paper was published.

Perhaps most importantly, Dr. Holman was a humanist as well as a scientist, devoted to the service of his fellow man. During World II his patriotism and selflessness were obvious during his volunteer time in the Pacific, though 51 at the time. His experiences in both World Wars made him a fervent critic of war; he did not hesitate to speak out against national policy or social injustice.

In all, he was perhaps the most Halsted-like graduate of any of the Halstedian residents.

"He was a man not easily forgotten. Yet it was not by bombast or power that he attracted attention. It was by his sharp and incisive mind, by his thoughtful and gentle demeanor and by his perpetual search for truth and excellence in science that we remember him." — James B.D. Mark, M.D

In his in memoriam tribute in the Journal of Thoracic and Cardiovascular Surgery, Frank Gerbode, in describing Dr. Holman's life and accomplishments, chose to quote William Shakespeare in King Lear: "We have seen the best of our time. We that are younger shall never see so much nor live so long." ■

Mary T. Hawn, MD, FACS

Professor and Chair
Emile Holman Professor in Surgery

The 2023 Emile F. Holman Lectureship and the Stanford Surgery Research Symposium had an unprecedented number and high caliber abstracts submitted this year. We're thrilled to continue the long tradition of showcasing the outstanding research by our trainees and their mentors. This year we are honored to welcome Dr. Andrea Hayes Dixon as our Holman Visiting Professor. Dr. Hayes Dixon is a pediatric surgical oncologist and Dean of Howard University.

I'm grateful to Dr. Arden Morris, Vice Chair for Clinical Research, Dr. Olivia Martinez, Vice Chair for Basic & Translational Research, Dr. Lisa Knowlton, Associate Chair of Research, and the surgical research council for their stewardship of this program and selection of the top abstracts for presentation.

Emile F. Holman was the first of the classically trained surgeon scientists and for 29 years served as the founding Executive Head of the Department of Surgery at Stanford University. He established the tradition of an integrated research program, permeating every aspect of the surgical department, which continues to this day. We honor his legacy today.

A critical component of research within the department is the active participation of our residents under the mentorship of surgeons and scientists across our university. The residents devote themselves to a project designed, first and foremost, to advance the field, but also to advance their own professional development and further forge their path in academic surgery. Basic science laboratories throughout the Department, the University and beyond are but one option, clinical research outcomes, education, device design and many others are options; advanced degrees are also possible.

I'm grateful to all of our faculty mentors and investigators for their commitment to this endless and exhilarating cycle of training the next generation of surgeon leaders. We're showcasing the abstracts that represent an enormous amount of work and preparation. We are proud of all their accomplishments! ■

Arden M. Morris, MD, MPH

Professor and Vice Chair
of Clinical Research
Director, S-SPIRE Center

Lisa M. Knowlton, MD, MPH, FACS, FRCSC

Assistant Professor and
Associate Vice Chair of Research
Associate Program Director,
Surgical Critical Care Fellowship

Olivia M. Martinez, PhD

Johnson and Johnson
Distinguished Professor
Vice Chair for Basic
Translational Research

We are honored to welcome you to the 24th Annual Emile F. Holman Lectureship and 14th Resident Research Day in Surgery!

Holman Day is the Stanford Department of Surgery's annual celebration of science across fields of basic, translational, clinical, and health services research. We are thrilled to host Dr. Andrea A. Hayes Dixon, professor of pediatric surgery and surgical oncology at the University of North Carolina Children's Hospital, who will discuss her novel work on cytoreductive surgery among pediatric and adolescent patients. The event will be held in-person at the beautiful Stanford Center for Academic Medicine.

Our Surgery residents, post-doc fellows, students and other trainees continue to impress us with their research productivity, achieving a new record of 68 individuals who submitted abstracts this year across all research tracks. Their work celebrates the diversity and breadth of innovative research across our department, from basic science to translational, clinical, bioinformatics, education, and health services research. The top abstracts selected for presentation are featured in this booklet. We hope that you will actively engage presenters with questions and discussion during our live sessions. There will be poster and podium presentations from our top-scoring trainee scientists, and the remaining abstracts will be made available through online posters on the Holman Day website *https://surgery.stanford.edu/holman/2023.html*.

We would like to thank the Holman Day staff committee, Rachel Baker, Michael Frazier, Joseph Martinez, Nancy McMahon, Julia Miranda, Kathleen Sochan and Tamara Winston for their assistance in planning this meeting. The day would also not have been made possible without the tremendous efforts of our Research Oversight Committee who met to review abstracts and generate the 2023 program. Your commitment to the academic mission of our Department should be commended!

Clinical and Health Services Research Reviewers:
Arden Morris, MD, MPH
James Korndorffer, MD, MHPE, FACS
George Poultsides, MD, MS
Catherine Curtin, MD
Rejoice Ngongoni, MD
Todd Wagner, PhD
Sherry Wren, MD, FACS, FSC (ECSA), FISS
Lisa Knowlton, MD, MPH, FACS, FRCSC

Basic and Translational Research Reviewers:
Nicholas Leeper, MD
James Dunn , MD, PhD
Sheri Krams, PhD
Derrick Wan, MD
Olivia Martinez , PhD
John Farag, MD
Marc Melcher, MD, PhD
Sakti Srivastava, MBBS, MS

Congratulations to all of our trainees and their mentors in the Department of Surgery for sharing your scholarly work

Sincerely,

Arden M. Morris, MD, MPH, Olivia M. Martinez, PhD, and Lisa M. Knowlton, MD, MPH ■

Andrea A. Hayes Dixon, MD, FACS, FAAP

Dean, Howard University College of Medicine
Vice President of Clinical Affairs
Chair of Surgery, Howard University Hospital

Dr. Andrea Hayes Dixon is the Professor and Chair of Surgery at Howard University College of Medicine (HUCOM). She is also the Associate Director of the Cancer Center at Howard. In October of 2022, she was appointed to the position of Dean of Howard University's College of Medicine and Vice President of Clinical Affairs. Dr. Hayes Dixon is the first African American female pediatric surgeon in the USA and the first female Dean at the HUCOM. She is nationally and internationally known for her work pioneering Desmoplastic Small Round Cell Tumor, DSRCT. Her patients' request her services from around the world because she was the first to do hyperthermic intraperitoneal chemotherapy, HIPEC, and cytoreductive surgery in a child. Dr. Hayes Dixon has a basic science laboratory which focuses on finding a cure for DSRCT. She has cared for the largest number of DSRCT, patients at any one hospital and by any one surgeon. Dr. Hayes Dixon was appointed by President Trump to the National Cancer Advisory Board. (The National Cancer Advisory Board reports to the Director of the National Cancer Institute and the Secretary of Health). Dr Hayes Dixon has published over 160 manuscripts and dozens of book chapters.Her own R01 funded research focuses on cirrhosis epidemiology and risk prediction (R01 x 2, U24) and process improvement in kidney transplantation (R01). ■

PROGRAM

Resident Research Day

Poster Presentations – Basic

Center for Academic Medicine Courtyard

10:30 AM – 12:00 PM

Title of Presentation	Presenter
Rapid intraoperative manufacturing of angiogenic cell-collagen patch for ischemic cardiomyopathy	Eric Pfrender
Human spinal SSCs display region-specific differences in cartilage and bone commitment	Lorene Lee
Development of Nanobody-Mediated Specified Targeting of Osteosarcoma Cells	Rovin Lachmansingh, MS
Multiomic single-cell profiling of human pancreatic adenocarcinoma reveals cell state heterogeneity and putative regulatory mechanisms of cancer-associated fibroblasts	Chuner Guo, M.D, PhD
Genome-wide Association Study of Intracranial Aneurysms Reveals Shared Heritability with Aortic Aneurysms and Atherosclerosis	Shaunak Adkar, MD, PhD
Angiogenic cell-sheets used to rescue microvascular malperfusion and ischemia in porcine myocardium	John A. Farag, MD
Investigating dysmotility and the expansion of glial cells and interstitial cells of Cajal in Crohn's disease strictures using a novel surgical mouse model	Alexia Kim
Single-Cell RNA-seq analysis characterizes fibroblast heterogeneity in irradiated skin of mice, pigs, and humans	Leo Kameni, MD

Poster Presentations – Clinical

Title of Presentation	Presenter
Most Privately Insured Patients Do Not Receive Federally Recommended Abdominal Aortic Aneurysm Screening	Vivian Ho, MD, MS
Impact of reinforced stapling on intraoperative bleeding in Laparoscopic Sleeve Gastrectomy procedures using OR Black Box® data	Sebastiano Bartoletti, MD
Perception is Not Reality: Examining the Quality of End-of-Rotation Evaluations	Ananya Anand, MD
Starting from the Bottom: Reducing the Environmental Footprint of an Operation	Jaclyn Wu, MD
Long-Term Outcomes Following Hybrid Breast Reconstruction – Does Mesh Type Matter?	Max Silverstein, MD
Fragmentation of Gastroesophageal Junction Cancer Care: is fragmented care as detrimental as previously thought?	Rejoice F Ngongoni, MD
A National Assessment of Disparities Between Rural-Urban Patients with Surgically Managed Advanced Appendiceal Cancer	Amy Li, MD
Rapid Cycle Evaluation Using the CFIR Framework Delivers Actionable Findings to Inform and Adapt the Implementation of the PAUSE Pragmatic Clinical Trial	Marzena Sasnal, PhD, MA

Resident Research Day

Abstracts – Basic

Grand Rounds
1:00 PM – 2:45 PM
Four minutes are allotted following each presentation for Q&A

Moderators:
Jeong S. Hyun, MD
Amanda Kirane, MD, FACS

	Title of Presentation	Presenter
1:05 - 1:13	Desmoplastic Stromal Signatures Predict Patient Outcomes in Pancreatic Ductal Adenocarcinoma	Jason L. Guo, PhD
1:18 - 1:26	Avoiding a 'sticky' situation: Translation of a sustained-release therapeutic to prevent abdominal adhesions	Deshka Foster, MD, PhD
1:31 - 1:39	Rescue of ischemic disease by transplanting intact vessel stem cell/niche cell clusters	Liming Zhao, MD
1:44 - 1:52	Blood Brain Barrier Directed Immunotherapy Nano-conjugates for Checkpoint-refractory Melanoma Brain Metastasis	Saurabh Sharma, PhD
1:57 - 2:05	Where there is fat there is fibrosis: Elucidating the mechanisms of creeping fat-driven stricture formation.	Khristian E. Bauer-Rowe
2:10 - 2:18	New Spatial Transcriptomic Analysis Reveals 3d Signaling Regulatory Relationships Within Skeletal Stem Cell Niches in Single Cell Resolution	Yuting Wang
2:23 -2:31	Patient-specific computational flow simulation reveals adverse hemodynamic factors associated with branch vessel occlusion after complex endovascular aneurysm repair	Kenneth Tran, MD
2:36 - 2:44	Proliferative and Expansive Properties of Next Generation Surrogate (NGS) Wnt and R-Spondin on Transplanted Intestinal Epithelial Cells	Siavash Shariatzadeh, MD, MPH
2:45 - 3:00	BREAK	

Resident Research Day

Abstracts – Clinical

Center for Academic Grand Rounds
3:00 PM – 4:45 PM
Four minutes are allotted following each presentation for Q&A

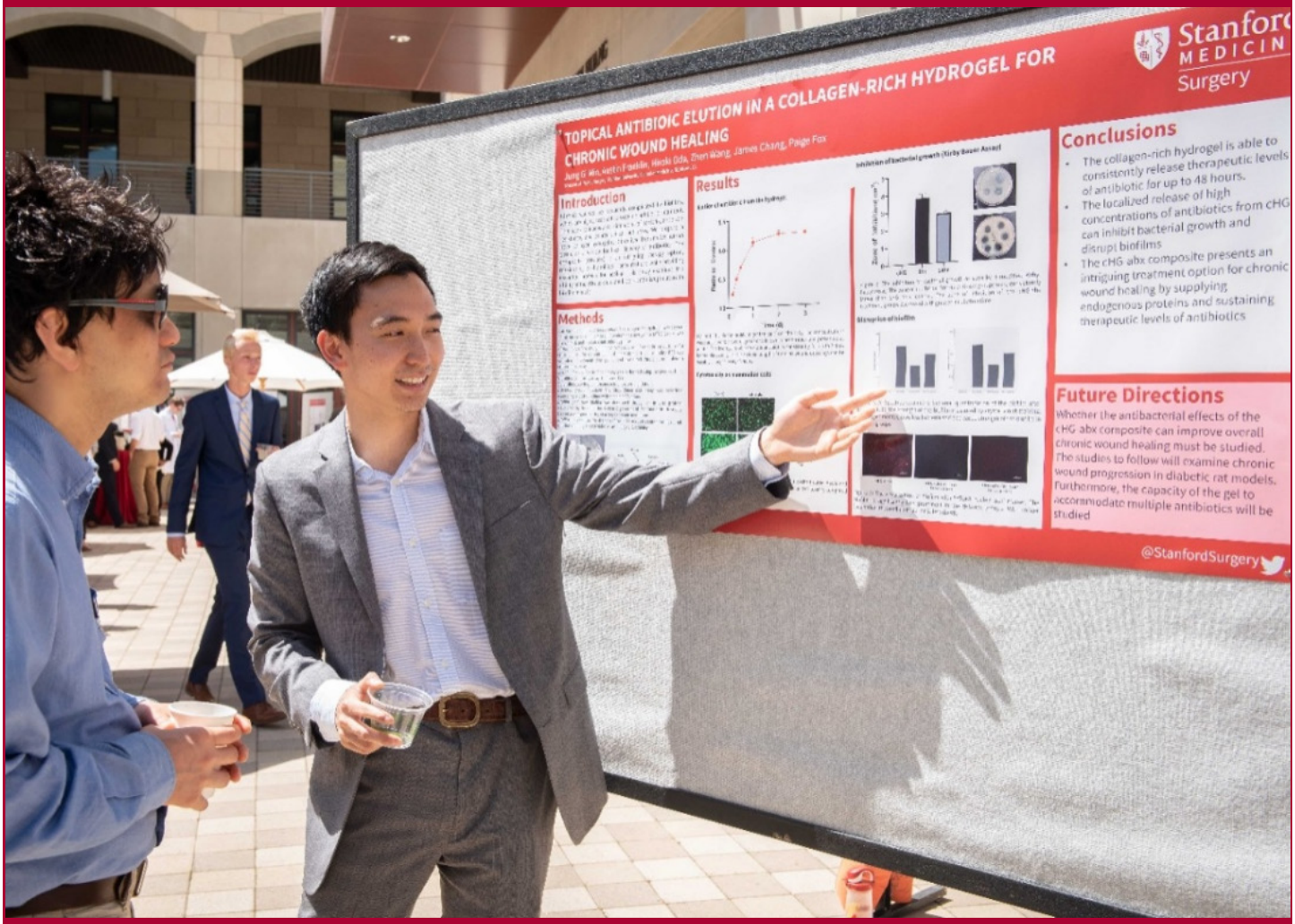
Moderators:
Catherine M. Curtin, MD
Derek M. Klarin, MD

	Title of Presentation	Presenter
3:00 - 3:08	Usability of the ENTRUST Learning Platform for Global Surgical Education: A Pilot Curriculum at the University of Global Health Equity, Rwanda	Tyler M. Wilson
3:13 - 3:21	Association of cumulative social risk and survival among patients with advanced colorectal cancer	Kirbi Yelorda, MD, MS
3:26 - 3:34	The Accuracy of Non-Standardized MELD/PELD Score Exceptions in the Pediatric Liver Allocation System	Daniel J. Ahn, MD
3:39 -3:47	Risk of Reintervention is Lower for Carotid Endarterectomy than Carotid Artery Stenting	Shaunak Adkar, MD, PhD
3:52 - 4:00	Barriers and facilitators of surgical prehabilitation adherence from the patient perspective: A mixed methods study	Cinitia Kimura, MD, PhD
4:05 - 4:13	Impact of induction therapy on rejection in pediatric transplantation: A multicenter study in the United States	Tetsuya Tajima, MD, PhD
4:18 - 4:26	Amplified inferior outcomes for infant pediatric liver transplant recipients listed and transplanted at low volume centers	Dan Stoltz, MD
4:31 - 4:39	Preoperative Weight Loss with GLP1 Before Bariatric Surgery	Brian Ruhle, MD, MS
4:45 - 5:00	BREAK	

5:00 PM
The 24th Annual Emile F. Holman Lecture in Surgery

Andrea A. Hayes Dixon, MD, FACS, FAAP

"The Peaks and Pitfalls of Cytoreductive Surgery and Hyperthermic Intraperitoneal Chemotherapy in Pediatric and Adolescent Patients"



POSTER PRESENTATIONS

Rapid intraoperative manufacturing of angiogenic cell-collagen patch for ischemic cardiomyopathy

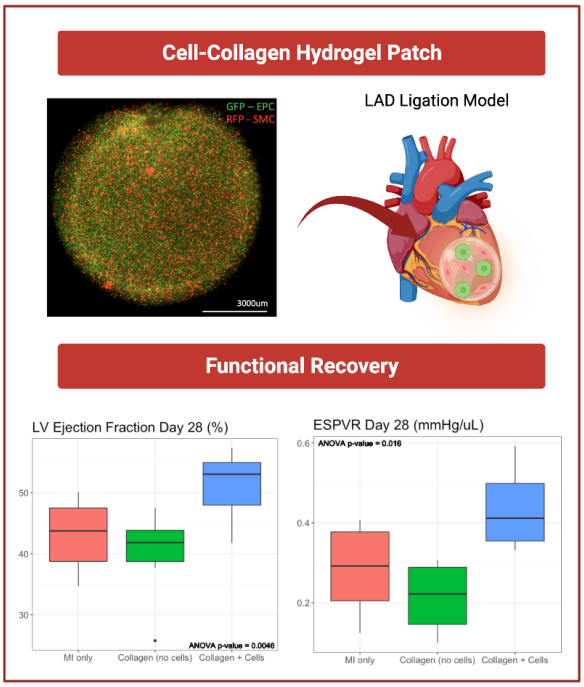
Eric Pfrender, BS, Sungwoo Kim*, PhD, Shin Yajima*, MD, PhD, John Farag, MD, Umayr Syed, BS, Koji Kawago, MD, PhD, Alex Dalal, MD, Yuanjia Zhu, MD, Y Joseph Woo, MD, Y Peter Yang**, PhD, Yasuhiro Shudo**, MD, PhD*
**These authors contributed equally*
***Co-senior authors*

Introduction: Current therapies to treat myocardial infarction are effective at addressing acute coronary artery occlusion. However, myocardial damage persists following ischemia due to inadequate treatment of microvascular injury, and can lead to fibrosis, adverse remodeling, and progressive heart failure. Here we have developed an intraoperatively constructed collagen patch containing angiogenic Endothelial Progenitor Cells (EPCs) and Smooth Muscle Cells (SMCs) to address cardiac microvascular malperfusion following ischemic injury.

Methods: Collagen patches were constructed by compressing a mixture of human EPCs and SMCs in collagen solution to maintain mechanical robustness with tissue-like cell density and high cell viability. Patches were then implanted into athymic nude rats immediately following permanent LAD ligation myocardial infarction (MI) model. Functional recovery was assessed by cardiac MRI, Pressure-Volume loop catheterization, and ex vivo histological assessment of fibrosis and microvascular density.

Results: Study groups include MI-only (negative control, n=8), MI with acellular collagen patch (n=6), and MI with SMC-EPC collagen patch (n=10). After sacrifice at four weeks, the cell patch treatment group exhibited attenuated left ventricle fibrosis and remodeling compared to the MI only control. There was increased functional recovery (LV Ejection Fraction [%]: 51.3±2.0 cell patch, 39.9±2.5 collagen only patch, 43.0±2.3 MI only control, ANOVA $p < 0.005$; ESPVR [mmHg/uL]: 0.44±0.04 cell patch, 0.21±0.05 collagen only, 0.28±0.04 MI only, ANOVA $p < 0.05$) in the treatment group.

Conclusion: We have shown that an intraoperatively enabled cell-collagen patch is an effective therapeutic for ischemic cardiomyopathy and the advantages in handleability and construction make it an ideal candidate for clinical translation.



Human spinal SSCs display region-specific differences in cartilage and bone commitment

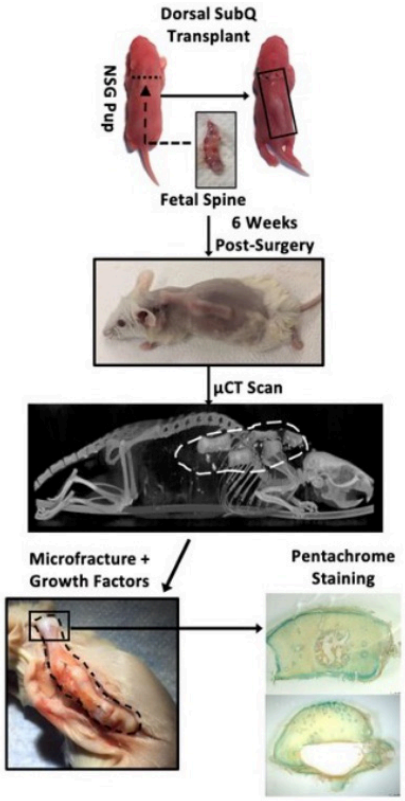
Lorene Lee; Malachia Hoover; Alina Alam; Elizabeth Arouge; Er iTakematsu, PhD; Yuting Wang, MD; Thomas Ambrosi, PhD; Matthew Murphy, MD; Serena Hu, MD; Charles Chan, PhD

Introduction: The vertebral column is a unique skeletal structure composed of intercalating vertebrae bone and intervertebral discs (IVD). This structure is responsible for supporting the body's structure, housing the nervous system, and enables movement. Though crucial for normal body function, the vertebral column is susceptible to a variety of genetic and injury- related disorders like IVD degeneration and osteoarthritis. Currently, treatment options for these conditions include medication and surgery. To alleviate these conditions and provide novel treatment options, research is being conducted on using resident stem cell populations as potential therapies.

Methods: We isolated skeletal stem cell (SSC) populations using protocols developed by our lab and found resident SSC populations in mice and human spines. After isolation, we used single cell-RNA sequencing to determine IVD-specificfactors.We used differentiation assays to test regional- and tissue-specific differences in cartilage and bone production. We have developed a human spinal xenograft model to test IVD-increasing factors in injured IVD tissue.

Results: We found that human spinal SSCs upregulate specific and distinct factors unique to their source location.We see that IVD and vertebral SSCs cluster together and are distinct from femoral SSCs. There is diversity amongst spinal SSCs in their skeletal differentiation. We have tested a combination of factors in mice that increased IVD regeneration in IVDs and will use a human xenograft model to test regeneration in human IVD specimens.

Conclusion: The data gathered in this study sets the foundation for the clinical translation of stem cell-based therapies for preventing and reversing IVD-related musculoskeletal diseases.



Development of Nanobody-Mediated Specified Targeting of Osteosarcoma Cells

Rovin N. Lachmansingh, MS, Charles K. F. Chan, PhD, MS, Liming Zhao, PhD, and Lorene Lee, MS

Introduction: Osteosarcoma is a malignant bone tumor typically presenting in adolescence. The dense extracellular matrix (ECM) and heterogeneity of osteosarcoma cells make developing targeted therapy for these tumors extremely difficult. Nanobodies, or single monomeric variable domain antibody fragments, show excellent promise for treating osteosarcoma due to their small size and high specificity, allowing them to efficiently target specific surface markers on these tumor cells while penetrating their dense ECM. Our hypothesis is that drug-conjugated nanobodies can specifically target osteosarcoma cells, effectively overcoming the associated challenges and offering a novel approach to treating solid tumors.

Methods: We engineered an osteosarcoma cell line to test the hypothesis by labeling the cell membrane with GFP protein, which the anti-GFP nanobody can recognize. In vitro co-culture of GFP labeled and non-labeled tumor cells was used to evaluate GFP nanobody specificity. In vivo mouse models of GFP labeled and non-labeled tumor cells derived osteosarcoma were surgically generated using intratibial injections to test nanobody-mediated specific targeting. We used cellular barcoding techniques and single-cell RNA-sequencing to track lineage cell output of transplanted human primary osteosarcoma and to identify specific surface markers.

Results: We observed that anti-GFP nanobody specifically binds to GFP-labeled osteosarcoma cells in the in vitro co-culture system. In the in vivo model, anti-GFP nanobody showed higher affinity and longer persistence in GFP-labeled tumors. Several specific markers have been identified and are under testing for nanobody targeting.

Conclusion: In conclusion, our results proved the concept of nanobody-drug conjugate for osteosarcoma cell targeted therapy.

Multiomic single-cell profiling of human pancreatic adenocarcinoma reveals cell state heterogeneity and putative regulatory mechanisms of cancer-associated fibroblasts

Chuner Guo, Michelle Griffin, Kathryn E. Yost, Andrea E. Delitto, Charlotte E. Berry, Byrne Lee, Monica Dua, Brendan Visser, George Poultsides, Irene L. Wapnir, Michael Januszyk, Howard Y. Chang, Daniel Delitto, Deshka S. Foster, Michael T. Longaker*, Jeffrey A. Norton**
**Co-senior authors*

Introduction: Recent efforts to understand cancer-associated fibroblasts (CAFs) function in solid tumors have revealed considerable CAF heterogeneity. CAF subtypes show distinct gene expression profiles corresponding to a wide range of molecular functions, including fibrosis, immune modulation, and steady state homeostasis. Functional perturbation of CAFs is an active area of investigation for cancer therapy. However, the underlying gene regulatory mechanisms driving the divergence of fibroblast subtypes remain underexplored.

Methods: Here, we simultaneously profiled single-cell gene expression and chromatin accessibility landscapes in human pancreatic adenocarcinoma. Tumor samples were collected from three patients with pancreatic adenocarcinoma who underwent pancreaticoduodenectomy. Using the 10X Genomics Multiome platform, we simultaneously captured transcriptomic and chromatin accessibly information from the same cells.

Results: We performed integrated multimodal analysis for dimension reduction, joint visualization, clustering, and semi-supervised cell type annotation. Gene expression and motif accessibility were used to infer gene regulatory relationships and find transcription factors associated with specific cell states. Our analysis revealed distinct CAF cell states, and identified specific transcription factors representing putative regulators of CAF subtypes.

Conclusion: We present a preliminary framework for decoding CAF heterogeneity at paired chromatin accessibility and gene expression level and identify regulatory pathways for downstream modulation and potential therapeutic application.

Genome-wide Association Study of Intracranial Aneurysms Reveals Shared Heritability with Aortic Aneurysms and Atherosclerosis

Shaunak Adkar, Julie Lynch, Sharika Bamezai, Sabina Sorondo, Ryan Choi, John Cabot, Michael Levin, Scott Damrauer, Saiju Pyarajan, Phil Tsao, Stephen Skirboll, Nicholas Leeper, Derek Klarin

Introduction: Genetic susceptibility to intracranial aneurysms (ICAs) has been ascribed largely to genetic predisposition to hypertension. The shared heritability with atherosclerosis and aortic aneurysms has not been described. We hypothesized that a subset of genetic loci associated with ICA are shared with atherosclerosis and aortic aneurysmal disease independent of hypertension.

Methods: We identified participants enrolled in the Million Veterans Program (MVP) with and without ICA. Thirty-two million genotyped and imputed variants were tested for association with ICA using mixed effect regression modeling, controlling for age, sex, and population structure prior to external replication and meta-analysis. Multi-trait colocalization was performed with summary statistics for systolic/diastolic blood pressure, peripheral/coronary atherosclerosis, thoracic aortic size/aneurysm, and abdominal aortic aneurysm. A polygenic risk score (PRS) was calculated with published summary statistics and validated in the MVP.

Results: We identified 3,165 participants (2280 European, 627 African, and 258 Hispanic ancestry) with and 592,927 without ICA in the MVP. After meta-analysis with data from an additional 12,273 individuals with and 591,046 without ICA, we identified 5 novel loci associated with ICA at genome-wide significance ($p<5e-8$). Multi-trait colocalization of significant loci identified five susceptibility loci that colocalized with atherosclerotic and aneurysmal traits, but not hypertensive traits (EDNRA, SOX17, RPPB8, NAV1, and CDKN2B; posterior probability > 0.7). After controlling for hypertension, individuals with a PRS in the top 5th percentile showed an increased risk of ICA across ancestries (OR: 1.6-2.3; $p < 0.05$).

Conclusion: We identify novel loci associated with ICA and identified shared heritability with atherosclerotic and aneurysmal disease independent of hypertension.

Angiogenic cell-sheets used to rescue microvascular malperfusion and ischemia in porcine myocardium

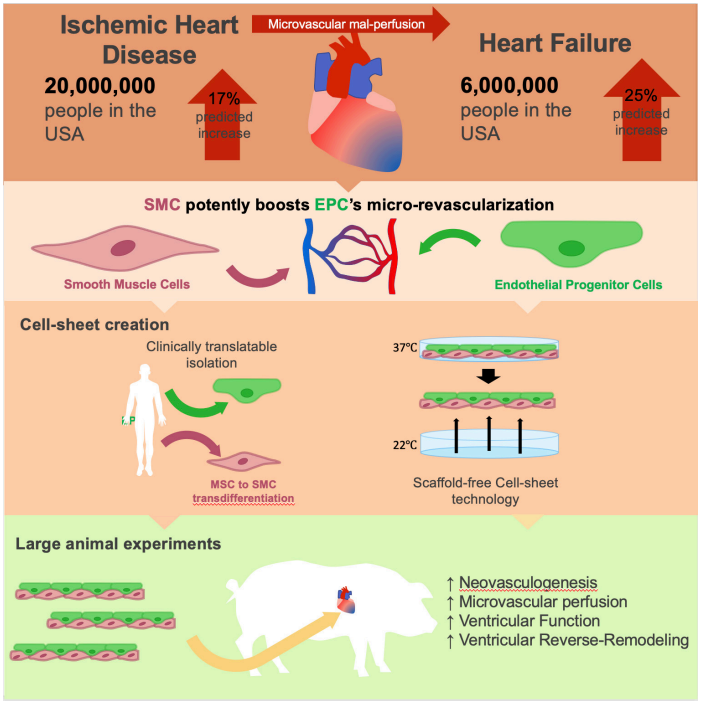
Farag JA, Pfrender E, Syed U, Kawago K, Yajima S, & Shudo Y

Introduction: Ischemic heart failure, which affects 6 million Americans, is a deadly pathology that projects to increase by 25% over the next two decades. While procedure-based therapy addresses coronary artery revascularization, microvascular malperfusion—a component of ischemic heart failure that leads to cardiomyocyte dysfunction and progressive deterioration—is left untreated. We hypothesize that endothelial progenitor cell (EPC)-smooth muscle cell (SMC) cell-sheets can treat ischemic heart failure by rescuing microvascular malperfusion and reversing ventricular remodeling.

Methods: We co-cultured human-derived EPCs and SMCs, then fabricated scaffold-free, bi-level cell-sheets. Yorkshire pigs were assigned to either ischemia-reperfusion (IR) only (control, n=3) or IR treated with EPC-SMC cell-sheet (n=3). Both groups underwent 60-minute balloon catheter occlusion of the left anterior descending coronary artery, followed by thoracotomy at day 14 and sacrifice at day 42. Both groups were followed with Cardiac MRI and histology.

Results: Though experiments are incomplete, we see that cell-sheet therapy, compared to control, significantly improves ΔLVEF (+5.55%±1.88% vs. -2.77%±1.52%, p=0.0261). Cell-sheet therapy, compared to control, trends toward lessening ΔLVEDV/BSA (30.78±19.86ml/m2 vs. 62.83±10.91ml/m2, p=0.189) and ΔLV mass index (5.25±13.84g/m2 vs. 14.35±9.57g/m2, p=0.617). ΔLV concentricity is relatively unchanged in both groups (-0.03g/ml±0.06g/ml vs. -0.05g/ml±0.04g/ml, p=0.791). Immunohistochemical analysis shows newly formed mature blood vessels of human cell origin integrated into the porcine myocardium.

Conclusion: By inducing microangiogenesis, EPC-SMC cell-sheets improve cardiac function and slow the progression of dilated cardiomyopathy caused by myocardial infarcts.



Investigating dysmotility and the expansion of glial cells and interstitial cells of Cajal in Crohn's disease strictures using a novel surgical mouse model

Alexia Kim, BS; Khristian E. Bauer-Rowe, BS; Norah Liang, MD; Michelle Griffin, MD, PhD; Deshka Foster, MD; Michael T. Longaker, MD, MBA, FACS; Jeong S. Hyun, MD; Stanford University, Stanford, CA

Introduction: One of the most common complications of Crohn's disease (CD) is a stricture, which is characterized by the accumulation of scar tissue and loss of normal tissue architecture. This process results in a loss of normal organ function, including dysmotility. To understand how strictures cause dysmotility, we characterized the cell composition of the enteric nervous system (ENS) in a novel surgical mouse model of CD and compared our results to human strictures.

Methods: We created anti-mesenteric colotomies in C57/B6 mice and closed them transversely under tension to induce stricture formation (wounded) along with sham controls (unwounded). Simultaneously, we harvested intestinal stricture samples from pediatric CD patients and control samples from ileostomy takedowns. We then stained for markers of nerves (Tubb3), glial cells (GFAP), nerve progenitors (Nestin), and interstitial cells of Cajal (cKIT) and compared between mouse and human bowel.

Results: Our surgical mouse model phenocopies clinical features of human strictures, including the formation of creeping fat, smooth muscle expansion, and collagen deposition (Figure 1B-F). In both stricture bowel and wounded bowel, we observed increased expression of GFAP and cKIT compared to control bowel and unwounded bowel (Figure 1G,H).

Conclusion: These observations suggest that our surgical mouse model recapitulates alterations in the ENS cell composition in human CD strictures. The increase in cKIT+ interstitial cells of Cajal and GFAP+ glial cells in both human strictures and wounded bowel suggests that these cells may play a crucial role in stricture-related dysmotility.

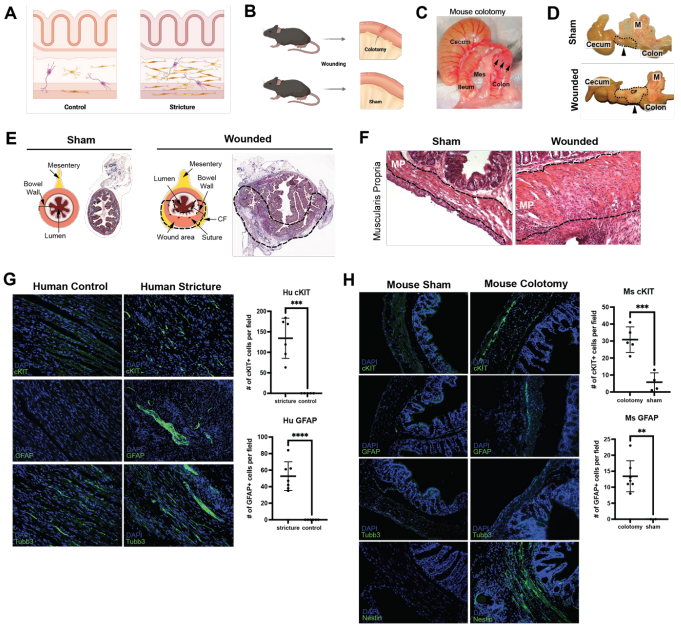


Figure 1: Expansion of enteric nervous system cells in a mouse model of strictures and human Crohn's disease stricture. Schematic of ENS cell composition comparison between control and stricture (**A**). Schematic of the murine stricture model (**B**). Gross image of colotomy on mouse bowel (**C**). Gross images comparing sham and wounded bowel at POD14 (**D**). Masson's Trichrome of sham (left) and wounded (right) bowel with corresponding schematics (**E**). H&E of sham and wounded comparing thickness of muscularis propria (**F**). Immunofluorescence staining (green) of interstitial cells of Cajal (cKIT+), glial cells (GFAP+) and nerves (Tubb3+) in human control and stricture samples along with quantification of cKIT+ and GFAP+ cells in human control and stricture (**D**). Immunofluorescence staining of interstitial cells of Cajal (cKIT+), glial cells (GFAP+), nerves (Tubb3+) and nerve progenitors (Nestin+) in mouse sham and colotomy samples along with quantification of cKIT+ and GFAP+ cells in human control and stricture (**E**).

Single-Cell RNA-seq analysis characterizes fibroblast heterogeneity in irradiated skin of mice, pigs, and humans

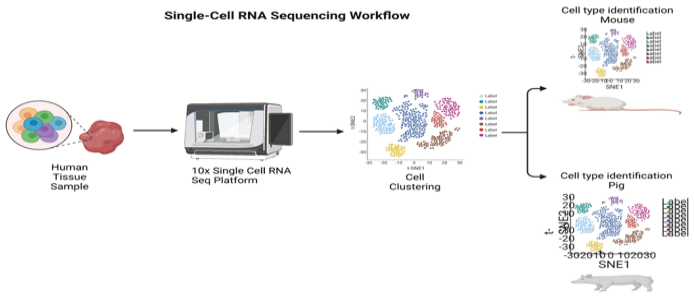
Lionel Kameni, M.D.[1], Charlotte E. Berry, BA[1], Michelle Griffin, M.D.[1], Darren Abbas, M.D.[1], Michael Januszyk, M.D. Ph.D.[1], Jason L. Guo, Ph.D.[1], Dayan Li, M.D. Ph.D.[1], Norah E. Liang, M.D.[1], Mauricio A. Downer, Jr., BS[1], Asha C. Cotterell, BS[1], Jennifer B. Parker, BS[1], Annah G. Morgan, BS[1], Michael T. Longaker, M.D.[1,2], Derrick C. Wan, M.D.[1].
[1]Hagey Laboratory for Pediatric Regenerative Medicine, Division of Plastic and Reconstructive Surgery, Department of Surgery, Stanford University School of Medicine, Stanford, CA, USA, [2]Institute for Stem Cell Biology and Regenerative Medicine, Stanford University School of Medicine, Stanford, CA, USA.

Introduction: Radiation induced Fibrosis (RIF) is a prevalent pathological complication from radiation therapy. Yet, the exact cellular changes that drive the pathogenesis of RIF of human skin have not been fully explored. Our laboratory has previously identified fibroblast populations in both porcine and murine models at the molecular level. In this study, we questioned whether a similar profile of fibroblast subpopulations is present in irradiated human skin.

Methods: Tissue samples were obtained from three patients with irradiated and non-irradiated skin (n=3, age 50-75 years of age). Tissue sections were then collected and analyzed using hematoxylin and eosin (H&E) for dermal thickness and picrosirius red staining of the extracellular matrix (ECM) ultrastructure. Tissue was processed into single cell suspension and submitted for 10X single cell RNA sequencing using the 10X platform. Next, Cell-type annotation via SingleR identified fibroblasts. Finally, Enrichment analysis using EnricheR generated the most highly ranked genes for each cluster.

Results: Consistent with our prior work, transcriptional clusters of fibroblasts in irradiated human skin were found to be comparable to clusters identified in both porcine and murine models. Gene ontology pathways were also found to be similar across the three species. Histologically, H&E staining showed similar tissue architecture between human, mice and pigs following irradiation. In addition, analysis of ECM collagen ultrastructure with picrosirius red staining further revealed shared extracellular matrix features across species in irradiated skin.

Conclusion: Our results suggest that there may be analogous fibroblasts subgroups in irradiated skin of humans, mice, and pigs. In future studies these fibroblasts subpopulations could be investigated for possible effective therapies in radiation skin fibrosis.



Most Privately Insured Patients Do Not Receive Federally Recommended Abdominal Aortic Aneurysm Screening

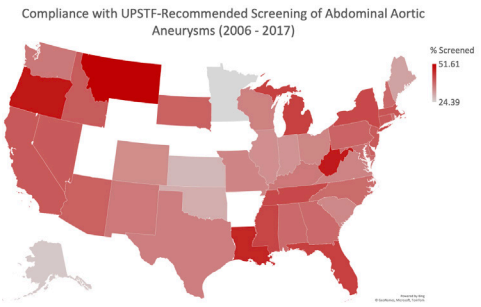
Vy T Ho MD MS[1], Kenneth Tran MD[1], Elizabeth L George MD MS[1], Steven M Asch MD MPH[2,3], Jonathan H Chen MD PhD[4,5], Ronald L Dalman MD[1], Jason T Lee MD[1]
[1] Division of Vascular Surgery, Department of Surgery, Stanford University School of Medicine, Stanford, CA
[2] Division of Primary Care and Population Health, Department of Medicine, Stanford University School of Medicine, Stanford, CA
[3] Center for Innovation to Implementation, VA Palo Alto Health Care System, Palo Alto, CA
[4] Center for Biomedical Informatics Research, Stanford University School of Medicine, Stanford, CA
[5] Department of Medicine, Stanford University School of Medicine, Stanford, CA

Introduction: Since 2005, the United States Preventative Services Task Force (USPSTF) has recommended abdominal aortic aneurysm (AAA) ultrasound screening for 65- to 75-year-old male ever-smokers. Integrated health systems such as Kaiser Permanente and the Veterans Affairs (VA) healthcare system report 74-79% adherence, but compliance rates in the private sector are unknown.

Methods: The IBM Marketscan® Commercial and Medicare Supplemental databases (2006 -2017) were queried for male ever-smokers continuously enrolled from age 65 to 75. Exclusion criteria were previous history of abdominal aortic aneurysm, connective tissue disorder, and aortic surgery. Patients with abdominal computed tomographic or magnetic resonance imaging from ages 65 to 75 were also excluded. Screening was defined as a complete abdominal, retroperitoneal, or aortic ultrasound. A logistic mixed-effects model utilizing state as a random intercept was used to identify patient characteristics associated with screening.

Results: Of 35,154 eligible patients, 13,612 (38.7%, Table I) underwent screening. Compliance varied by state, ranging from 24.4% in Minnesota to 51.6% in Montana ($p < 0.05$, Figure 1). Screening activity increased yearly, with 0.7% of screening activity occurring in 2008 versus 22.2% in 2016 ($p < 0.05$, Figure 2). In a logistic mixed-effects model adjusting for state as a random intercept, history of hypertension (OR 1.07, 95% CI [1.03 – 1.13]), coronary artery disease (OR 1.17, 95% CI [1.10, 1.22]), congestive heart failure (OR 1.14, 95% CI [1.01 – 1.22]), diabetes (OR 1.1, 95% CI [1.06 – 1.16]) and chronic kidney disease (OR 1.4 95% CI [1.24 – 1.53]) were associated with screening. Living outside of a census-designated metropolitan area was negatively associated with screening (OR 0.92, 95% CI [0.87 – 0.97], Table II).

Conclusion: In a private claims database representing 250 million claimants, 38.7% of eligible patients received UPSTF-recommended AAA screening. Compliance was nearly half that of integrated health systems and was significantly lower for patients living outside of metropolitan areas. Efforts to improve early detection of AAA should include targeting non-metropolitan areas and modifying Medicare reimbursement and incentivization strategies to improve guideline adherence.



Impact of reinforced stapling on intraoperative bleeding in Laparoscopic Sleeve Gastrectomy procedures using OR Black Box® data

S. Bartoletti, D. Azagury, T. Grantcharov

Introduction: While postoperative bleeding is a rare event after LSG, intraoperative maneuvers to address or prevent bleeding are more challenging to evaluate. The Operating Room Black Box® (ORBB) provides insight into intraoperative events otherwise unrecorded and unanalyzed.

This study involves retrospective analysis of prospectively collected data.

Methods: This study conducted examined 19 Laparoscopic Sleeve Gastrectomy procedures performed by 2 attending surgeons, involving residents and/or fellows.

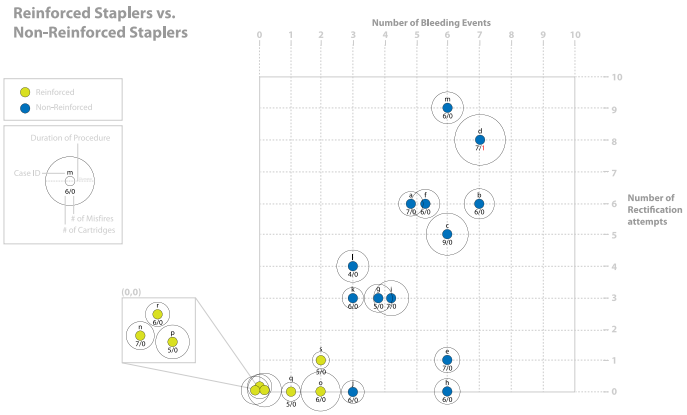
Of the 19 (100%) procedures, 6 (32%) were performed using reinforced stapling and the remaining 13 (68%) cases relied on non-reinforced stapling.

ORBB collected intraoperative events including frequency of device associated intraoperative bleeding adverse events, frequency of adverse event rectification, duration of the specimen resection surgical phase and number of cartridges consumed.

Results: The 6 procedures using reinforced stapling had on average 0.8 intraoperative bleeding adverse events per procedure. 20% of these events required rectification. They consumed on average 5.7 cartridges per procedure and had an average duration of Specimen Resection of 13.8 minutes.

The 13 procedures using non-reinforced stapling had on average 5 intraoperative bleeding adverse events per procedure. 83% of these events required rectification. They consumed on average 6.3 cartridges per procedure and had an average duration of Specimen Resection of 15.7 minutes.

Conclusion: In laparoscopic sleeve gastrectomy ORBB, reinforced staplers have lower specimen resection time, consume fewer cartridges, and have significantly fewer intraoperative bleeding events of whom less require rectifications compared to non-reinforced staplers.



Perception is Not Reality: Examining the Quality of End-of-Rotation Evaluations

Ananya Anand MD, Rachel Jensen MD, Cara Liebert MD, James R Korndorffer Jr. MD MHPE

Introduction: Faculty feedback plays a critical role in surgical residents' skill development. End-of rotation (EOR) evaluations, which typically contain quantitative and qualitative elements, are an important source of feedback, yet studies show their quality is highly variable. We designed a mixed-methods study to examine the quality of EOR evaluations and hypothesized that faculty would report providing higher quality written feedback than would be supported by a qualitative analysis.

Methods: Narrative feedback from de-identified EOR evaluations of 26 PGY1-3 residents over a 6-month period at a single institution were deductively coded by two reviewers as "specific," "constructive," or "actionable." Surveys using 5-point Likert scales were utilized to evaluate surgery resident and faculty perceptions of EOR feedback. Descriptive statistics and independent t-tests were used for statistical analyses.

Results: Qualitative analysis of feedback comments (N=175) demonstrated that 76 (43.4%) were specific, 16 (9.1%) were constructive, 2 (1.1%) were actionable, and 81 (46.2%) did not meet any of the feedback criteria (interrater reliability k=0.81). Survey results revealed that while faculty and resident respondents had similar perceptions of how specific feedback is (3.6 v 3.4, p=0.44), there was significant disagreement regarding whether faculty written feedback is constructive (4.0 vs 2.9, p<0.001) and actionable (3.4 vs 2.6, p=0.001) (Table 1).

Conclusion: This study demonstrates that while written EOR evaluations are often specific, they rarely provide constructive or actionable feedback and there is a significant gap between faculty and resident perceptions. Rigorous faculty development is required to better align feedback with resident needs and feedback quality standards.

Table 1: Faculty vs Resident Perceptions of Written Feedback Quality

Statement*	Faculty N=43 Mean (SD)	Resident N=29 Mean (SD)	p-value
My written feedback of the residents is/I find the written feedback on my evaluations to be:			
Specific (quantifiable, objective, pays attention to learning climate/learner's needs)	3.6 (1.0)	3.4 (1.1)	0.44
Constructive (helpful, behavioral not personal, balanced)	4.0 (1.0)	2.9 (1.2)	<0.001
Actionable (generates action plan, based on goals, focuses on modifiable traits)	3.4 (1.0)	2.6 (1.1)	0.001

*1 – strongly disagree, 2 – somewhat disagree, 3 – neither agree nor disagree, 4 – somewhat agree, 5 – strongly agree

Starting from the Bottom: Reducing the Environmental Footprint of an Operation

Jaclyn Wu, MD, Karen Wong, RN, Paige Fox, MD, PhD, John Gahagan, MD, Courtland Couture, CST, Gretchen Annie, RN, Thomas Weiser, MD

Introduction: Stanford Healthcare (SHC) generates 6,200 tons of waste annually; 30% comes from our operating rooms. Disposable items contribute significantly to an operation's carbon footprint and waste. We sought to streamline resource utilization for a single high-volume procedure: anorectal exams under anesthesia.

Methods: We observed 35 representative cases for unused or duplicated instruments, disposable supplies, and preference card items. We instituted changes to reflect usage at both SHC and Valley Care Pleasanton (VCP). We assessed post-intervention instrument processing and supply usage and estimated cost savings from these changes.

Results: At SHC, 7/30 unique instruments in the existing tray were used on average. We separated frequently used instruments into a smaller tray, resulting in a 36% decrease in instrument processing and 15 minutes of labor saved per tray assembly; this equates to $6,460 in labor costs annually. In the premade disposable pack at SHC, 15/36 items were used on average during each case. A reformulated pack eliminated two pounds of plastic waste, which will result in 900 pounds of waste diverted from landfill annually. At VCP, the average reduction in disposable items was about 5 pounds per case (780 pounds of waste diverted annually). Finally, preference cards were reviewed and an average of 6 single-use items were removed per card, resulting in ~$35 savings per case.

Conclusion: Simple changes to supply and instrument selection yielded useful reductions in cost and waste. Performing this process across the 40,000 cases conducted annually at SHC would have a profound impact on the environmental footprint of Stanford's operating rooms.

Key Figure:

Figure 1. A. Frequency of use of pack items. B. Frequency of use of instruments. Highlighted components indicate intervention.

Long-Term Outcomes Following Hybrid Breast Reconstruction – Does Mesh Type Matter?

Max L Silverstein, MD[1]; Arash Momeni, MD, FACS[1]
Division of Plastic and Reconstructive Surgery, Stanford University School of Medicine, Palo Alto, CA

Introduction: Hybrid breast reconstruction combines free tissue transfer with implant placement, thereby allowing surgeons to offer autologous reconstruction to patients with otherwise insufficient donor tissue. In this study, the authors present their long-term outcomes of hybrid breast reconstruction, focusing specifically on differences in clinical outcomes according to the type of mesh used.

Methods: A retrospective analysis of all patients with at least 24 months of follow-up after immediate bilateral prepectoral hybrid breast reconstruction was performed to evaluate long-term outcomes and compare breasts reconstructed with polyglactin mesh versus acellular dermal matrix (ADM).

Results: A total of 39 consecutive patients (78 breasts) who underwent hybrid breast reconstruction with an average follow-up period of 50.4 months (range, 27 to 73 months) were included in the study. There were no instances of implant infection, implant exposure, or flap failure. Polyglactin mesh and ADM were used in 24 breasts and 54 breasts, respectively. Implant malposition and capsular contracture occurred more frequently in the polyglactin cohort leading to 10 (41.7 percent) instances of re-operation for implant replacement compared to only 1 (1.9 percent) in the ADM cohort ($p < 0.001$). On multivariate regression analysis, polyglactin mesh was associated with a 36-fold greater probability of requiring implant replacement compared to ADM ($p = 0.006$).

Conclusion: Hybrid breast reconstruction fills an important niche in the breast reconstruction paradigm. Our long-term data indicate that, compared to polyglactin mesh, ADM is associated with lower rates of capsular contracture and implant malposition when used to define the implant pocket.

Table. Characteristics, complications, and revisions per breast

Variable	Polyglactin (N = 24)	ADM (N = 54)	Total (N = 78)	*p*
Characteristic				
Flap type				**0.020**
DIEP	2 (8.3%)	18 (33.3%)	20 (25.6%)	
MS-TRAM	22 (91.7%)	36 (66.7%)	58 (74.4%)	
Pre-operative radiotherapy	1 (4.2%)	5 (9.3%)	6 (7.7%)	0.436
Complication				
Mastectomy skin necrosis	1 (4.2%)	11 (20.4%)	12 (15.4%)	0.067
Hematoma	1 (4.2%)	1 (1.9%)	2 (2.6%)	0.551
Fat necrosis	0 (0.0%)	6 (11.1%)	6 (7.7%)	0.089
Implant infection	0 (0.0%)	0 (0.0%)	0 (0.0%)	
Cellulitis	0 (0.0%)	0 (0.0%)	0 (0.0%)	
Implant exposure	0 (0.0%)	0 (0.0%)	0 (0.0%)	
Implant malposition	3 (12.5%)	1 (1.9%)	4 (5.1%)	**0.049**
Capsular contracture	7 (29.2%)	0 (0.0%)	7 (9.0%)	**< 0.001**
Flap failure	0 (0.0%)	0 (0.0%)	0 (0.0%)	
Revision				
Fat grafting	0 (0.0%)	12 (22.2%)	12 (15.4%)	**0.012**
Implant replacement	10 (41.7%)	1 (1.9%)	11 (14.1%)	**< 0.001**

DIEP, deep inferior epigastric perforator; MS-TRAM, muscle sparing transverse rectus abdominis myocutaneous

Fragmentation of Gastroesophageal Junction Cancer Care: is fragmented care as detrimental as previously thought?

Rejoice F Ngongoni, Amy Li, Hester Timmerhuis, Adam Furst, Amber Trickey, Nicolas Barreto, Jonathan DeLong, Monica Dua, Brendan Visser

Introduction: Fragmented care (FC) is health care that is provided by different providers and/or facilities. It has been associated with inferior outcomes resulting from disjointed care. This study aims to identify the association of fragmented gastroesophageal junction (GEJ) cancer care with patient outcomes.

Methods: In this retrospective cohort study, adults diagnosed with GEJ cancer between 2007-2017 were identified in the California Cancer Registry (information on cancers diagnosed in California) and linked with the California Healthcare Access and Information database (hospital-encounter information). Fragmentation was defined as care received at >1facility within 12months of diagnosis. Demographic, cancer-specific and facility-level variables were identified. Multivariable Cox regression was performed to determine the association of FC with survival.

Results: In total, 5254patients were identified; 74% were male. Of the 2097(40%) patients who experienced FC, 1531(73%), 437(21%) and 129(6%) were seen at 2, 3, and >3 facilities, respectively. On Cox regression, increasing age, poor differentiation, T3/4 stage, node positive and metastatic disease were predictive of worse survival. Asian/Pacific-Islander race, high socioeconomic status and care at designated cancer center facilities were associated with improved survival. Despite adjusting for these variables, FC was firmly protective (HR:0.82[CI 0.77-0.88]; p<0.001). Further analysis regarding degree of fragmentation demonstrated that care at 2-3 facilities was protective but this association disappeared at higher degrees of fragmentation (Table).

Conclusion: Contrary to prior studies, fragmentation of GEJ cancer care at two or three facilities is associated with improved survival. This suggests that receiving aspects of specialized multidisciplinary cancer care and seeking second opinions from multiple facilities could improve survival.

Table. Cox regression analysis of predictors of survival in patients receiving gastroesophageal junction cancer care

Variable	Hazard Ratio	Lower 95% CI	Upper 95% CI	P-value
Fragmentation				
ref: non-fragmented				
2 facilities	0.81	0.75	0.87	**<0.001**
3 facilities	0.85	0.75	0.96	**0.007**
4+ facilities	1.00	0.80	1.25	0.993
¶Age (year)	1.02	1.01	1.02*	**<0.001**
Race				
ref: Caucasian				
Black	0.95	0.81	1.11	0.505
Hispanic	0.97	0.89	1.06	0.538
Asian/Pacific Islander	0.85	0.77	0.94	**0.002**
Other	0.74	0.50	1.10	0.137
Socioeconomic Status				
ref: lowest SES				
lower middle SES	0.86	0.78	0.96	**0.007**
middle SES	0.84	0.75	0.94	**0.003**
upper middle SES	0.76	0.67	0.86	**<0.001**
highest SES	0.76	0.66	0.88	**<0.001**
Grade				
ref: well differentiated				
moderately differentiated	1.18	0.99	1.40	0.064
poorly differentiated	1.56	1.32	1.86	**<0.001**
undifferentiated	1.09	0.76	1.58	0.639
T stage				
ref: T1				
T2	1.00	0.89	1.12	0.983
T3	1.13	1.02	1.23	**0.022**
T4	1.49	1.32	1.68	**<0.001**
M stage				
ref: M0				
M1	2.52	2.34	2.72	**<0.001**
Cancer Center Designation				
ref: non-cancer center				
NCCN	0.73	0.64	0.83	**<0.001**
NCI	0.78	0.69	0.89	**<0.001**
COC	0.99	0.92	1.07	0.781

¶continuous variable; *rounded down value; CI, confidence interval; ref, reference; SES, socioeconomic status; NCCN, National Comprehensive Cancer Network; NCI, National Cancer Institute; COC, Commission on Cancer

A National Assessment of Disparities Between Rural-Urban Patients with Surgically Managed Advanced Appendiceal Cancer

Amy Y. Li, MD[1], MD; Beatrice J. Sun, MD[1]; Thuy B. Tran, MD[2]; Byrne Lee, MD[1]; Oliver S. Eng, MD[2]
[1] Section of Surgical Oncology, Stanford University, Stanford, California
[2] Division of Surgical Oncology, University of California-Irvine, Orange, California

Introduction: Despite advancements in the diagnosis, treatment and quality of cancer care, disparities remain, particularly among rural/small-town populations. These patients face challenges including socioeconomic disparities and difficulty accessing care. Given the rarity and multidisciplinary care involved in treating appendiceal cancer, we aim to understand the impact of rurality on outcomes in patients treated surgically for advanced appendiceal cancer.

Methods: The National Cancer Database was queried for adult patients, diagnosed with Stage III/IV appendiceal adenocarcinoma between 2004-2017, who underwent surgical intervention of the primary site. Using Rural-Urban Continuum Codes (RUCC), patients were categorized into urban/metro or rural/small-town. Cox proportional hazard models were used to evaluate survival outcomes.

Results: 7,064 patients were identified, with 9.6% (n=681) residing in rural/small-town regions. Compared to urban/metro patients, rural/small-town patients were associated with lower-income bracket, lower education attained, and government insurance (all p<0.05). Rural/small-town patients were more likely seek care at a community hospital and travel further (median 51.6[28.5-92.8] vs 10.2[4.7-23.3] miles) (both p<0.001). Overall survival in rural/small town patients was worse at 1-year (78%vs83%), 3-years (50%vs55%), and 5-years (38vs41%) (p=0.004). In a multivariable model, rurality (HR:1.138, 95% CI:1.014-1.278, p=0.028), lower education attained (2nd quartile: HR:1.119, CI:1.013-1.237, p=0.027; 3rd quartile: HR:1.165, CI:1.045-1.300, p=0.006), and stage IV disease (HR:1.396, CI:1.296-1.503, p<0.001) were associated with decreased survival.

Conclusion: Rural/small-town patients who undergo surgical intervention for advanced appendiceal cancer have lower survival compared to their metro/urban counterparts. Additionally, these patients experience socioeconomic disparities that may serve as barriers to care. Future research towards improving cancer care access for rural populations is warranted.

Table. Cox Regression Model for Surgically Managed Advanced Appendiceal Cancer Controlling for Patient Demographic, Socioeconomic, Clinical, Travel Distance and Hospital Characteristics

Variable	*Hazard Ratio*	*95% Confidence Interval*	*p-value*
Rurality			
Urban/Metro			Reference
Rural/Small-town	1.138	1.014-1.278	0.028
Race			
White			Reference
Black	1.187	1.068-1.319	0.001
Asian	0.892	0.739-1.076	0.230
Other/Unknown	0.799	0.603-1.006	0.055
Age, categorical			
<40			Reference
40-49	0.830	0.581-1.185	0.306
50-59	0.879	0.618-1.251	0.475
60-69	1.024	0.720-1.457	0.894
70-79	1.317	0.924-1.877	0.128
>80	2.078	1.447-2.985	<0.001
Median income quartiles			
1 (<$30,000)			Reference
2 ($30,000-$34,999)	0.929	0.833-1.036	0.184
3 ($35,000-$45,999)	0.924	0.824-1.037	0.182
4 (≥$46,000)	0.752	0.664-0.852	<0.001
No high school degree quartiles			
1 (≥17.6%)			Reference
2 (10.9-17.5%)	1.119	1.013-1.237	0.027
3 (6.3-10.8%)	1.165	1.045-1.300	0.006
4 (<6.3%)	1.111	0.984-1.256	0.090
Distance from treatment facility			
<25 miles			Reference
25-50 miles	0.997	0.904-1.099	0.950
50-100 miles	0.846	0.748-0;.957	0.008
>100 miles	0.760	0.668-0.865	<0.001
Pathological Stage			
III			Reference
IV	1.396	1.296-1.503	<0.001

Rapid Cycle Evaluation Using the CFIR Framework Delivers Actionable Findings to Inform and Adapt the Implementation of the PAUSE Pragmatic Clinical Trial

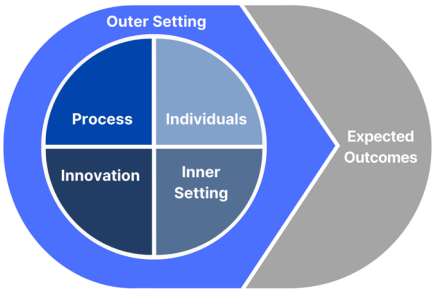
Marzena Sasnal, PhD, MA; Rana N. Doruk, BA; Ashley H. Langston, MS, MA; Karleen F. Giannitrapani, PhD, MPH, MA; Arden M. Morris, MD, MPH; Alex H. Sox-Harris, PhD, MS; Shipra Arya, MD, SM

Introduction: Formative evaluation (FE) is critical for improving ongoing implementation of pragmatic clinical trials. Rapid qualitative methods generate rich, contextualized data that can inform FE processes relatively quickly while maintaining scientific rigor. We present the findings of a rapid cycle evaluation (RCE), including rapid qualitative analysis and developmental FE, to inform pre-trial adaptation of our stepped-wedge multi-site pragmatic clinical trial (the PAUSE trial), proposing a multidisciplinary care model for frail surgical candidates to improve patient-centered outcomes.

Methods: We conducted a multi-method qualitative study of 29 semi-structured interviews, 6 focus groups, and 3 multiday site observations to understand factors impacting the acceptability, fidelity, and implementation of the PAUSE intervention. We purposefully sampled key informants. We adopted a rigorous team-based rapid approach to analyze qualitative data. The Consolidated Framework for Implementation Research (CFIR) guided data collection and analysis. We validated findings through triangulation, member-checking, and search for disconfirming evidence.

Results: Key stakeholders identified champions, potential barriers and facilitators, and possible intervention adaptations. They indicated limited time, staff shortage, and the concern that the PAUSE model may delay surgery as the main barriers to implementation. Nurses were identified as partners in intervention execution. Surgical and nursing leadership engagement was indicated as crucial to adopting any new healthcare model in the studied facilities. We also learned that existing inter-site and inter-specialty variations might influence the implementation process.

Conclusions: RCE embedded in the CFIR framework delivers timely and actionable findings for FE to inform the intervention and identify implementation modifications to optimize opportunities for success.



Innovation: PAUSE Trial (the stepped-wedge hybrid 1 effectiveness implementation clinical trial consisting of (1) RAI screening of surgical candidates for frailty; (2) referring frail patients to the multispecialty PAUSE Board for evaluation and recommendations)

Outer Setting: VA Healthcare System; VA Sites: VA Palo Alto Health Care, VA Houston Health Care, and VA Tennessee Valley Health Care; non-surgical specialties and clinicians providing care for frail patients; patients

Inner Setting: surgical specialties at the VA Palo Alto Health Care, VA Houston Health Care, and VA Tennessee Valley Health Care; broader surgical teams (including leadership, physicians, mid-level personnel, and trainees) within those specialties

Process: assessing stakeholders' needs, indicating barriers and facilitators to implementation, identifying roles and responsibilities (including champions and executors), engaging stakeholders, indicating strategies to adapt the intervention

Individuals: surgical and nursing leadership, surgeons, other physicians (esp. anesthesia), mid-level personnel (esp. nurses), trainees, patients

Expected Outcomes: perceived acceptability, appropriateness, feasibility, implementation climate, implementation readiness, anticipated outcomes: implementation success or failure, intervention impact


How to build useful tools? Think about the end user
How to build useful tools? Think about the end user

ABSTRACTS

Desmoplastic Stromal Signatures Predict Patient Outcomes in Pancreatic Ductal Adenocarcinoma

Jason L. Guo, Ph.D.[1], Shamik Mascharak, Ph.D.[1], Deshka S. Foster, M.D., Ph.D.[1], Michelle Griffin, M.D., Ph.D.[1], Michael F. Davitt, M.D.,[1] Nicholas J. Guardino, B.S.[1], Elisabeth Miller, M.D.[2], Michael Januszyk[1], M.D., Ph.D.[1], Shyam Raghavan, M.D.[2], Teri A. Longacre, M.D.[3], Daniel J. Delitto, M.D., Ph.D.[1], Jeffrey A. Norton, M.D., F.A.C.S.[1], Michael T. Longaker, M.D., M.B.A., F.A.C.S.[1]

[1]Hagey Laboratory for Pediatric Regenerative Medicine, Division of Plastic and Reconstructive Surgery, Department of Surgery, Stanford University School of Medicine, Stanford, CA

[2]Department of Pathology, University of Virginia School of Medicine, Charlottesville, VA

[3]Department of Pathology, Stanford University School of Medicine, Stanford, CA

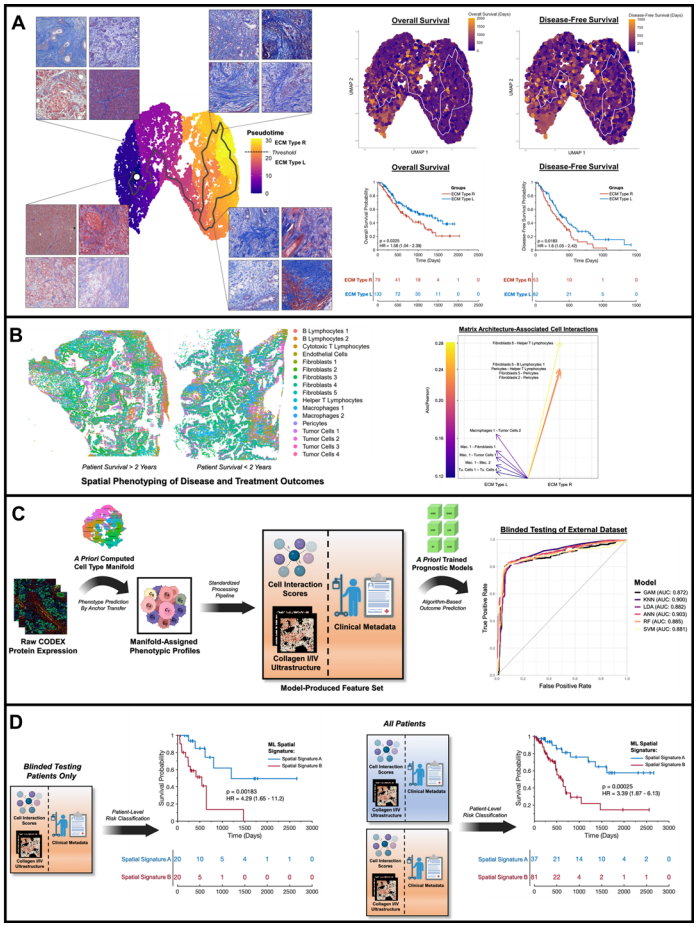
Introduction: Pancreatic ductal adenocarcinoma (PDAC) is projected to become the second-leading cause of cancer-related death in the next decade. To elucidate the role of desmoplastic and stromal organization in PDAC, we profiled clinical specimens using two novel technologies. First, we leveraged an ultrastructural algorithm to quantify matrix patterning in 437 patients. Next, we profiled 137 clinical specimens using CO-Detection by indEXing (CODEX) of spatial protein expression. Lastly, we integrated these modalities using machine learning (ML) to define unified signatures of patient survival.

Methods: Matrix ultrastructure in Trichrome images was quantified using an automated pipeline of 147 fiber-features, which capture architectural variation on local (fiber length, width, persistence, etc.) and global scales (alignment, porosity, etc.). This feature matrix was reduced by UMAP to visualize differences in overall matrix architecture. A 31-plex CODEX panel was used to quantify protein expression on paraffinized sections, which were processed using an in-house algorithm to spatially profile cell phenotypes. Cell-cell interactions were quantified at spatial co-localization of k=20 nearest neighbors. Six machine learning (ML) models of survival were trained using architectural parameters, cell-cell interactions, and clinical metadata.

Results: We uncovered two global architectures that differentiated patient survival by 662 days, outperforming biomarker-based methods that differentiate survival by 200-300 days (Fig. 1A). Furthermore, survival-negative architecture was associated with IL6high fibroblast-mediated cell-cell interactions (Fig. 1B). Unified ML signatures predicted survival in a blinded cohort (40 patients) with AUCs of 0.872-0.903, differentiating outcomes by 655 days (Fig. 1C-D).

Conclusions: This study applied an advanced fibrosis quantification algorithm to prognosticate PDAC in the postoperative setting, providing novel insight into the role of desmoplasia and stromal organization in driving clinical variability of PDAC. Critically, we have uncovered a novel desmoplastic-stromal signature that accurately predicts patient outcomes and suggests promising targets for therapeutic development.

Figure 1: Spatial phenotyping of pancreatic ductal adenocarcinoma. (A) Manifold of PDAC desmoplastic architecture with higher pseudotime representing increasingly disrupted, heterogeneous matrix architecture. Boxed images show representative tiles along the pseudotime trajectory. Scale bars represent 100 µm. Higher pseudotime matrix architecture was correlated with poorer outcomes (faster relapse, death). (B) Representative CODEX patient specimens with spatially indexed cell phenotypes, and identification of cell interactions correlated with differential matrix architecture. (C) Blinded testing of prognostic ML models using an independent dataset of 40 PDAC patients. (D) Kaplan Meier analysis of ML spatial signature for blinded testing dataset (left), and entire set of patients (right). For the blinded testing dataset, the spatial signature successfully differentiated patient survival by a difference of 655 days (HR = 4.29; p = 0.00183).



Avoiding a 'sticky' situation: Translation of a sustained-release therapeutic to prevent abdominal adhesions

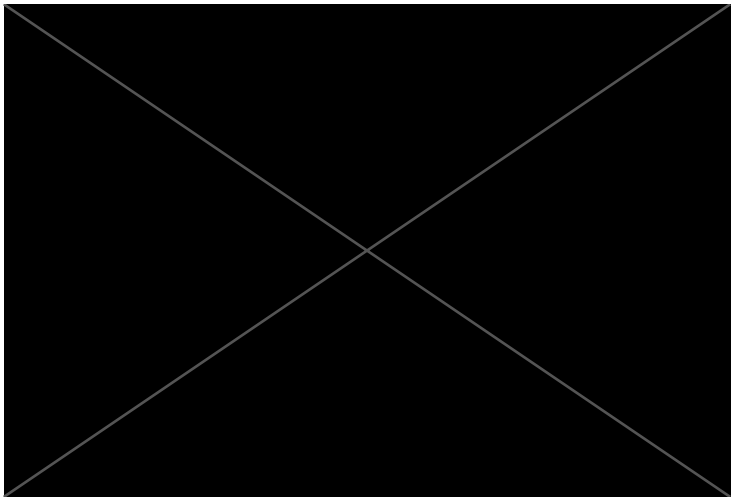
Deshka S. Foster, MD, PhD; Jason L. Guo, PhD; Emily Meany, PhD; Charlotte E. Berry, BS; Malini S. Chinta, MD; Gerlinde Wernig, MD; Michael Januszyk, MD, PhD; Daniel J. Delitto, MD, PhD; Eric Appel, PhD; Jeffrey A. Norton, MD; Michael T. Longaker, MD, MBA

Introduction: Adhesions are fibrotic scars that form between abdominal organs following surgery or infection, and can cause bowel obstruction, chronic pain, or infertility. Adhesions occur post-operatively in up to 90% of all abdominal operations and as such, represent an enormous clinical problem impacting millions of patients worldwide. Until recently, our understanding of adhesion biology has been limited, which explains the dearth of effective anti-adhesion therapies.

Methods: To bridge this gap in knowledge, we systemically analyzed abdominal adhesions in mouse and human tissues, at a cellular, transcriptomic, and protein level. To translate our findings towards clinical application, we developed an intraperitoneal formulation, which we test using our mouse model. We evaluated safety and tolerance, efficacy at varying doses/timepoints post-operatively, fibroblast uptake using mass spectrometry, and fibrotic matrix structure using a machine learning algorithm.

Results: We identified that JUN pathway signaling among peritoneal fibroblasts drives adhesion formation. When JUN expression is suppressed, adhesions are significantly diminished. We developed a sustained-release therapeutic involving a small molecule JUN inhibitor packaged in a hydrogel with independent anti-adhesion properties. Applied intra-peritoneally following laparotomy, the therapy was well tolerated, suppressed adhesion formation (Figure 1), and showed decreased fibrosis matrix scoring. Adhesion fibroblast uptake of the small molecule is dose-dependent and persistent over time.

Conclusion: Intraperitoneal delivery of a sustained-release anti-JUN formula shows clinical promise as a tool to prevent adhesions. Translation to a large animal (pig) model is underway. A local therapy to prevent this challenging pathology could significantly improve the lives of patients who undergo abdominal surgery.



Rescue of ischemic disease by transplanting intact vessel stem cell/niche cell clusters

Liming Zhao, Chao Ma, Andrew Lee, Koki Sasagawa, Jan Sokol, Yuting Wang, Lorene Lee, Michael Longaker, Patricia Nguyen, Charles Chan

Introduction: In our previous study, we identified two populations of distinct vascular stem/progenitor cells (VSPCs). VSPC1 gives rise to stunted vessels, and VSPC2 forms stunted vessels and fat in transplantation settings. Interestingly, co-transplantation of VSPC1 and VSPC2 populations is required to form functional vessels that improve perfusion in the mouse hindlimb ischemia model. Here we proposed that co-isolation and transplantation of VSPC1/VSPC2 with their niche cells in the intact cluster will keep the native interaction and synergism to give rise to optimized vessel formation.

Methods: In the present study, we established a new microfluidic-based method (On-chip Sort) to isolate intact VSPC/niche cell (VSPC/NC) clusters. Rainbow reporter mice and CloneTracker barcoding were used for lineage tracing in vivo. We further transplanted and evaluated these VSPC/NC clusters in a mouse model of ischemic osteonecrosis. Laser Doppler imaging was used to measure blood perfusion of ischemic tissue, micro-CT was used to assess changes of bone structure, and histologic analysis was also performed to characterize neovascularization.

Results: We observed that isolated VSPC/NC clusters gave rise to a higher vessel formation frequency than the VSPC alone group. In addition, the transplantation of VSPC/NC clusters resulted in the restoration of blood flow around the cauterized vessel to supply the distal tissue. Finally, the bone cell viability and bone structure in the ischemic area were remarkably improved in VSPC/NC clusters transplanting group.

Conclusion: In conclusion, our findings describe a new approach to rescue ischemic disease by co-isolating and transplanting VSPC/NC units as their intact organization.

Blood Brain Barrier Directed Immunotherapy Nano-conjugates for Checkpoint-refractory Melanoma Brain Metastasis

*Saurabh Sharma[1,2], Ali Khademhosseini[2], Eggehard Holler[2], Amanda Robinson Kirane**
[1]Department of General Surgery, Stanford University School of Medicine, 300 Pasteur Drive, Palo Alto, California-94304, United States
[2]Terasaki Institute for Biomedical Innovation,11570 WOlympic Blvd, Los Angeles, California-90064, United States

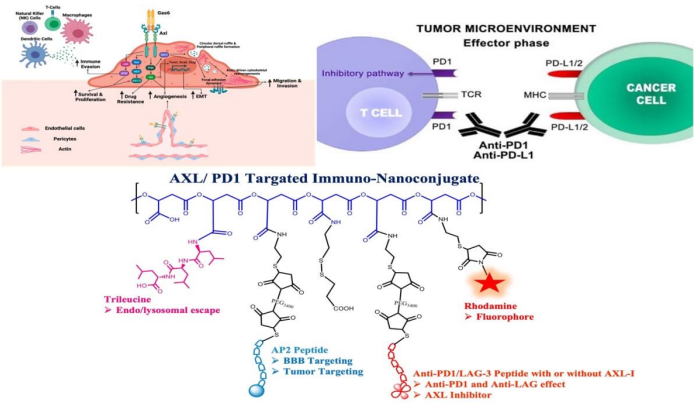
Introduction: Brainmetastases(BM)remain a significant clinical challenge for melanoma patients with an average survival of six weeks in immune checkpoint blockade (ICB) refractory disease. In part, this is a result of poor delivery of ICB across the blood brain barrier (BBB).We propose a novel, targeted NP-12-Polycefin™ Nanoconjugates (NCs)that crosses the BBB, delivering ICB peptides to the brain tumor-immune microenvironment (TiME).

Methods: NCs was synthesized using biodegradable malic acid polymer synthesized with Anti-PD-1 peptide (AUNP-12)and Angiopep-2 peptide. Confocal microscopy and flowcytometry were used to assess NCs-BBB transwell permeability in vitro and T cell activation from mouse splenocytes. TCGA- SKCM melanoma tumor mRNA expression and clinical data for metastatic melanoma patients were downloaded from the GDC legacy archive(https://portal.gdc.cancer.gov/legacy-archive) (n=471) to create Kaplan-Meier survival curves.

Results: In vitro, NCs successfully crossed the BBB into 3D tumor spheroids. NCs was selectively internalized by activated T cells and improved proliferation. Biodistribution in C57Balb/C mice showed accumulation of rhodamine-labeledNCs superior to systemically administered ICB. High expression of novelty rosine kinase, AXL, was associated with ICB nonresponse in StageIV patients ($p<0.01$). AXL expression diverged from T-cell signatures but was associated with immunosuppressive myeloid signatures and significantly diminished survival in patients with BM ($p<0.05$).

Conclusion: We demonstrate NCs crosses the BBB through receptor-mediated transcytosis to improve delivery of ICB, further therapeutic models are underway to confirm improved efficacy. We additionally identify AXL as an important target in BM that presents a rational combination strategy in a second- generation bispecific NCs.

Keywords: Brainmetastases (BM), Immunotherapy, Blood brain barrier (BBB), Biodegradable Nanoconjugates (NCs), AXL TK



Where there is fat there is fibrosis: Elucidating the mechanisms of creeping fat-driven stricture formation.

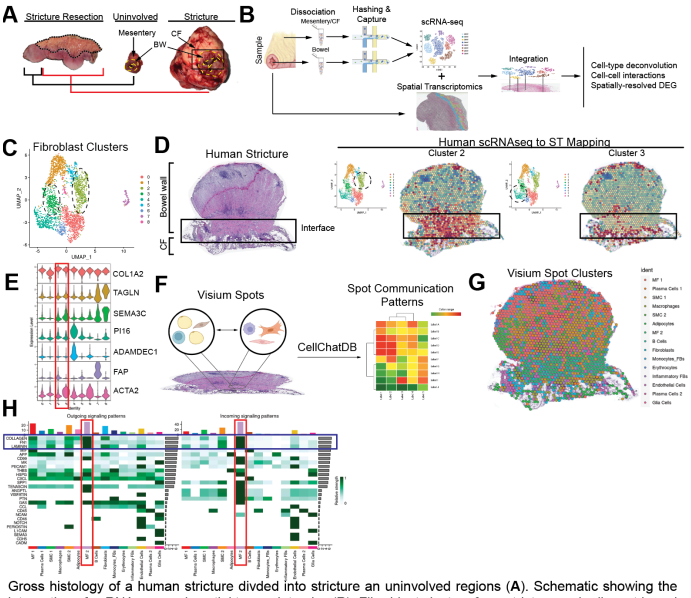
Khristian E. Bauer-Rowe, BS, Alexia Kim, BS, Michelle Griffin, MD, PhD, Norah Liang, MD, Deshka Foster, MD, Jason L. Guo, PhD, Jeffrey Allen. Norton, MD FACS, Michael T. Longaker, MD MBA FACS, and Jeong S. Hyun, MD

Introduction: One significant complication of Crohn's disease (CD) is an intestinal stricture, which develops in 25% of pediatric CD patients. Creeping fat (CF) forms adjacent to strictures, but whether it promotes stricture formation is unclear. Here, we use a multi-omic approach to show the enrichment of pro-fibrotic fibroblasts and ECM remodeling programs at the CF-stricture interface, providing new evidence that CF drives stricture formation.

Methods: We performed single-cell RNA-sequencing (scRNA-seq) on six pediatric stricture and three adjacent uninvolved tissue samples and subclustered the fibroblasts (Figure 1A-B). We performed 10X Visium ST on an intestinal stricture, clustered the spots, integrated the two datasets, and mapped pro-fibrotic single-cell clusters onto our ST data. Finally, we used CellChatDB (Figure 1F) to elucidate spot-to-spot cell communication networks at the CF-stricture interface.

Results: We identified two major pro-fibrotic fibroblast populations in bowel and CF (Cluster 2 and 3, respectively) that map to the CF-stricture interface (Figure 1C-E). Visium spot clustering revealed a cluster (MF2) present at the interface enriched for fibroblast and smooth muscle genes that correlated with the Cluster 2 mapping. CellChat revealed that these spots strongly express ECM remodeling programs (Figure 1G-H) compared to other spots.

Conclusion: We identified two pro-fibrotic fibroblast populations by scRNA-seq present at the CF-stricture interface. ST and CellChat revealed that the interface contains a mixture of fibroblast and smooth muscle cell populations that highly express ECM remodeling programs compared to other areas in the stricture, strongly suggesting that the CF-stricture interface is the primary driver of stricture formation.



Gross histology of a human stricture divded into stricture an uninvolved regions (**A**). Schematic showing the integration of scRNA-seq and spatial transcriptomics (**B**). Fibroblast clusters from stricture and adjacent bowel and creeping fat (CF) or mesentery. Pro-fibrotic clusters circled. (**C**). H&E showing stricture structure (left). Cluster 2 and 3 mappings onto Visium (right) (**D**). Violin plots of representative pro-fibrotic genes in fibroblast clusters (**E**). Schematic showing cell-to-cell communication analysis (**F**). Spatial plot of Visium spot clusters (**G**). CellChat heatmap showing the MF2 cluster (red box) ECM programs (blue box) (**H**).

New Spatial Transcriptomic Analysis Reveals 3d Signaling Regulatory Relationships Within Skeletal Stem Cell Niches in Single Cell Resolution

Yuting Wang, Jan Sokol, Ke Ding, Thomas Ambrosi, Eri Takematsu, Malachia Hoover, Charles Chan

Introduction: Skeletal stem cells (SSCs) play a crucial role in the maintenance and repair of the skeletal system including cartilage, bone and bone marrow. A thorough understanding of the regulatory mechanism within the skeletal stem cell niches during development, injury, and ageing, is essential to develop efficient and specific strategies to stimulate stem cell mediated regeneration of damaged skeletal system.

Methods: In the present study, we mapped crosstalk within skeletal stem cell niches during long bone development, fracture injury and ageing with our new 3D, single cell spatial transcriptomic method(TESSERACT). The spatial information of intact growth plate, callus and articular cartilage clusters size around 50-100 cells from rainbow mice were recorded by confocal before enzymatically dissociated and index sorted for single cell sequencing by high coverage Smart-seq2 scRNA-seq, and further analyzed for their precise cellular identity and signaling status. Visium, along with in situ methods such as RNA Scope have also been used to validate and expand on unbiased discovery results as detected by TESSERACT. Gene regulatory networks of interacting cells was analyzed by Boolean analysis, and further identified the effective combination of factors with invitro and in vivo function assay.

Results: Through comprehensive functional and single-cell transcriptomic analyses, we identified a serious of key factors expressed by skeletal stem cell niches that controlled fate of the osteochondral SSC (ocSSC) that facilitates long bone growth, soft callus formation and initiates marrow reconstitution during fracture healing. With TESSERACT analysis, we also provide insight into the temporal and spatial heterogeneity of both skeletal stem cell and niche cells as well as crosstalk within skeletal stem cell niches that instructed growth plate development and callus formation.

Conclusion: In conclusion, we systematically reconstructed real 3D spatial regulatory relationship within skeletal stem cell niches in single cell resolution and determine the essential arrangements of signals between niche cells and stem cells during long bone development and callus formation, setting an example of application of TESSERACT analysis for other biology processes.

Patient-specific computational flow simulation reveals adverse hemodynamic factors associated with branch vessel occlusion after complex endovascular aneurysm repair

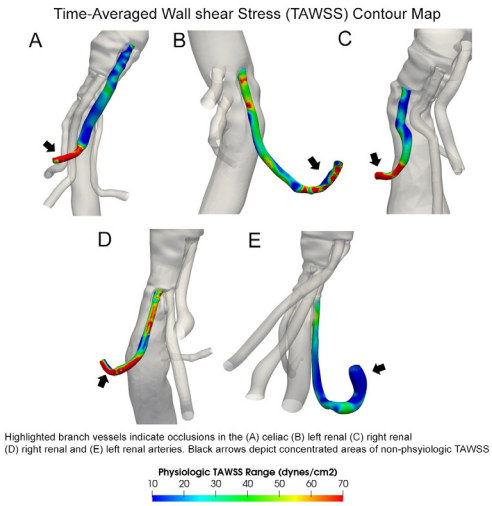
Kenneth Tran MD[1,2], Jesse Chait DO[3], Emmanuel Tenorio MD PhD[4], Weiguang Yang PhD[2,5], Alison Marsden PhD[2,5], Bernardo Mendes MD[3], Gustavo Oderich MD[4], Jason T Lee MD[1,2]
[1] Division of Vascular Surgery, Stanford Health Care, Stanford CA
[2] Cardiovascular Institute, Stanford University, Stanford, CA
[3] Division of Vascular Surgery, Mayo Clinic, Rochester, MN
[4] Division of Vascular Surgery, University of Texas Houston, Houston, TX
[5] School of Bioengineering, Stanford University, Stanford, CA

Introduction: This study assessed the hypothesis that patient-specific computational flow simulation (CFS) can identify adverse hemodynamic factors associated branch vessel occlusion after fenestrated and branched EVAR (FB-EVAR).

Methods: A multi-institution retrospective review was performed on patients who underwent four-vessel FB-EVAR with custom manufactured stent grafts for Extent II-IV thoracoabdominal aortic aneurysms. Patients with branch occlusion in the absence of demonstrated stenosis or kinking were identified. Using SimVascular software, pulsatile rigid-wall flow simulations were performed using patient-specific geometries and boundary conditions. Hemodynamic variables were compared between branches with occlusion and patent branches serving as internal controls.

Results: A total of nine patients treated with four-vessel FB-EVAR for thoracoabdominal aortic aneurysms who experienced ten target vessel occlusions (n=2 celiac, n=1 superior mesenteric, n=7 renal arteries). Larger surface area of abnormal time-averaged wall shear stress (TAWSS) was significantly associated with future renal branch occlusion (14.5 [10.4-19.8] vs 5.9 [4.0-7.4]%, p=.003; occluded vs patent, median [IQR]), with a >10.4% abnormal TAWSS area threshold correctly classifying 94.4% of renal occlusions on receiver-operator characteristic curve analysis (AUC 0.92). A similar relationship was not observed for celiac (p=.50) or superior mesenteric branch occlusions (p=.66). Qualitative 3D contour mapping revealed areas of abnormal wall shear stress commonly occurring at the distal aspect of branch arteries with eventual loss of patency (Figure 1).

Conclusion: Computationally estimated abnormal TAWSS area of greater than 10% may identify renal branches at hemodynamic risk prior to occlusion. Prospective studies are required to further investigate the ability of CFS to predict branch patency loss after complex EVAR.



Highlighted branch vessels indicate occlusions in the (A) celiac (B) left renal (C) right renal (D) right renal and (E) left renal arteries. Black arrows depict concentrated areas of non-physiologic TAWSS

Proliferative and Expansive Properties of Next Generation Surrogate (NGS) Wnt and R-Spondin on Transplanted Intestinal Epithelial Cells

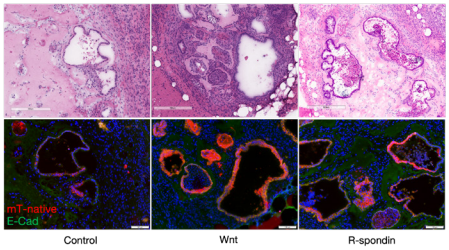
Siavash Shariatzadeh, MD, MPH, Chih-Hsin Chen, MS, Christopher Garcia PhD, Calvin Kuo, MD, PhD, James Dunn, MD, PhD

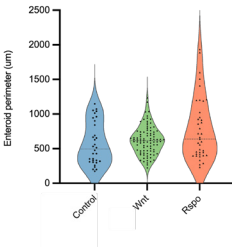
Introduction: Enteroids can be used as a donor source of intestinal cells to regenerate a functional and immune-compatible prefabricated intestinal epithelium. We have previously developed enteroids from human intestine that were successfully transplanted in the immunosuppressed rats' subcutaneous tissue. Herein, we examined the addition of Next Generation Surrogate (NGS) Wnt and R-spondin agonists with the aim to expand the transplanted enteroids in immunosuppressed rats.

Methods: Mouse intestinal crypts were harvested and cultured to produce viable enteroids. Enteroids were seeded in a basement membrane extract matrix with L-WRN conditioned culture medium, then injected into the subcutaneous space of immunosuppressed rats (Rag1/Il2 knockout) with NGS Wnt, R-spondin, and control (5nM, 250nM, and PBS, respectively). After 7 days, the skin was analyzed to determine the presence of mouse enteroids in subcutaneous tissue. Histology was analyzed using immunofluorescence.

Results: All immunosuppressed rats did not show signs of rejection or inflammation at the injection sites. H&E staining and E-cadherin immunofluorescence confirmed the survival and replication of the enteroids in all specimens. The larger average diameter of the enteroids treated with NGS Wnt and R-spondin was observed as compared with the control group. A larger number of enteroids was also detected in the animals treated with NGS Wnt.

Conclusion: We demonstrated that NGS Wnt and R-spondin proteins supported better growth of mouse enteroids in immunosuppressed rats' subcutaneous tissue. The enteroids treated with NGS Wnt and R-spondin formed normal crypts and villi. This study, for the first time, provides evidence that NGS Wnt and R-spondin can play a significant role in the development of enteroids after transplantation.





Usability of the ENTRUST Learning Platform for Global Surgical Education: A Pilot Curriculum at the University of Global Health Equity, Rwanda

*Tyler Wilson, BA; Lye-Yeng Wong, MD; Barnabas Alayande, MBBS, PgDTh, MBA, FMCS; Hyrum Eddington, BS; Amber Trickey, PhD, MS, CPH; Edward F. Melcer, PhD; Samuel Shields, BS; Jason Tsai, MS; Fatyma C. Peralta, MSc; Abebe Bekele, MD, FCS(ECSA), FACS; Thomas G. Weiser, MD, MPH, FACS; Martin Bronk, MD, FACS; *Dana T. Lin, MD, FACS; *Cara A. Liebert, MD, FACS*

Introduction: There is a global need for accessible evidence-based tools to support competency-based medical education in low- and middle-income countries (LMIC). In this pilot, we evaluate the feasibility and usability of ENTRUST to address this educational need with a partner institution in Rwanda.

Methods: We conducted this study in collaboration with the University of Global Health Equity (UGHE). Eighteen UGHE medical students completed two surgical ENTRUST learning cases followed by an online survey including the System Usability Scale (SUS) [0-100], Test of Online Learning Success (TOOLS) Computer Skills sub-score [0-5], Likert responses, and open-ended responses. We calculated descriptive statistics for SUS, TOOLS, and Likert responses and performed bivariate analysis to evaluate for potential bias in usability related to demographic factors or ENTRUST performance. Qualitative analysis was performed inductively in an iterative fashion.

Results: Median SUS score was 82.5, indicating high usability; median TOOLS Computer Skills sub-score was 5, indicating high computer literacy. Usability was independent of demographic variables, ENTRUST score, and completion time (all p>0.05). Participants strongly agreed they enjoyed completing ENTRUST cases (94%), would like to complete additional ENTRUST surgery cases (94%), and would like to complete cases in additional specialties (94%). Qualitative analysis of the perceived value of ENTRUST yielded five primary themes of engagement, challenge, realism, feedback, and organization.

Conclusion: This pilot demonstrates initial feasibility for use of the ENTRUST Learning Platform in LMIC. The target audience found the online virtual patient platform highly usable and valuable. ENTRUST holds promise as a scalable educational tool in global surgery.

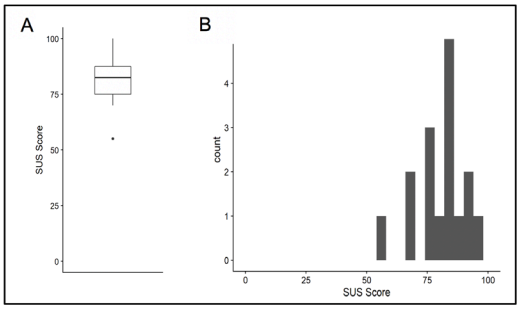


Figure 1. ENTRUST Learning Platform System Usability Scale (SUS) Scores. A) Box and Whisker plot of SUS scores including maximum (100), median (82.5), and minimum (55); B) Histogram distribution of SUS scores

Association of cumulative social risk and survival among patients with advanced colorectal cancer

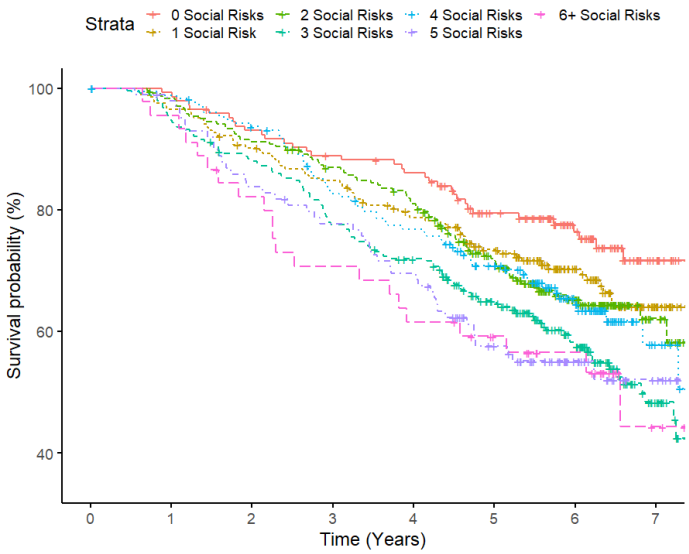
Yelorda, Heather S. Day, MS; Pohl, Amber W. Trickey, PhD, MS; Badi Quinteros; Davis, Morris

Introduction: Socioeconomic disadvantage is associated with poor surgical outcomes among patients with colorectal cancer (CRC). However, many studies are limited to aggregated zip-code level rather than individual-level socioeconomic factors. Moreover, the influence of social risk factors on long-term oncologic outcomes has not been explored. Our purpose was to examine cumulative associations of multiple, co-occurring individual-level social risk factors with long-term survival among patients with advanced colorectal cancer.

Methods: Between 2011-2014, we partnered with the Surveillance, Epidemiology and End Result (SEER) registries of Georgia and Metropolitan Detroit to survey patients with Stage III CRC who had undergone surgery in the prior year. Cumulative social risk included preoperative employment, annual income, health insurance, comorbidities, marital status, health literacy, adult caregiving, and perceived discrimination. The primary outcome was survival time measured as time-to-death. Hazard ratios were estimated with multivariable Cox proportional hazards regression, adjusted for age, race, sex, and receipt of chemotherapy.

Results: A total of 1164 patients were followed for a median of 5.48 years. Overall survival differed by cumulative social risk (5-year survival: 0 social risks 80.0%, 6+ social risks 60.0%). After adjusting for demographics and treatment, each additional social risk was associated with a higher likelihood of death (HR: 1.13 ; 95% CI: 1.06-1.21, p<0.001, Figure 1).

Conclusion: Cumulative social risk was associated with long-term survival after treatment for Stage III CRC. Assessing social risk may help identify patients with CRC who are at higher risk of mortality to receive support programs designed to mitigate social disadvantage.



The Accuracy of Non-Standardized MELD/PELD Score Exceptions in the Pediatric Liver Allocation System

Daniel J. Ahn MD[1], Sharon Zeng BS[2], Kenley M. Pelzer PhD[3], Rolf N. Barth MD[4], Amy Gallo MD[1], William F. Parker MD, PhD[3,5]
[1]Department of Surgery, Stanford University, Stanford, CA
[2]Pritzker School of Medicine, University of Chicago, Chicago, IL
[3]Department of Medicine, University of Chicago, Chicago, IL
[4]Department of Surgery, University of Chicago, Chicago, IL
[5]Department of Public Health Sciences, University of Chicago, Chicago, IL

Introduction: In the United States, over half of pediatric candidates receive exceptions and status upgrades that increase their allocation MELD/PELD score above their laboratory MELD/PELD score. We determined whether these "non-standardized" MELD/PELD exceptions accurately depict true pre-transplant mortality risk.

Methods: Using data from the Scientific Registry of Transplant Recipients, we identified pediatric candidates (<18 years of age) with chronic liver failure added to the waitlist between June 2016 and September 2021 and estimated all-cause pre-transplant mortality with mixed-effects Cox proportional hazards models that treated allocation MELD/PELD and exception status as time-dependent covariates. We also estimated concordance statistics comparing the performance of laboratory MELD/PELD to allocation MELD/PELD. We then compared the proportion of candidates with exceptions before and after the National Liver Review Board's (NLRB) establishment.

Results: Out of 2026 pediatric candidates listed during our study time period, 403 (19.9%) received an exception within a week of listing and 1182 (58.3%) received an exception before delisting. Candidates prioritized by their laboratory MELD/PELD scores had an almost 9-times greater risk of pre-transplant mortality compared with candidates who received the same allocation score from an exception (HR 8.69, 95% CI [4.71, 16.03], p < 0.001). Laboratory MELD/PELD without exceptions was more accurate than allocation MELD/PELD score with exceptions (Harrell's c-index 0.843 vs. 0.763). The proportion of patients with an active exception at the time of transplant decreased significantly after the NLRB was implemented (67.4% vs. 43.4%, p < 0.001) (Fig. 1).Conclusions: Non-standardized exceptions undermine the rank-ordering of pediatric candidates with chronic liver failure.

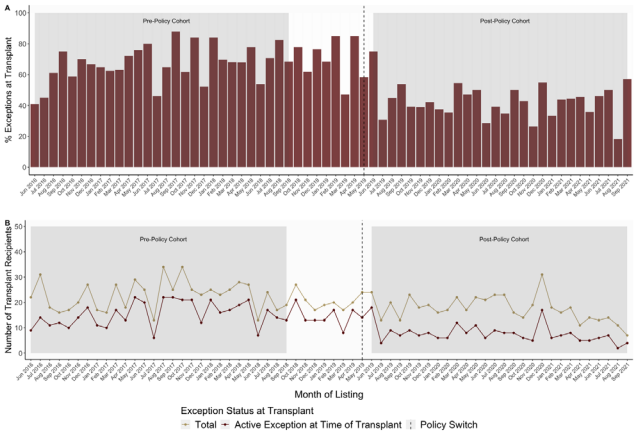


Figure 1: Trends in proportion of (A) and absolute number (B) of transplant recipients with active non-standardized exception status at the time of transplant from June 2016 to September 2021. Dashed vertical line represents May 2019, when the policy change establishing the NLRB was implemented. Total of 1296 DDLTs were performed in this period, with 638 in the pre-policy period and 493 in the post-policy period. Proportion of recipients with active non-standardized exceptions decreased significantly after the policy change (67.4% vs. 43.4%, p < 0.001).

Risk of Reintervention is Lower for Carotid Endarterectomy than Carotid Artery Stenting

Shaunak S. Adkar, Xinyan Zheng, Sabina M. Sorondo, Elizabeth L. George, Jordan R. Stern

Introduction: Perioperative outcomes for carotid endarterectomy (CEA) and carotid artery stenting (CAS) have been well studied, but reintervention rates of each remain unclear. We sought to compare rates of ipsilateral reintervention, stroke, and death in patients undergoing CEA and CAS, with a subgroup analysis of CAS patients undergoing transfemoral stenting (TFCAS) and transcarotid artery revascularization (TCAR).

Methods: The Vascular Quality Initiative (VQI) was matched to Medicare claims via the Vascular Implant Surveillance and Implantation Network (VISION) database, and we identified patients who had primary carotid revascularization from 2016 to 2019. The primary outcome was ipsilateral reintervention, while secondary outcomes included stroke and mortality. After 1:1 propensity score matching, time-dependent Cox regression models were used to compare CEA and CAS and subsequently TFCAS and TCAR.

Results: We identified 27,944 patients undergoing CEA (n=21,256) or CAS (n=6,688). After propensity matching, we compared 4,705 patients in each group. Risk of re-intervention was increased within 6 months for CAS (HR:1.97;CI:1.11-3.50;p<0.05) but not beyond 6 months. The risk of stroke was increased for CAS within 6 months (HR:2.91;CI:2.42-3.48;p<0.0001) but not beyond 6 months. Mortality for CAS was increased within 6 months (HR:1.69;CI:1.38-2.07;p<0.0001) and beyond 6 months (HR:1.52; CI:1.27-1.81;p<0.0001). On comparison of TFCAS and TCAR, risk of re-intervention was increased for TFCAS beyond 6 months (HR:2.31;CI:1.05-5.11;p<0.05, Figure 1)

Conclusions: CEA portends a lower risk of reintervention and stroke compared to CAS. On subgroup analysis, TCAR had a lower rate of reintervention than TFCAS. CEA appears to be most durable carotid revascularization strategy, with TCAR being more durable among stenting procedures.

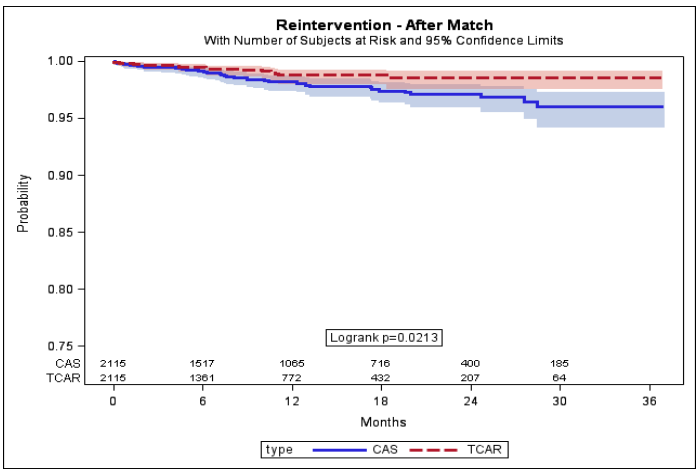


Figure 1: Risk of Reintervention for TFCAS and TCAR using Kaplan-Meier Analysis. Probability of freedom from reintervention from index procedure to 3 years after propensity matching. TFCAS indicates Transfemoral Carotid Stenting and TCAR indicates Transcarotid Artery Revascularization.

Barriers and facilitators of surgical prehabilitation adherence from the patient perspective: A mixed methods study

Cintia Kimura MD PhD, Yuning Liu RD, Sarah E. Crowder BS, Carlie Arbaugh MD, Uyen Mai BS, Kreeti Shankar MPH, Andrew Shelton MD, Brendan Visser MD, Cindy Kin MD MS

Introduction: Identifying and addressing barriers while supporting facilitators of prehabilitation adherence is critical to maximizing its potential benefit. This study aimed to identify barriers and facilitators that affect adherence to prehabilitation among surgical patients undergoing major gastrointestinal surgery.

Methods: This mixed-methods study had an explanatory sequential design with connected integration. Patients enrolled in an app-based prehabilitation program were invited to complete a survey on barriers to physical activity and healthy eating. Those who participated in the program and had already recovered from surgery were invited for a semi-structured interview to further explore barriers and facilitators to prehabilitation adherence. Interviews were performed until reaching thematic saturation. Interview transcripts were iteratively coded, and key themes were discussed to consensus. Quantitative and qualitative data were integrated through the lens of the Theoretical Domains Framework.

Results: Of the 133 participants who participated in the prehabilitation program, 116 (87.2%) completed the survey, and 15 were interviewed. Medical issues and lack of motivation were the most frequent barriers to physical activity and healthy eating (Table 1). Emergent themes regarding facilitators of prehabilitation adherence included prior experience with healthful eating and exercise, desire to improve quality of life and longevity, and social support. Themes that emerged as barriers were medical conditions that limited tolerance to food, orthopedic problems, preconceptions of particular diets, disordered relationship to food, and environmental factors (e.g., extreme weather) (Table 1).

Conclusion: The in-depth understanding of barriers and facilitators to patient adherence to prehabilitation obtained in this study will inform strategies to improve adherence in future programs.

Table 1. Integration of quantitative and qualitative findings

Table 1. Integration of quantitative and qualitative findings

Domain[1]	Themes	Illustrative quote	Survey question	N(%)
Physical	Comorbidities as a barrier	*"The only thing that limits my walking is my creaky arthritic knees."*	Pain prevents me from exercising	59 (50.9)
	Effect of treatment on taste and appetite	*"Taste is a big thing in chemotherapy and cancer because most things taste like a paper bag to a lot of people."*	Medical issues prevent me from eating healthy foods	26 (22.4)
Knowledge	Prior experience as facilitator or barrier	*"It's fairly easy for me to do it (Mediterranean diet) because I lived in the Middle East for a long time." "I did not do the diet. I think it's rich in olive oil and fish. I don't eat fish, and none of my family members do either."*	Do not have enough information about a healthy diet	28 (24.1)
Beliefs about consequences	Belief that healthy habits can help in the recovery process	*"Okay, let's try to have me be in as good a shape as I can be in to try to heal and try to have my hospital stay be shorter"*	Do not have the motivation to exercise	48 (41.4)
Reinforcement	Perception of the benefits leading to more motivation	*"on the Mediterranean diet, (…) you almost feel like you've got good energy afterwards. (…) I'm awake and alert, and I'm not lethargic after a big red meat meal like before the program."*	Do not have the motivation to eat a healthy diet	36 (31)
Environmental context and resources	Environment as a potential barrier to exercise	*"I live in 103, 105-degree. My daughter has been walking with me lately and we've tried going after 8 o'clock at night when it cools down to about 97."*	Do not have access to places to do physical activity or exercise	17 (14.7)
	Importance of being time-efficient	*"If you had to spend a lot of time during the day doing those exercises, I probably would not have done it, but they were very time efficient"*	Do not have time to exercise because of job	19 (16.4)
	Environment as a potential facilitator to healthy eating	*"I have a huge garden, and so I eat lots of vegetables all the time anyway."*	Do not have access to healthy foods	14 (12.1)
Social influences	Importance of engaging the person who cooks	*"I live alone, I'm single, and so I was able to adopt them and not have to force somebody else to have the same diet or follow the examples."*	No family support to eat a healthy diet	15 (12.9)
	Challenges of eating healthy during social interactions	*"Buying things when you have guests over and then not being able to resist temptation"*	No friends' support to eat a healthy diet	14 (12.1)
	Poor relationship with food / eating disorders	*"I already didn't have a good relationship with food. So, participating in a study that would ask me to track what I was eating or really monitor my food intake, I think that, personally, that was not a good study to participate in"*	Do not enjoy eating healthy	23 (19.8)

[1] – From the Theoretical Domains Framework

Impact of induction therapy on rejection in pediatric transplantation: A multicenter study in the United States

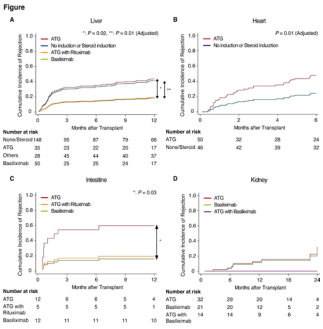
Tetsuya Tajima[1], Amy Gallo[1], Daniel Bernstein[2], C. Andrew Bonham[1], Scott Boyd[3], Dita Gratzinger[3], Grant Lum[1], Kazunari Sasaki[1], Brent Tan[3], Kenneth Weinberg[2], Brian Armstrong[4], Merideth Brown[5], Clifford Chin[6], Dev Desai[7], Thomas Fishbein[8], George Mazariegos[9], Mark Robien[5], Akin Tekin[10], Clare Twist[11], Robert Venick[12], Sheri M. Krams[1], Olivia M. Martinez[1], Carlos O. Esquivel[1].
[1]Department of Surgery, Division of Abdominal Transplantation, Stanford University School of Medicine, Stanford, CA; [2]Department of Pediatrics, Stanford University School of Medicine, Stanford, CA; [3]Department of Pathology, Stanford University School of Medicine, Stanford, CA; [4]Rho, Durham, NC; [5]National Institute of Allergy and Infectious Diseases, Rockville, MD; [6]Department of Pediatrics, Cincinnati Children's Hospital Medical Center, University of Cincinnati College of Medicine, Cincinnati, OH [7]Division of Surgical Transplantation, UT Southwestern Medical Center, Dallas, TX; [8]Departments of Surgery and Pediatrics, MedStar Georgetown University Hospital, Washington, DC; [9]Department of Pediatrics, UPMC Children's Hospital, Pittsburgh, PA; [10]Department of Surgery, University of Miami Miller School of Medicine, Miami, FL; [11]Department of Pediatric Oncology, Rosewell Park, Buffalo, NY; [12]Department of Pediatric Gastroenterology, David Geffen School of Medicine, University of California Los Angeles, Los Angeles, CA

Introduction: Induction therapy is often used in pediatric transplantation to mitigate the risk of rejection in pediatric organ transplantation; however, the efficacy of each induction agent in preventing rejection remains unknown.

Methods: This prospective, multicenter, study (NCT02182986) enrolled 944 children (≤21 years). Of these, 872 patients received liver, heart, kidney, intestinal, or multivisceral transplants (LT, HT, KT, and IT, respectively) in seven US centers (2014-2019). After patient selection, 470 patients (261 LTs, 97 HTs, 79 KTs, and 33 ITs) were retrospectively analyzed. The clinical variables included sex, age, ethnicity, pre-transplant Epstein-Barr virus (EBV) and cytomegalovirus serologies, and induction therapy. Cumulative incidence of rejection was compared, with patient death as a competing risk.

Results: The cohort included 265 males and 205 females, and the median age at transplant was 4.1 years (IQR: 1.3-12.7). Uni/multivariable analyses revealed antithymocyte globulin (ATG) vs. basiliximab (SHR: 2.46 [1.15-5.27], P=0.02) and no induction or steroids vs. basiliximab (2.25 [1.21-4.21], P=0.01) were significant risk factors for rejection in LT. ATG vs. no induction or steroids (2.35 [1.21-4.54], P=0.01) and EBV-naïve vs. EBV-seropositive recipients (2.32 [1.20-4.49], P=0.01) were identified as significant risk factors for rejection in HT. Univariable analysis showed ATG vs. basiliximab was a significant risk factor for rejection in IT (5.29 [1.20-23.3], P=0.03). All patients who received ATG with basiliximab had no rejection within 2 years after KT.

Conclusion: Basiliximab was a superior induction agent compared to ATG or no induction or steroids in LT and IT. No induction or steroids developed less rejection than ATG in HT.



Amplified inferior outcomes for infant pediatric liver transplant recipients listed and transplanted at low volume centers

Dan Stoltz, Kliment Bozhilov, Amy Gallo, Varia Kirchner, Grant Lum, Julianne Mendoza, Carlos Esquivel, Andrew Bonham

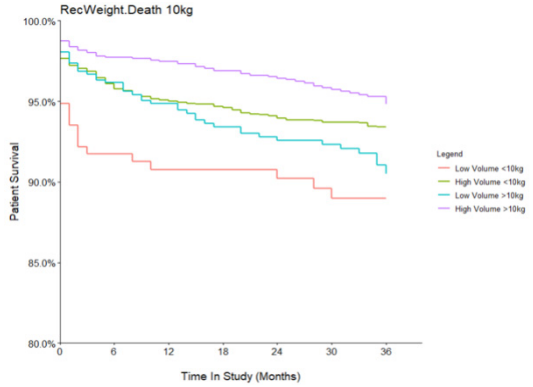
Introduction: This study aimed to compare patient and graft survival of low-weight pediatric liver transplant recipients at high volume (HV) and low volume (LV) transplant centers in the United States. It also aimed to identify discrepancies in waitlist mortality based on recipient weight at HV and LV centers.

Methods: Pediatric liver transplant recipients from 2010 through 2020 were identified via the SRTR database. Transplant centers were designated as HV or LV based on the average number of pediatric liver transplants performed per year (HV: ≥ 5, LV: <5). Overall patient and graft survival up to 3 years post-transplant was calculated according to transplant center volume and recipient weight (<10kg and >10kg) and compared using Kaplan-Meier curves and log-rank tests. Waitlist mortality was calculated and compared between these groups.

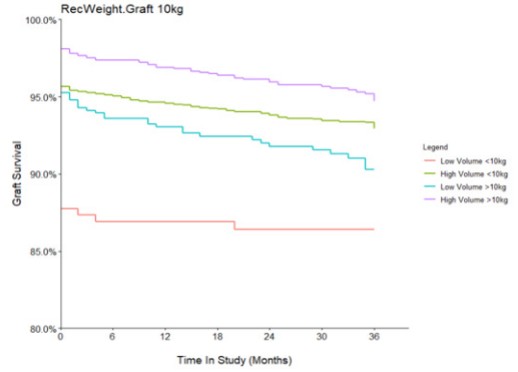
Results: 4332 patients received transplants at HV centers (2635 patients >10kg, 1697 patients <10kg) and 876 patients received transplants at LV centers (624 patients >10kg, 252 patients <10kg). Patient and graft survival for recipients <10kg was worse at LV centers compared to HV centers (p<0.001 and p<0.001, respectively). Waitlist mortality was significantly higher at LV centers compared to HV centers for recipients <10kg (28.95 vs 16.5 events per 100 person-years; p<0.001).

Conclusion: Low-weight pediatric liver transplant recipients have inferior outcomes at LV centers. Waitlist mortality for low-weight pediatric liver candidates is increased at LV centers. There is a need for collaboration between HV and LV centers to reduce waitlist mortality and improve transplant outcomes in this vulnerable population.

Pediatric Liver Transplant Overall Patient Survival



Pediatric Liver Transplant Overall Graft Survival



Preoperative Weight Loss With Glucagon-like Peptide-1 Receptor Agonists (GLP1) Before Bariatric Surgery

Brian Ruhle, MD, Sebastiano Bartoletti, MD, Dan Elison Azagury, MD FACS

Introduction: GLP-1 agonists (GLP-1) are safe and effective in treating patients with obesity. However, the utility and timing of GLP-1 combined with bariatric surgery is not established. Downstaging with preoperative medical therapy may confer additional benefit over surgery alone for patients with obesity, especially for individuals with BMI above 50.

Methods: Retrospective analysis of patients with obesity (BMI >30) who underwent laparoscopic gastric bypass or sleeve gastrectomy from 2012 to 2022. Aim: to assess the impact and optimal duration of preoperative treatment with semaglutide or liraglutide. The primary outcome was percent of total body weight loss (%TBWL) during the 12-months before surgery.

Results: In total, 130 patients were prescribed GLP-1 during the preoperative period, and 823 patients were never prescribed an anti obesity medication. Patients prescribed GLP-1 were significantly older, had a higher baseline BMI and more weight related comorbidities. The percentage of patients experiencing 5% and 10% TBWL with preoperative GLP-1 was 63% and 38%, respectively. By comparison, only 25% and 8% of patients without GLP-1 achieved 5% and 10% TBWL (p <0.001). Weight loss was dependent on duration of therapy; greater weight loss was achieved for patients receiving at least 5 weeks of liraglutide, and at least 20 weeks of semaglutide. In a logistic regression analysis, GLP-1 and BMI over 50 were both independent predictors of weight reduction of 5% or more.

Conclusion: In patients with obesity being considered for bariatric surgery, including those with BMI over 50, preoperative GLP-1 was associated with clinically relevant body weight reduction.

VIRTUAL POSTER SESSION

Resident Research Day

Virtual Poster Session – Basic

Title of Presentation	Presenter
Mechanical Offloading Prevents and Rescues Microtrauma-Induced Fibrosis in a Large Animal Model	Alexia Kim
Multi-Omic Spatial Analysis Reveals Fibroblast Heterogeneity in the Progression and Repair of Fibrotic Lung Architecture	Jason L. Guo
Mechanosensitive Adaption and Regeneration of The Intestinal Muscle Layers in a Partial Obstruction Murine Model	Siavash Shariatzadeh
Tumor-Associated Macrophage Subpopulation in Intrahepatic Cholangiocarcinoma (ICC) as Prognostic and Therapeutic Targets	Joshua Sam Badshah
A Novel Mouse Model to Study Tibial Distraction Osteogenesis	Sarah DiIorio
Identifying novel drug candidates to improve efferocytosis in atherosclerosis	Lingfeng Luo
Meta-analysis of scRNA-seq data of cardiac fibroblasts reveals temporal dynamics of cardiac fibroblast activation after myocardial infarction	John Lu
Advanced quantification and acquisition of surgical skills using Wearable Technology	Brett Wise
Effect of intestinal epithelial piezo1 gene deletion on murine distraction enterogenesis	Akanksha Sabapaty

Resident Research Day

Virtual Poster Session – Clinical

Title of Presentation	Presenter
Impact of adapting a surgical safety checklist training to a virtual platform in Ethiopia	Maia R. Nofal
Small Victories: Microlearning through Animation is an Effective Tool in Surgical Education	Cintia Kimura
Looking Beyond the Numbers: A Comparison of Operative Self-Efficacy, Supervision, and Case Volume	Rachel Jensen
The effects of mesh fixation techniques on surgical outcomes during simulated Laparoscopic Ventral Hernia (LVH) repair.	Sindhushree Hosakote
Using Animation to Enhance Patient Understanding of Prolapse	Hassina Adel
Association of baseline chronic kidney disease stage with outcomes after FEVAR	Shernaz Dossabhoy
Having other comorbidities do not affect the pain symptoms and recurrence rate in patients with pilonidal disease	Akanksha Sabapaty
Multidisciplinary Gastrointestinal Healthcare Professional Beliefs, Behaviors, and Practices Around Personal and Patient Nutrition	Carlie Arbaugh
Team-Centered Care after Trauma Patient Death: Promoting Healers' Healing by Humanizing Our Roles	Sydni Au Hoy
We Need to Do Better: A Call for Evidence-Based Wellness Programs in Surgery Residency	Ananya Anand
Ngongoni R_Current Landscape of Minimally Invasive Pancreatectomy for Neoplasms Across the USA	Rejoice F Ngongoni
Trends In Instagram Content Amongst Private Practice Plastic Surgeons	Brian Sangalang
Outcomes of Procedural-Based Palliation for Malignant Bowel Obstruction	Nova Xu
Postoperative antibiotic prescribing practices and surgical site infections in twenty low- and middle-income country hospitals	Maia R. Nofal

Mechanical Offloading Prevents and Rescues Microtrauma-Induced Fibrosis in a Large Animal Model

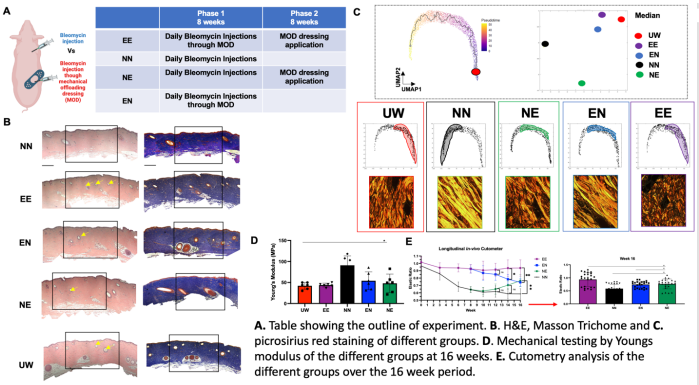
Alexia Kim, Michelle Griffin, Heather Talbott, Shamik Mascharak, Norah Liang, Annah Morgan, Nicholas Guardino, Jason Guo, Asha C. Cotterell, Jennifer B. Parker, Mauricio Downer, Darren Abbas, Michael Januszyk, Michael T. Longaker, Derrick Wan

Introduction: Repetitive subdermal injections, as seen with insulin in diabetes mellitus, cause microtrauma leading to skin fibrosis and consequential pain. We hypothesized that microtrauma induced fibrosis could be attenuated by injecting through a mechanical offloading dressing (MOD). We developed a large animal porcine model to evaluate injection associated fibrosis.

Methods: Two Red-Duroc (3-month-old) pigs were subjected to four treatment conditions over a 16-week period, in two 8-week phases. All conditions received daily bleomycin injections in Phase 1 to induce microtrauma induced fibrosis. Group 1 (NN) received no MOD. Group 2 (EE) received the MOD through Phases 1, 2. Group 3 (EN) received the MOD in Phase 1 only. Lastly group 4 (NE) received the MOD in Phase 2 only. Biopsies from each group, with their respective adjacent unwounded skin (UW), were acquired at the 16-week timepoint for both histology and transcriptional analysis using single-cell-RNA sequencing.

Results: Skin histology by H&E and Masson trichome demonstrated that EE-treated skin significantly reduced dermal thickness and restored hair follicle formation (*p<0.05) (Fig.1A-B). Picrosirius red staining confirmed that EE-treatment resembled the architecture of unwounded skin (*p<0.05) (Fig.1C). Mechanical testing of EE, EN, and NE treated skin exhibited significantly decreased stiffness compared to NN skin (*p<0.05) (Fig.1D). Finally, skin deformation, was significantly greater for EE, EN, and NE treated skin (*p<0.05) (Fig.1E). scRNA-seq analysis identified specific profibrotic notch pathways responsible for fibrosis in NN treated skin, which were downregulated following MOD application.

Conclusion: To date there is no effective treatment to prevent injection induced fibrosis, which is a huge clinical problem in diseases such as diabetes. This pig study demonstrates for the first time that mechanical offloading may prevent and microtrauma induced fibrosis.



A. Table showing the outline of experiment. **B.** H&E, Masson Trichome and **C.** picrosirius red staining of different groups. **D.** Mechanical testing by Youngs modulus of the different groups at 16 weeks. **E.** Cutometry analysis of the different groups over the 16 week period.

Multi-Omic Spatial Analysis Reveals Fibroblast Heterogeneity in the Progression and Repair of Fibrotic Lung Architecture

Jason L. Guo, Ph.D.[1], Michelle Griffin, M.D., Ph.D.[1], Jennifer Parker, B.S.[1], Nicholas J. Guardino, B.S.[1], Darren B. Abbas, M.D.[1], John M. Lu, B.S.[1], Asha C. Cotterell, B.S.[1], Derrick C. Wan, M.D., F.A.C.S.[1], Michael T. Longaker, M.D., M.B.A., F.A.C.S.[1]

[1]Hagey Laboratory for Pediatric Regenerative Medicine, Division of Plastic and Reconstructive Surgery, Department of Surgery, Stanford University School of Medicine, Stanford, CA

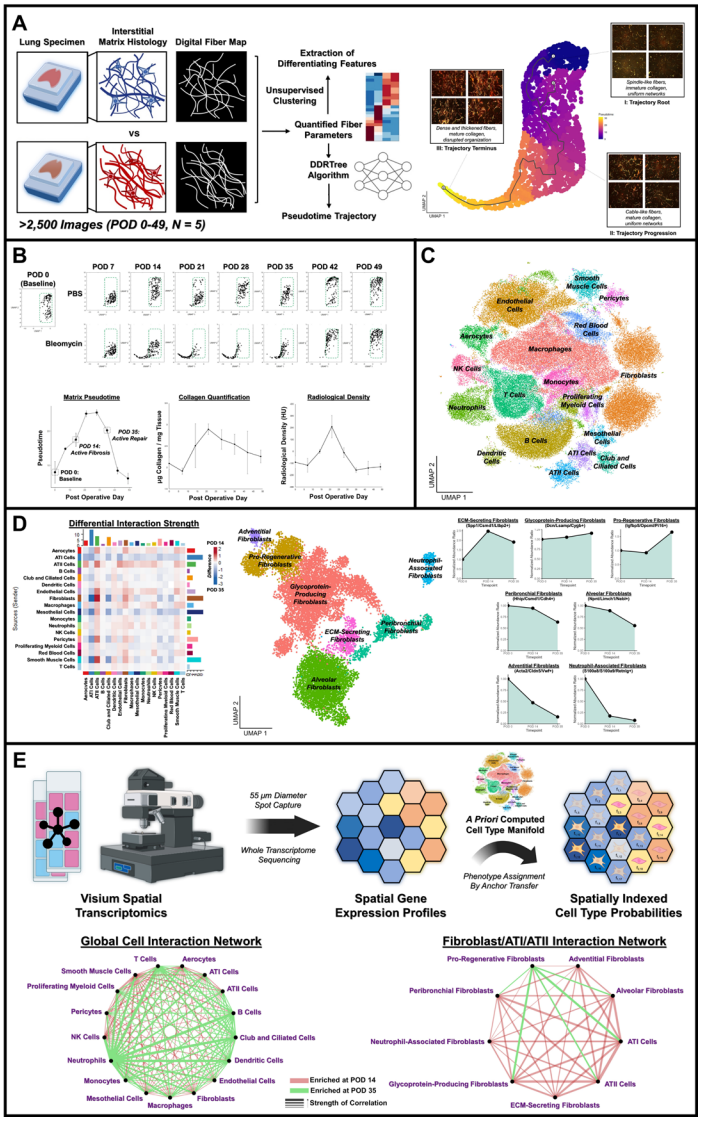
Introduction: Pulmonary fibrosis (PF) represents a pathological outcome of numerous lung-associated diseases, producing a global clinical burden for >5,000,000 patients. PF generates a spatially heterogeneous mixture of pro-fibrotic and pro-reparative foci within the lungs, and the cell populations that drive these concurrent but opposing processes are not well-understood. To elucidate the spatiotemporally-defined drivers of PF matrix aberration and repair, we performed a multi-omic spatial analysis of fibrotic progression and resolution in a mechanistic mouse model.

Methods: C57BL/6 mice were intranasally administered 1.25mg bleomycin/g weight, then imaged with Picrosirius Red from postoperative day (POD) 0-49. Matrix ultrastructure was quantified using an automated pipeline of 147 fiber-features, which capture architectural variation on local (fiber length, width, etc.) and global scales (alignment, porosity, etc.). This feature matrix was reduced by UMAP to quantify differences in overall matrix architecture. Single-cell RNA sequencing (scRNA-seq) was utilized to identify cell subpopulations at baseline, fibrotic, and reparative timepoints, and Visium spatial transcriptomics was used to generate paired spatial profiles of cell phenotypic probability. Cell-cell interactions were calculated using a custom algorithm based on spatial co-localization of cell phenotypes at k=6 nearest neighbors.

Results: Ultrastructural analysis revealed progressive aberration of matrix architecture from POD 0-28, followed by post-fibrotic resolution to POD 49, with kinetics supported by radiological and collagen-based quantification (Fig. 1A-B). ScRNA-seq demonstrated that fibroblasts drove differential cell-cell signaling with alveolar epithelial cells, with subtypes of ECM-secreting (Spp1/Csmd1/Ltbp2+) and pro-regenerative (Igfbp5/Opcml/Pi16+) fibroblasts distinctly enriched during fibrosis and repair, respectively (Fig. 1C-D). Visium spatial analysis also identified pro-regenerative fibroblasts as a reparative cell-cell interaction node (Fig. 1E).

Conclusions: Fibroblast heterogeneity drives the spatiotemporally-defined progression of fibrotic lung architecture, and a pro-regenerative fibroblast subtype is associated with reparative lung matrix and cell spatial interactions.

Figure 1: Multi-omic spatial analysis of pulmonary fibrosis (PF) in a mechanistic mouse model. (A) Matrix ultrastructural analysis of PF reveals one-dimensional pseudotime trajectory from baseline architecture to progressively aberrant lung matrix. (B) Kinetics of PF progression and resolution, as supported by ultrastructural analysis, collagen quantification, and radiological density. POD 14 and 35 were identified as actively fibrotic and actively reparative timepoints, respectively. (C) Unified manifold of scRNA-seq cell phenotypes in baseline, fibrotic, and reparative lungs. (D) CellChat analysis demonstrates that fibroblasts predominantly drive differential cell-cell signaling with alveolar epithelial cells (left), with transcriptionally defined subtypes (middle) distinctly enriched during active fibrosis and repair (right). (E) Visium spatial transcriptomics was paired with the scRNA-seq reference to quantify spatially indexed cell type probabilities (top), which further identified pro-regenerative fibroblasts as a reparative cell-cell interaction node (bottom).



Mechanosensitive Adaption and Regeneration of The Intestinal Muscle Layers in a Partial Obstruction Murine Model

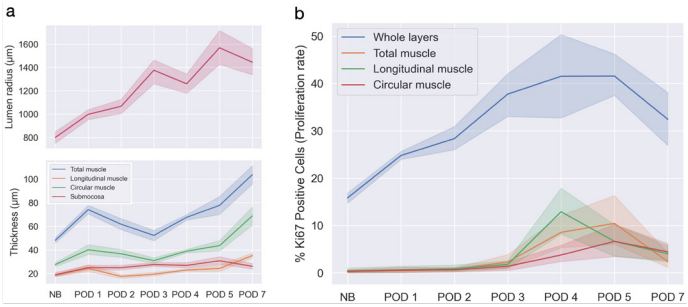
Siavash Shariatzadeh, MD, MPH, Anne-Laure Thomas, MS, Nolan Lopez, Martin Martin, MD, James Dunn, MD, PhD

Introduction: Intestinal wall is a layered viscoelastic tissue with layer-specific mechanoreceptors to sense mechanical forces. Herein, we aim to characterize the adaptation of intestinal layers in response to radial force utilizing a partial obstruction mouse model that provides non-dissipative force over time.

Methods: 5-mm tubes were placed around the terminal ileum of C57BL/6 mice that were euthanized at post-operation days 1-7. Dilated ileum proximal to the tube was harvested and compared with the normal bowel of untreated mice. The thickness of submucosa, circular, and longitudinal muscularis layers was measured. The proliferation of each layer was analyzed by ImageJ using Ki67 immunofluorescence.

Results: The lumen of the ileum dilated over time, and the muscularis thickness gradually increased after an initial decrease. The number and size of cells in the muscularis layers increased over time, indicating hyperplastic and hypertrophic adaptation. The maximal decrease in thickness was observed in the longitudinal muscle layer on POD 2 (Figure a). A significant increase in proliferation was observed on POD 4, with a larger increase in the longitudinal layer compared to the circular layer (Figure b).

Conclusion: These findings suggest that muscularis may sense and adapt to radial force, with the longitudinal layer being particularly well-suited for mechanosensation. This study provides new insights into the underlying mechanosensitivity of the intestinal wall, which could have implications for understanding and treating intestinal disorders.



(a) The increase in lumen radius represented intestinal dilation over time. The decrease in the thickness of muscularis layers on POD 2 and 3 demonstrated the strain in these layers due to dilation. A 25% decrease in the longitudinal muscle thickness was observed on POD 2 compared to the control group. Muscle thickening was observed after 7 days.

(b) An increase in the proliferation of epithelial and muscularis layers was observed. A significantly larger increase (3 times) in the proliferation rate of the longitudinal muscularis layer compared to the circular layer was observed on POD 4.

Tumor-Associated Macrophage Subpopulation in Intrahepatic Cholangiocarcinoma (ICC) as Prognostic and Therapeutic Target

J.S. Badshah, A. Aliwaisi, S. Subramanian, S. Hong , W. Teavir , K. Sasaki , M.L. Melcher , C.A. Bonham , T. Pham , A.E. Gallo , C.O. Esquivel, A. Reitsma, F. Nosrati, T.L. Pruett, S.M. Krams, O.M. Martinez, D.J. Delitto, V.A. Kirchner

Introduction: Tumor-associated macrophages (TAM) promote tumorigenesis in ICC microenvironment. We studied macrophage subpopulations (MS) in ICC to investigate novel TAM targets for prognosis and immunotherapy.

Method: Single-cell RNA-sequencing (scRNA-seq) characterized MS in ICC (n=4) and healthy liver tissue (HLT) from healthy donors) (n=4) (GSE136103, GSE138709). Top 30 differentially expressed genes (DEGs) in MS were validated by Bulk-RNA-seq in ICC and adjacent normal tissue (ANT) (n=27)(GSE107943). DEGs were statistically significant if p-value (< 0.05) with log2fold change (>2, <-2).

Results: ScRNAseq identified three MS based on DEGs: $M^{CD68+, LYZ+, CD163-, FCN1-, CSTA-, APOE+}$(TAM) in ICC; $M^{CD68+, S100A9+, LYZ+, FCN1+, CSTA+}$ (MS1) and $M^{CD68+, MARCO+, CD163+, VSIG4+, VCAM1+, APOE+}$(MS2) in both HLT (Fig 1). HLT expressed inflammatory (MS1) and tolerogenic (MS2) phenotypes whereas TAM had predominantly one distinct population with tolerogenic and inflammatory features. Bulk-RNA-seq of ICC validation cohort confirmed partial loss of MS1 (2 of 30 top DEGs) and MS2 (12 of 30 top DEGs) phenotype in ICC compared to ANT. Based on scRNAseq, TAM exhibited modulation of tolerogenic phenotype by downregulating CD5L, VCAM1, SLC40A1 and upregulating APOE and C1QC. TAM exhibited upregulation of genes associated with inflammatory profile but distinct from inflammatory MS1(Fig 2).

Conclusion: TAM in ICC exhibit both tolerogenic (APOE, C1QC) and inflammatory (S100A6) phenotype that is distinct from MS in HLT. Upregulation of APOE and C1QC in TAM have been linked to tumorigenesis and may represent novel prognostic and therapeutic targets in ICC. Further, phenotype of tolerogenic MS2 is diminished in ICC and could serve as a diagnostic tool.

Figure 1

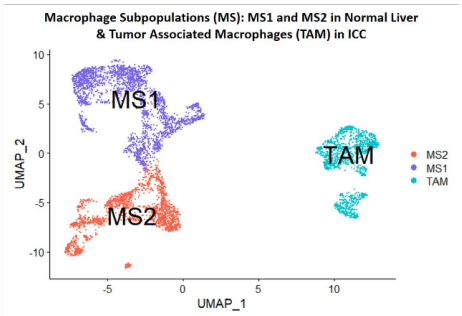
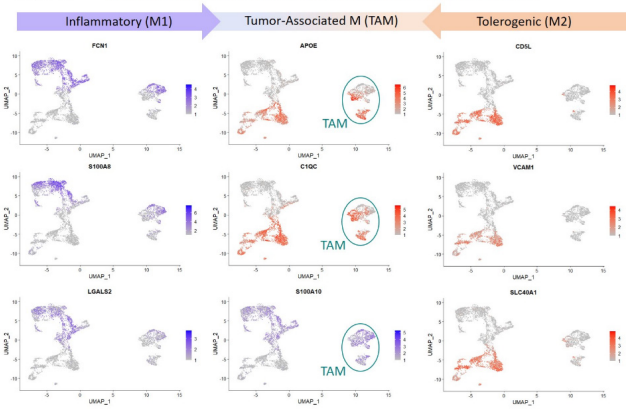


Figure 2 TAM in ICC Exhibit Tolerogenic and Inflammatory-Associated Gene Markers



A Novel Mouse Model to Study Tibial Distraction Osteogenesis

Sarah E. Dilorio, Ruth Tevlin, Harsh N. Shah, Ankit Salhotra, Michelle Griffin, Michael Januszyk, Derrick C. Wan, Michael T. Longaker

Introduction: Distraction osteogenesis (DO) is used to address skeletal defects, however complications such as malunion, delayed union, and failure occur. Previous mouse models of long bone DO have been hampered by post-operative complications, expense, and availability. The focus of this study was to develop a reproducible mouse model of long bone (tibial) DO with consistent bone regeneration. The DO model was tested by comparing it to mice undergoing sham and acute lengthening.

Methods: A light-weight distractor, developed using computer-aided design (CAD) and three-dimensional (3D) printing, was fixed to the tibia of C57Bl/6J mice prior to osteotomy using commercially available screws. DO protocol consisted of 5 days of latency, 10 days of distraction at a rate of 0.15mm every 12 hours, and 14 days of consolidation. Bone regeneration was examined and compared using histology and micro-CT (µCT) in mice cohorts undergoing sham surgery and acute lengthening.

Results: DO demonstrated superior osteogenesis on histology and µCT in comparison to sham or acute lengthening cohorts. The mineralized volume fraction (bone volume/total tissue volume) of the bone regenerate was significantly increased in DO (0.93 +/- 0.02) compared to sham (0.84 +/- 0.05) (P < 0.001). The callus mineralized volume fraction was significantly decreased in acute lengthening (0.7 +/- 0.04) (P < 0.0001) compared to the sham group (0.84 +/- 0.05).

Conclusion: Our novel model of tibial DO is well tolerated by mice and employs CAD, 3D-printing, and commercially available screws. This model results in effective, reproducible osteogenesis, which enables its implementation in genetically-dissectible transgenic mice.

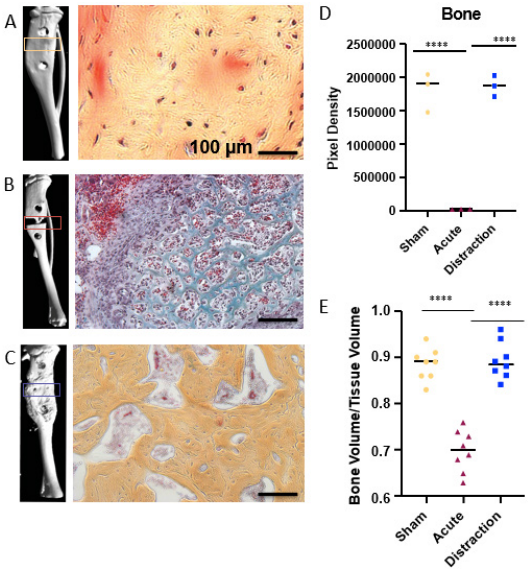


Figure 1. Representative microCT (left) and pentachrome stained section (right) of the (A) sham, (B) acute lengthened, and (C) gradually distracted (DO) tibia at POD 43. On pentachrome staining, bone appears yellow, cartilage appears blue-green, muscles appear bright red, and stroma appears brown. D. Graph demonstrating the pixel density of bone following histomorphometric analysis of micrographs stained using Movat's Pentachrome. E. Graph demonstrating the % bone volume / tissue volume, which was analyzed using µCT.

Identifying novel drug candidates to improve efferocytosis in atherosclerosis

Lingfeng Luo, Yoko Kojima*, Zhongde Ye, Nicholas Leeper. (*co-first authors)*

Introduction: Foam cells undergoing apoptotic cell death contribute to necrotic core formation and plaque instability during atherosclerosis. Efferocytosis, the phagocytic cleanup of apoptotic cells by macrophages plays a pivotal role in plaque stability. We aim to screen drugs that can boost efferocytosis against apoptotic foam cells.

Methods: First, we used a high-throughput phagocytosis assay based on flow cytometry. We treated macrophages with 2966 compounds from MCE FDA Approved & Pharmacopeial Drug Library. These macrophages were labeled with a fluorescent cell tracker before incubating with target (foamy/apoptotic) cells that were labeled with a different cell tracker. The phagocytic ratio was analyzed via a flow cytometer. The results were validated on human peripheral blood mononuclear cells-derived macrophages, mouse bone marrow-derived macrophages, and the RAW 264.7 cell line. After identifying the top drug candidates, we validated the results through an IncuCyte live-cell phagocytosis assay. In this assay, target cells were labeled with pHrodo, the fluorescent signal of which increased dramatically during phagocytosis. After narrowing down the drug list, we performed bulk RNA sequencing to examine the gene expression changes induced by these drugs to select the most promising drug for future validation in vivo.

Results: 8 drug candidates passed the initial screening and validation. Among them, 2 greatly changed the gene expression pattern of macrophages. The gene ontology analysis revealed Drug 1 was associated with genes involved in the immune and inflammatory response.

Conclusion: Through this drug screening, we identified a novel drug candidate that stimulates efferocytosis to clear apoptotic foam cells.

Meta-analysis of scRNA-seq data of cardiac fibroblasts reveals temporal dynamics of cardiac fibroblast activation after myocardial infarction

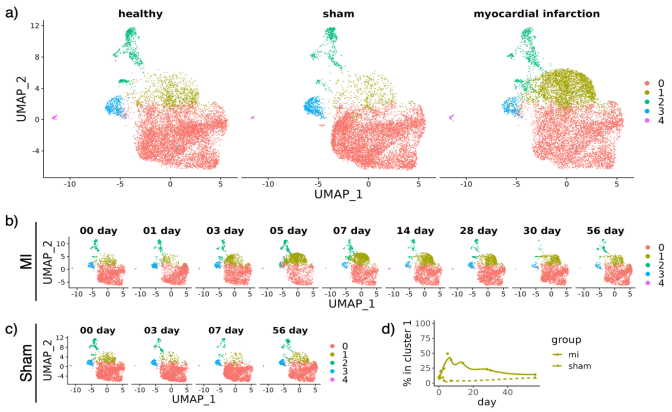
John Lu MS, Michael Januszyk MD PhD, Michelle Griffin MD PhD, Jason Guo PhD, Derrick Wan MD, Michael Longaker MD MBA

Introduction: After acute myocardial infarction (MI), cardiac fibroblasts create a dense collagen scar that replaces the necrosed cardiac muscle to prevent acute cardiac rupture. Over time, however, the fibrotic scar triggers hypertrophy and fibrosis in the remote myocardium, leading to ischemic cardiomyopathy. Despite the central role of the MI collagen scar in the pathogenesis of ischemic cardiomyopathy, the formation and remodeling of the MI scar are poorly understood. To study MI scar formation, we sought to characterize the universal molecular drivers of cardiac fibroblast activation by performing a meta-analysis of published single-cell transcriptomics data at days 1, 3, 5, 7, 14, 28, 30, and 56 after myocardial infarction.

Methods: We constructed a comprehensive atlas of mouse cardiac fibroblasts after MI by integrating 9 previously published single-cell transcriptomic datasets. Datasets were identified by searching the ArrayExpress and GEO databases. To integrate and analyze these datasets, we used Seurat, Cytotrace, and scVelo.

Results: Using our cardiac fibroblast atlas, we uncover significant temporal heterogeneity of cardiac fibroblast response after MI. We identify certain cardiac fibroblast subpopulations that emerge starting 3 days after MI that express canonical myofibroblast markers including Col1a1 and Postn. RNA velocity analysis using scVelo reveal the origin and key molecular drivers of this post-MI myofibroblast subpopulation.

Conclusion: Our comprehensive atlas of cardiac fibroblasts after myocardial infarction uncovers significant temporal heterogeneity of cardiac fibroblast response after myocardial infarction. Further work will reveal the signaling pathways responsible for cardiac fibroblast activation and provide insight into therapeutic targets.



Advanced quantification and acquisition of surgical skills using Wearable Technology

Brett Wise, BS[1], Sindhushree Hosakote, MS[1], Su Yang, BS[1], Audrey Bowler, AA[1], Calvin Perumalla, PhD[1], Carla Pugh, MD, PhD[1]
Department of Surgery, Stanford University, Stanford, CA

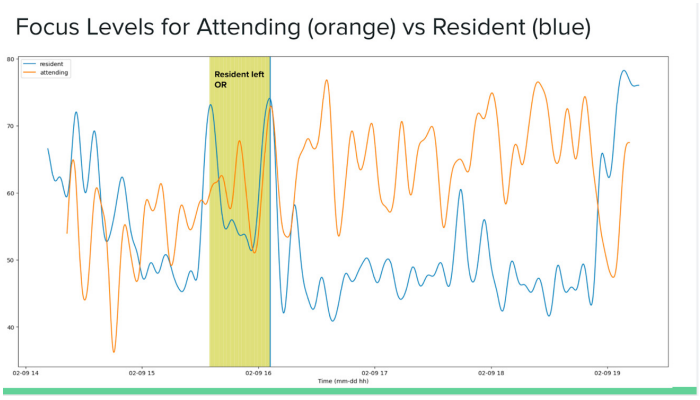
Introduction: In order to capture baseline and annual laparoscopic skills performance data from MDs and residents, a previously validated, wearable sensor system was deployed. One component of the system includes an EEG sensor which has been shown to correlate with cognitive load. When synchronized with operative video, EEG data can indicate key decision-making points within a surgical procedure. Our goal is to implement and assess data from wearable technologies (EEG) that may be successful at predicting surgical skills in order to shorten the learning curve to competency.

Methods: In a pilot implementation, an attending surgeon and resident wore the EEG sensor during an Exploratory Laparoscopy and adhesiolysis in the operating room. The sensor captured focus, emotion, head movement, and heart rate data. Additionally, a baseline calibration was performed prior to the operation. Video data was recorded and synchronized.

Results: Real-time changes in focus levels of an attending vs resident in the operating room were successfully captured and correlated to events during the operation. One event that was captured was when the resident left the operation for a clinical emergency. During this time, we note that the resident's focus decreased as the attending's focus increased, Figure 1.

Conclusion: EEG data has valuable insight on cognition and critical decision-making during surgery. More work is necessary to fully categorize this data for surgical skills assessment and feedback. Moreover, there is a clear path to translate these findings into streamlined video review for resident education and to enable data driven coaching with objective, sensor-based metrics.

Figure 1. Five hours of EEG data showing attending and resident focus levels throughout an Exploratory Laparoscopy. Yellow highlighted area is when the Resident left the OR for a clinical emergency.



Effect of intestinal epithelial piezo1 gene deletion on murine distraction enterogenesis

Akanksha Sabapaty, Chih-Hsin Chen, James C.Y. Dunn

Introduction: Mechanical activities predominate most of the functions of the intestine. The mechanosensors convert force into electrochemical signals. Piezo1 is one such mechanosensitive ion channel that plays a critical role in the gut. Since distraction enterogenesis has been well-established to lengthen segments of the intestine, we hypothesized that the lack of the piezo1 gene in the epithelium of the intestine of the transgenic mice would result in increased lengthening of the cecum using intraluminal spring technology.

Methods: Piezo1 knockout transgenic mice underwent surgical insertion of gelatin-encapsulated compressed and uncompressed nitinol springs into the cecum. The spring segment lengths were measured at the initial spring placement and on postoperative day 7 after euthanasia. The differences in spring segment lengths were evaluated at sacrifice. T-tests were used to compare the groups.

Results: We found that there was significant lengthening of the cecum in the mice treated with the compressed spring observed on postoperative day 7 by an average of 120%. However, there was no significant difference in the lengthening observed between piezo knockout transgenic mice and the control mice($p=0.46$). No change in length was observed in animals treated with the uncompressed springs.

Conclusion: Even though piezo1 was deleted from the epithelium of the transgenic mice, there was no difference in the lengthening between the 2 groups treated with the compressed spring. This suggests that there might be other factors that are responsible for sensing mechanical force in the intestine across the layers.

Impact of adapting a surgical safety checklist training to a virtual platform in Ethiopia

Maia R. Nofal, MD MPH[1,2,3,4], Tihitena Negussie Mammo[2,5], MD, Amber Trickey, PhD[3], Sara Taye Haile, MPH[2], Nichole Starr, MD MPH[2,4,6], Matiyas Asrat, MD[2,7], Natnael Gebeyehu, MD[2,5], Habtamu Woldeamanuel, MS[2], Thomas G Weiser, MD MPH[2,3]

[1.] Boston Medical Center, Department of Surgery, Boston, Massachusetts, USA
[2.] Lifebox Foundation, Addis Ababa, Ethiopia
[3.] Stanford University, Department of Surgery, Palo Alto, California, USA
[4.] Fogarty International Center, Global Health Equity Scholars Program (D43TW010540), Washington DC, USA
[5.] Addis Ababa University, Department of Surgery, Addis Ababa Ethiopia
[6.] University of California San Francisco, Department of Surgery, San Francisco, California, USA
[7.] Saint Paul's Hospital Millennium Medical College, Department of Obstetrics and Gynecology, Addis Ababa, Ethiopia

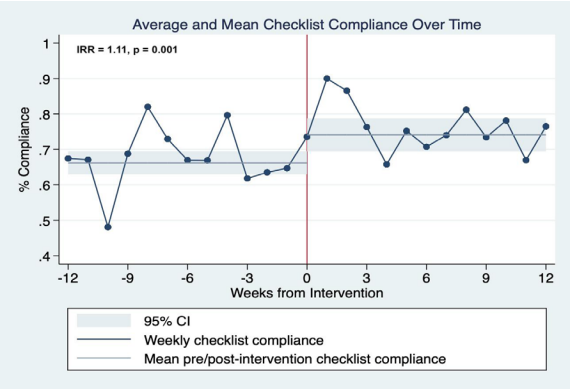
Introduction: Using the WHO Surgical Safety Checklist (SSC) reduces morbidity and mortality from surgery, though uptake in low-income countries is challenging. The SSC has been successfully implemented through in-person trainings as part of a quality improvement program in Ethiopia with a 50% increase in correct checklist use. During the coronavirus pandemic, SSC workshops were adapted to a virtual platform. We aimed to evaluate the impact of these virtual SSC workshops.

Methods: From January-September 2022, nine Ethiopian hospitals participating in a quality improvement program received virtual SSC training. Checklist utilization before and after was measured through direct observation of behaviors in the operating room. Using statistical process control methodology, we performed a time series analysis using population-averaged generalized estimating equations Poisson regression. We calculated incidence rate ratios (IRR) of correct checklist use pre- and post-intervention and predicted the change in average monthly compliance before and after the training.

Results: We observed and captured checklist compliance from 9,408 operations, 5,700 (60.6%) pre-intervention and 3,708 (39.4%) post-intervention. Average monthly checklist compliance improved from 66.2% to 74.1% (Figure 1), an 11.9% improvement over baseline (IRR=1.11, p=0.001). Statistically significant improvements were noted in all nine hospitals.

Conclusion: Virtual SSC workshops improved checklist use and compliance but to a lesser degree than prior in-person iterations. Virtual training can improve access to LMIC clinicians that are often far from educational hubs and allow training programs to scale where travel is expensive or inefficient. A better understanding of how to best adapt training to virtual platforms is needed.

Figure 1. Average and mean checklist compliance over time



Small Victories: Microlearning through Animation is an Effective Tool in Surgical Education

Cintia Kimura MD PhD, Caitlin Bungo BS, Tiffany Yue MD(c), David Hindin MD, Jonathan DeLong MD, Brooke Gurland MD

Introduction: Microlearning is an approach in which content is delivered in small self-contained learning units. This study aimed to evaluate whether a 2-minute animation could facilitate knowledge retention about a surgical pathology

Methods: A short animation (100 seconds) about rectal prolapse and rectocele was developed based on principles of microlearning. The video was posted on YouTube and distributed to health professions students along with an anonymous survey. Kirkpatrick's evaluation framework was used to assess pedagogical outcomes on the first two levels (reaction and learning). To assess short term knowledge retention (learning), the survey contained a pre- and post-video quiz about rectal prolapse and rectocele.

Results: A total of 115 students answered the entire survey. Most of them (82%) were MD or DO students, were in their second or third year (76%), and between 22 and 25 years old (57%). Video was a major source of surgical education for 70% of respondents. Regarding reaction, the median time spent on the video was 40.5 seconds (IQR 74.5), and 81% agreed or strongly agreed that the video explained the concepts clearly. Among students who spent 40 seconds or more on the video, 76% (44/58) went from extremely or somewhat uncomfortable to either somewhat or extremely comfortable in explaining the concept of rectal prolapse. Regarding learning, 74% (43/58) increased their score or remained at the maximum score in the post-video quiz.

Conclusions: Microlearning through animation was well accepted among students and contributed to short-term knowledge retention.

Looking Beyond the Numbers: A Comparison of Operative Self-Efficacy, Supervision, and Case Volume

Rachel Jensen MD, Ananya Anand MD, LaDonna Kearse MD, James R. Korndorffer Jr. MD MHPE

Introduction: A survey of general surgery residents linked to the 2020 ABSITE revealed significant deficits in preparation for independent practice, with only 7.7% of graduating PGY5 residents reporting self-efficacy (SE) for all 10 commonly performed operations surveyed. These findings have not yet been compared to case-specific data. We hypothesized that SE would be positively correlated with operative independence and case volume.

Methods: Case information for the same 10 previously surveyed operations was analyzed for residents graduating in 2020. Operative independence data was obtained through an operative assessment tool (SIMPL OR). Case volume data was obtained through the ACGME National Data Report. Cases were categorized into high, middle (mid), and low SE tiers.

Results: There were significant differences in SE between high (87.7%) v mid (68.2%) v low (25.4%) tiers. There were also significant differences in operative independence by tier: high (32.6%) v mid (13.8%) v low (4.9%). While total case volume decreased from high (91.8) to mid (20.8) to low (11.1), this did not reach statistical significance on post-hoc analysis (Table 1). SE and operative independence were strongly correlated (r=0.85, p=0.002). SE and case volume showed no significant correlation (r=0.61, p=0.14).

Conclusion: The strong correlation between SE and supervision suggests that operative independence, indicative of the quality of the case experience, contributes to perceptions of SE. Additionally, the lack of a significant correlation between SE and case volume, suggests that in the era of competency based medical education, it is essential to look beyond case numbers to train self-efficacious graduates.

Table 1: Self-Efficacy, Supervision, and Case Volume by Tier

Self-Efficacy Tier	Operation	% Self-Efficacy (PGY5s on post-ABSITE 2020 survey)	% of cases trainees report as completing with operative independence	Number of cases per ACGME National Data Report
High Self-Efficacy	Laparoscopic cholecystectomy	84.1% (1001/1190)	32.9% (568/1725)	118.6
	Laparoscopic appendectomy	89.8% (1068/1189)	40.8% (283/693)	64.9
	Diagnostic laparoscopy	86.8% (1030/1187)	27.0% (30/111)	Not available
	Wide local excision	90.2% (1072/1188)	30.0% (39/130)	Not available
	Mean	**87.7%**	**32.6%**	**91.8**
Mid Self-Efficacy	Breast biopsy	77.0% (913/1186)	8.3% (5/60)	11.9
	Inguinal hernia	67.1% (799/1190)	17.4% (72/420)	42.8
	Trauma exploratory laparotomy	60.7% (722/1190)	15.6% (7/45)	7.8
	Mean	**68.2%**	**13.8%**	**20.8**
Low Self-Efficacy	Thyroidectomy	19.6% (233/1190)	2.7% (3/113)	19.3
	Laparoscopic right hemicolectomy	26.5% (315/1187)	1.9% (2/105)	Not available
	Trauma thoracotomy	30.0% (357/1190)	10.0% (1/10)	2.8
	Mean	**25.4%**	**4.9%**	**11.1**

The effects of mesh fixation techniques on surgical outcomes during simulated Laparoscopic Ventral Hernia (LVH) repair.

Sindhushree Hosakote, MS, Su Yang, BS, Brett Wise, BS, Calvin Perumalla, MS PhD Audrey Bowler AA, Carla Pugh, MD, PhD

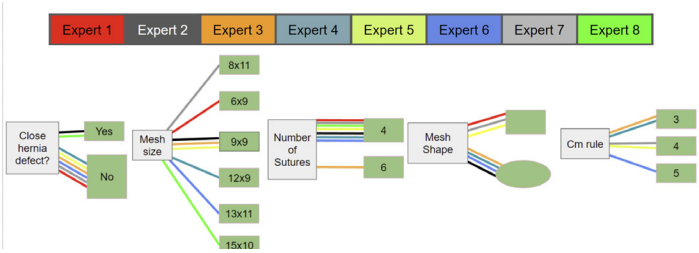
Introduction: Mesh fixation in LVH repair involves several technical decisions and is heavily influenced by individual surgeon preferences. Management of transfacial anchoring sutures is one example of the many decisions required during LVH repair. We hypothesized that technical decisions have measurable effects on procedural outcomes.

Methods: Surgeons (N=111) were invited to perform a simulated LVH repair at the American College of Surgeons Clinical Congress 2022. We examined mesh fixation videos of all participants and developed a total mesh grading scale from 0 to 5. This score is a sum of three grading criteria: mesh flatness (0 to 2), mesh centering (0 to 2), and mesh stability (0 or 1).

Results: The mean age of participants was 45.3 years. Of the 111 participants, the majority identified as male (N=76) and specialized in general surgery (N=60). 62% currently perform LVH repair (N=69), 55.8% last performed the procedure < 1 year ago (N=62). For participants with stable mesh placements (N=80), average procedure duration was 27.33 minutes and average mesh grade was 4.02. A wide variety of intraoperative decisions were observed on video review including mesh placement, size, shape, and number and length of anchoring sutures (Figure 1). Early results show a correlation between length of anchoring suture and operative time.

Conclusion: This study represents the first step in understanding the variety of technical decisions made by experienced surgeons. Further analysis is needed to understand what role these factors play in procedural outcomes.

Figure 1: Decision tree from 8 expert surgeons



Using Animation to Enhance Patient Understanding of Prolapse

Hassina Adel, BS, Caitlin Bungo, BS, Cintia Kimura, MD, PhD, Brooke Gurland, MD,

Introduction: Patient facing resources for pelvic floor disorders (PFD) are scarce. This study aims to identify patient preferences for learning about PFD and to obtain feedback on a rectal prolapse animation developed to aid patient education.

Methods: Patients in the IRB-approved Rectal Prolapse Registry received a survey that included 20 questions about educational preferences and a 100-second video animation on rectal prolapse. They were also invited to participate in a structured interview for a deeper understanding of their thoughts and preferences regarding health education.

Results: Of 146 female registry participants (mean age 65.7) who received the survey, 46 (31.5%) completed it and 10 volunteered to interview. Most patients (63%) reported that they searched online about PFD. Common challenges were difficulty finding content they were looking for (41.5%), complex language (18.8%) and unable to find a reliable source (16.9%). After watching the animation, 97% agreed that it explained the condition clearly, and 66% would be comfortable explaining the condition to someone else. During the interviews, those challenges were highlighted and explored. Other emergent themes were that patients had a mostly positive feeling after watching the animation, would like it to be shown during the first appointment, and would like to see similar content when preparing for surgery.

Conclusion: The information patients seek about PFD is not always available online. This study demonstrated the ability of a short video animation to enhance patients' understanding of rectal prolapse and rectocele. Additional videos will help to enhance their understanding of surgery for those conditions.

Table 1. Respondent Education Level and Diagnosis

Education Level	Total Number of Question Respondents N = 35 (%)
Some High School, No Diploma	1 (2.86%)
High School Graduate	1 (2.86%)
Some College Credit, No Degree	2 (5.71%)
College Graduate	17 (48.6%)
Professional Degree	14 (40%)
Diagnosis	Total Number of Question Respondents N = 44 (%)
Rectal Prolapse	40 (90%)
Rectocele	12 (27%)
Constipation	24 (55%)
Fecal Incontinence	30 (68%)

Association of baseline chronic kidney disease stage with outcomes after FEVAR

Shernaz S. Dossabhoy, MD, MBA, Sabina M. Sorondo, MD, Andrea T. Fisher, MD, Vy T. Ho, MD, Jordan R. Stern, MD, Jason T. Lee, MD

Introduction: Short and long-term outcomes for none-to-mild versus moderate-to-severe chronic kidney disease (CKD) patients undergoing fenestrated endovascular aneurysm repair (FEVAR) are unknown.

Methods: We retrospectively reviewed patients undergoing standard FEVAR, stratified by preoperative CKD stage (CKD1-2 and CKD3-5), and compared outcomes.

Results: From 2012-2022, 184 patients (82% male) underwent FEVAR (mean follow-up 34.3months). Group CKD3-5 comprised 77 patients (42%), was older (75.2 vs 73.0y, P=.04), and had increased preoperative creatinine (1.6 vs 0.9mg/dL, P<.0001) and renal artery ostial calcification (37.7% vs 21.5%, P=.02) compared with Group CKD1-2. Operatively, CKD3-5 sustained higher EBL (342 vs 228ml, P=.01) and longer operative times (186 vs 162min, P=.04) and longer length of stay (3 vs 2days, P<.0001). Kaplan-Meier 1- and 5-year survival estimates were lower for CKD3-5 (82.3% vs 95.1%, P=.005 and 55.4% vs 70.8%, P=.021, FIGURE). Fewer CKD3-5 patients remained free from dialysis at 1 year (94.4% vs 100%, P=.015) and 5 years (84.7% vs 100%, P=.004). No differences in post-operative AKI (CKD1-2 6.5% vs CKD3-5 14.3%, P=.13) or long-term renal patency, reintervention, endoleak, sac regression, or surveillance CT scans were observed. CKD stage progressed in 47 patients (31%) at latest follow-up but did not differ between groups (P=.17). On Cox PH modeling, age (HR 1.05, 95%CI 1.01-1.09, P=.02) and CKD4-5 (HR 6.39, 95%CI 2.26-18.05, P=.0005) were independent risk factors for mortality (TABLE).

Conclusion: Worsening baseline CKD stage was associated with lower 1- and 5-year survival and freedom-from dialysis but did not appear to negatively impact durability or long-term technical outcomes after FEVAR.

Figure. Freedom from all-cause mortality after FEVAR stratified by none-to-mild CKD (stage 1-2) vs moderate-to-severe CKD (stage 3-5) at (A) 1 year and (B) 5 years.

A. **B.**

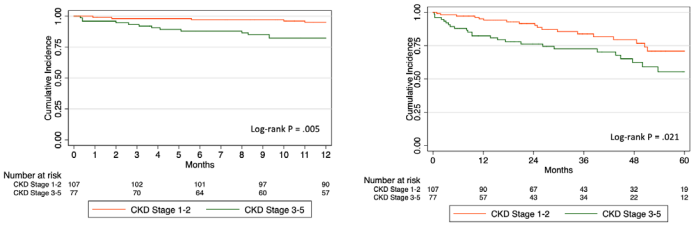


Table. Multivariable Cox proportional hazards model to determine independent risk factors for all-cause mortality at latest follow up following FEVAR.

Variable	Hazard Ratio	95% CI	P value
Age, per year	1.05	1.01-1.09	.02
CKD stage 3	1.46	0.79-2.68	.23
CKD stage 4-5	6.39	2.26-18.05	.0005

Having other comorbidities do not affect the pain symptoms and recurrence rate in patients with pilonidal disease

Akanksha Sabapaty MBBS, Claire Abrajano, Razie Yousefi PhD, Fereshteh Salimi-Jazi MD, Deanna Garza, Kyla Santos Dalusag, Thomas Hui, MD, Wendy Su, MD, Claudia Mueller, MD, Julie Fuchs, MD, Bill Chiu, MD

Introduction: Comorbidities such as diabetes or inflammatory bowel disease can potentially impact the presentation or outcome of patients with pilonidal disease (PD) due to poor wound healing or increased inflammatory response. We hypothesized that certain co-morbidities could lead to worse pain or higher recurrence rate.

Methods: A retrospective study was performed on all PD patients treated with minimally invasive protocol at our clinic from 2019 to 2022. Patients' demographics, comorbidities, initial and follow-up pain score, duration of pain, and recurrence were recorded. Data were analyzed by multivariate t-test and chi-square test.

Results: Of a total of 207 PD patients (108 male, 99 female), 61 had other comorbidities. Mean age was 18.2±3.7 years. 55% of patients had pain as an initial symptom. Associated comorbidities included mood/psychiatric disorders, asthma/respiratory illness, obesity-related illness, gastrointestinal disorders, diabetes, thyroid disease, cardiac disease, musculoskeletal/connective tissue disorders, immunologic disease, inflammatory bowel disease, chest wall disorders. The recurrence rate of pilonidal disease in our cohort was 7%. The presence of comorbidities did not correlate with PD recurrence (p =0.96). The initial pain score (p=0.57), duration of pain (p=0.63), and the pain score at follow-up (p=0.64) did not correlate with the comorbidities. The comorbidities were not associated with the age of the patient (p=0.19) or gender (p=0.15).

Conclusion: Surprisingly, having other co-morbidities did not affect the pain symptoms or recurrence in PD patients treated with minimally invasive protocol. This encouraging finding supports the continued application of our treatment approach to a wide variety of patients with PD.

Disease Category	Individual Disease
Neurologic Disease	Cerebral palsy, seizure, sensory disintegration disorder, hearing loss, Sydenham chorea, vertigo, overactive bladder, reading disorder, hydrocephalus, myofascial pain syndrome, periventricular leukomalacia, neurofibromatosis, hyperhidrosis
Mood/Psychiatric Disorder	Anxiety, mood disorder, depression, obsessive compulsive disorder, attention-deficit/hyperactivity disorder, autism
Thyroid Disorders	Hypothyroidism, thyroiditis
Asthma and Respiratory Illness	Asthma, sleep apnea
Chest Wall Disorders	Pectus excavatum, pectus carinatum
Cardiac Disease	Congenital tricuspid regurgitation, inferior ST segment depression, coronary artery anomaly, hypertension, atrial septal defect
Inflammatory Bowel Disease	Crohn's disease, ulcerative colitis
Gastrointestinal Disorders	Chronic diarrhoea, gastroesophageal reflux disease, constipation, encopresis, Gilbert's syndrome
Musculoskeletal and Connective Tissue Disorders	Ehlers Danlos Syndrome, congenital foot abnormality, degeneration of lumbar intervertebral disc
Obesity and Related Illness	Obesity, hepatic steatosis
Diabetes	Insulin-dependent diabetes
Immunologic Disease	Autoimmune hepatitis, juvenile idiopathic arthritis, lupus

Co-morbidities	Number of Patients	Percentage
Neurological Disorders	15	25%
Mood and Psychiatric Disorders	19	31%
Thyroid related illness	5	8%
Asthma and Respiratory Illness	18	30%
Chest Wall Disorders	2	3%
Cardiac Disease	5	8%
Inflammatory Bowel Disease	3	5%
Gastrointestinal Disorders	8	13%
Musculoskeletal and Connective Tissue Disease	4	7%
Obesity-Related Illness	9	15%
Diabetes	6	10%
Immunologic Diseases	4	7%

Multidisciplinary Gastrointestinal Healthcare Professional Beliefs, Behaviors, and Practices Around Personal and Patient Nutrition

Carlie Arbaugh, MD; Cintia Kimura, MD PhD; Cindy Kin, MD MS
Stanford Department of Surgery

Introduction: Healthcare professionals' personal beliefs and behaviors influence the way they counsel patients about lifestyle habits. This study sought to explore nutrition-related beliefs, behaviors, and practices among healthcare professionals specializing in gastrointestinal issues (medical, surgical, and oncologic).

Methods: A survey on nutrition beliefs, behaviors, and patient care practices was given to multidisciplinary gastrointestinal healthcare professionals. We then conducted semi-structured interviews until thematic saturation. Interviews were audio-recorded, transcribed verbatim, iteratively coded, and discussed to consensus. We used thematic analysis to explore healthcare professional beliefs and practices.

Results: Healthcare professionals commonly followed vegetarian and Mediterranean diets, and principles of eating fresh whole foods, maximizing home-prepared foods, minimizing processed foods, and "everything in moderation". Of the 26 survey participants, 42% felt very/extremely equipped to answer patients' nutrition questions, and 97% would recommend or prescribe medically-tailored smoothies or soups over nutritional supplements if available (Table 1). Key themes identified from the 15 provider interviews were: challenges around patient nutrition such as diet trends/fads; the belief that nutritional supplements are an imperfect nutrition tool; and a desire to liberalize what patients eat instead of restrict (Table 2).

Conclusion: Healthcare professionals treating patients with gastrointestinal disorders have evidence-based nutrition principles that they make efforts to follow personally despite lacking time. When counseling patients, fad diets and poor appetite are challenges, and their approach is to encourage more liberal food intake rather than restriction. These mixed method data have informed the work of a multidisciplinary task force we created to improve the nutrition experience of patients.

Table 1: Nutrition Survey of Healthcare Professionals

Survey Question	N (%)
Age range	
20-29 years	2 (7.7%)
30-39 years	6 (23.1%)
40-49 years	8 (30.8%)
50-59 years	6 (23.1%)
60-69 years	4 (15.4%)
Self-described gender	
Male	14 (53.9%)
Female	12 (46.2%)
Healthcare specialty	
Surgery	14 (53.9%)
Medical Oncology	6 (23.1%)
Gastroenterology	3 (11.5%)
Dietetics	3 (11.5%)
Diets (if any) followed personally	
Vegetarian	5 (19.2%)
Mediterranean	4 (15.4%)
Plant-based	3 (11.5%)
Pescatarian	3 (11.5%)
Low fat	2 (7.7%)
Intermittent fasting	2 (7.7%)
Low carbohydrate	1 (3.8%)
High protein	1 (3.8%)
Vegan, Gluten free, Dairy free, Ketogenic	0 (0.0%)
Dietary Principles (if any) believed personally	
Eating fresh foods	20 (76.9%)
Maximizing home cooked foods	19 (73.1%)
Avoiding simple carbohydrates	18 (69.2%)
Eating whole foods	16 (61.5%)
"Everything in moderation"	16 (61.5%)
Eating locally produced foods	14 (53.8%)
Minimizing pre-prepared foods	13 (50.0%)
Eating organic foods	12 (46.2%)
Eating probiotic foods	9 (34.6%)
To what extent does patient nutrition impact surgical out-comes	16 (61.5%)
To a great extent	10 (38.5%)
Somewhat	0 (0.0%)
Not at all or very little	
How often you include nutrition counseling in your patient conversations	7 (26.9%)
Always	13 (50.0%)
Often	6 (23.1%)
Sometimes	0 (0.0%)
Never or rarely	
When your counseling (if any) about nutrition occurs	
During clinic visits	22 (84.6%)
While the patient is admitted to the hospital	4 (15.4%)
How equipped you feel to answer patient questions about nutrition	4 (15.4%)
Extremely	7 (26.9%)
Very	10 (38.5%)
Moderately	5 (19.2%)
Slightly	0 (0.0%)
Not at all	
How often you recommend/prescribe nutritional supplements	
Always	2 (7.7%)
Often	8 (30.8%)
Sometimes	11 (42.3%)
Rarely	4 (15.4%)
Never	1 (3.9%)
Willingness to recommend/prescribe smoothies/soups instead of nutritional supplements if available	
Yes, absolutely	23 (88.5%)
Maybe, I would give it a try	2 (7.7%)
No	1 (3.9%)

Table 2: Interviews of Healthcare Professionals: Themes Related to Patient Nutrition Care

Main Themes	Subthemes and Descriptions
Healthcare professional beliefs, experiences & practices regarding patient nutrition	• Patient situation and care setting influence nutrition approach - Competing demands of acute vs. chronic health concerns and prevention vs. treatment • Diet trends/fads add to patient nutrition counseling/care complexity • Nutritional supplements are an imperfect patient nutrition tool • Healthcare professional strategies for counseling/coaching patients • Healthcare professionals want to liberalize and not restrict what patients eat - Especially cancer patients and post op patients (once tolerating a diet) • Patient barriers and facilitators (from the healthcare professional perspective) • Healthcare professional lifestyle beliefs and prescriptions for patients - Includes specific dietary recommendations, physical activity recommendations, fiber, small frequent meals, exercise for cancer patients • Referral practices
Gaps, inconsistencies & barriers in nutrition knowledge & practice	• Systemic issues delay or prevent patient nutrition care - Insurance approval challenges, understaffed, care delays, lack of continuity • Lack of information or misinformation about nutrition complicates patient nutrition care - The study does not exist or the evidence is out there but the healthcare professional is uninformed or misinformed • There is a care team disconnect in terms of approach to patient nutrition care – Post-operative low fiber debate, post-operative diet advancement debate, disagreement about whether patients want more nutrition info and if what they ask for would actually be helpful

Team-Centered Care after Trauma Patient Death: Promoting Healers' Healing by Humanizing Our Roles

Sydni, Au Hoy, sauhoy@stanford.edu
Caitlin, Bungo, cbungo@stanford.edu
Carlie, Arbaugh, carliea@stanford.edu
Amanda, Deutsch, deutscha@stanford.edu
Bonnie, Chow, bechow@stanford.edu
Kristen, Gallegos, kgallegos@stanfordhealthcare.org
Nerissa, Alansalon, NAlansalon@stanfordhealthcare.org
Al'ai, Alvarez, aalvare2@stanford.edu
Brooke, Gurland, bgurland@stanford.edu
Joseph, Forrester, jdf1@stanford.edu

Introduction: Recurrent exposures to adverse events can increase self-isolation and burnout in clinicians. We share our progress with a 3-month pilot wellness intervention for resuscitation care teams managing patients who die from trauma.

Methods: A collaborative group from Stanford's trauma, emergency department (ED), and well-being leadership developed a workflow for connecting with care team members after resuscitation ending in patient death. Using Plan Do Study Act methodology, we personalized an email containing a peer support and mental health resources document, a $15 coffee card encouraging taking a personal moment or debriefing with a colleague, and an invitation to monthly grief counselor-facilitated healing sessions. We also offered a framework for pausing and defusing immediately after a patient's death. Engagement is measured based on email responses and healing session attendance.

Results: At 2 months, we sent 100 emails for seven trauma mortalities. The average event-to-distribution time was 89.1 hours. 17 unsolicited positive email responses and several in-person feedback were received. 15 and 10 individuals attended the two healing sessions. Workflow revisions included condensing the resources document to one page, adding healing session logistics to the email, and reducing event-to-distribution time to a critical impact period of 72 hours or less.

Conclusions: Trauma-associated death is not uncommon yet often occurs without organized support systems for care teams. Streamlining access to institutional resources and creating spaces for facilitated peer-to-peer discussions offer consistent opportunities for healing support. This intervention demonstrates the potential to foster camaraderie and community among healthcare workers caring for trauma patients.

Table 1: Communication Efforts 2 Months Post Pilot Launch

Trauma Patient Death Event	Event to Email (hours)	Number of Care Team Members Emailed	Number of Unsolicited Email Responses from Care Team Members
#1	72	15	3
#2	24	16	1
#3	48	14	2
#4	192	11	8
#5	120	14	5
#6	96	15	4
#7	72	15	3

Total: 7	Average (SD) 89.1 (66.6)	Total: 100	Total: 17

Table 2: Excerpts of Email Responses from Care Team Members

Role	Email Response
RN	"Thank you for this email."
RN	"Thank you for the gift card and for providing support and resources. I appreciate it."
MD	"I received the email, thank you. This is a wonderful and much needed wellness project."
MD	"Thanks so much for sending this. What a great project."
ED Tech	"Good evening I acknowledge this email, thank you so much really made the start of my shift."
SW	"Thank you. I have reviewed the email. Appreciate the acknowledgement and support."
RRT	"Thank you for taking the time to check in with us. I appreciate the supportive culture here at SHC, it's a great place to work."
PharmD	"Thank you so much for the email, kind words, and gift certificate."

We Need to Do Better: A Call for Evidence-Based Wellness Programs in Surgery Residency

Ananya Anand MD, Rachel Jensen MD, James R Korndorffer Jr. MD MHPE

Introduction: Burnout, depression, and fatigue are common among surgical residents. Most published wellness studies in surgery only focus on a cross-sectional view of attitudes and perceptions and questions remain as to the quality and effectiveness of these individual wellness programs in surgical residencies.

Methods: This scoping review addressed: 1) What wellness initiatives are used in surgery residency programs? 2) Which wellness domains do these programs address? and 3) How are program outcomes evaluated? A literature search identified United States-based wellness initiatives for surgery residents. Two authors independently screened all abstracts and full texts. Data extracted included wellness domain(s), outcomes evaluation methods with associated Kirkpatrick level(s) (1-reaction, 2-learning, 3-behavior, 4-results), and Medical Education Research Study Quality Index (MERSQI) scores.

Results: 2237 abstracts were screened with 112 full texts reviewed for eligibility and 51 studies included in final analysis, representing 39 distinct wellness programs. The most common domains of wellness addressed were emotional (19/39, 48.7%), occupational (17/39, 43.6%), and physical (16/39, 41.0%). 8 out of 51 studies (15.7%) did not conduct any program evaluation, 27 (52.9%) evaluated level 1, 30 (58.8%) evaluated level 2, 3 (5.9%) evaluated level 3, and none evaluated level 4 outcomes. The mean MERSQI score was 9.2 (SD 1.8) out of 18.

Conclusion: This review reveals a major gap in evaluation and quality of surgical wellness programs. Rigorous efforts addressing multiple wellness domains and utilizing more robust evaluation methods are required to achieve effective wellness programming.

Table 1: Domains of wellness (as described by Williams-Karnesky et al. 2020) with examples and representation in published wellness interventions in surgical residency

Domains of Wellness	Examples	Number of programs addressing domain (N=39) n (%)
Physical	Access to healthy food, Ergonomics training	19 (48.7%)
Social	Yearly resident retreat, Off-campus group activities for residents and faculty	17 (43.6%)
Emotional	Faculty panels on work-life integration, Stress-reduction workshops	16 (41.0%)
Spiritual	Mindfulness training, Yearly patient memorial or Schwartz Rounds	8 (20.5%)
Occupational	Scheduled mentoring sessions; Leadership training; Residents as Educators training	7 (17.9%)
Financial	Contract negotiation training; Financial management seminars	1 (2.6%)
Intellectual	Knowledge-based educational curriculum (eg, SCORE); Simulation-based laboratories	0 (0.0%)

Current Landscape of Minimally Invasive Pancreatectomy for Neoplasms Across the USA

Rejoice F Ngongoni MD, Busisiwe Mlambo MBChB, I-Fan Shih PhD, Yanli Li PhD, Sherry M Wren MD

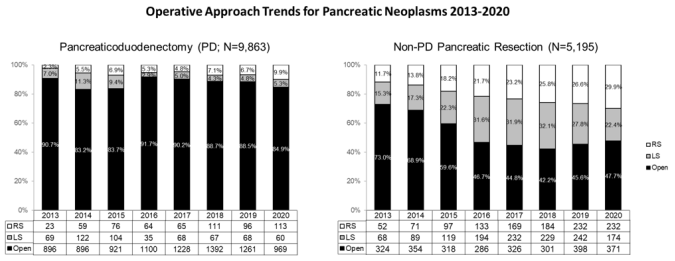
Introduction: To evaluate recent national trends in minimally invasive pancreatectomy (MIP) for neoplastic disease and compare clinical outcomes.

Methods: Adult patients who underwent elective open (OS) or MIP (laparoscopic-LS or robotic-RS) pancreaticoduodenectomy (PD) or non-pancreaticoduodenectomy resections (non-PD) for neoplasms from 2013-2020 were identified from Premier Healthcare Database. Outcomes e.g., length of stay (LOS), conversion to OS, blood transfusion, cost, in-hospital mortality, and 30/90-day readmission rates were compared using multivariable regression adjusting for patient and hospitals baseline characteristics.

Results: Total 15,058 patients; 9,863 PD and 5,195 non-PD. OS was predominant approach for PD (87.8%) with fluctuating MIP rates (8.2%-16.8%). MIP rates were higher for non-PD (48.5%) and became the majority approach in 2016 (53.3%). Regionally, MIP rate was highest in the South (13.6% PD, 51.3% non-PD) and lowest in the West (7.8% PD, 38.0% non-PD). In PDs, MIP had higher transfusions (1.31[1.13-1.51];p<0.001) and perioperative costs (6,611[4,181-9,168];p<0.001), respectively, than OS. Conversion to open was lower in RS than LS (0.30[0.23-0.40];p<0.001). In non-PDs, MIP had improved outcomes than OS including lower LOS>10-days (0.64[0.54-0.76];p <0.001) and transfusions (0.62[0.52-0.75];p <0.001). Conversion to OS (0.42[0.33-0.54];p<0.001) and splenectomy (0.67[0.57-0.79];p<0.002) were lower in RS than LS. Perioperative costs were higher in RS non-PD (7351[5,444-9,291];p<0.001) than LS and OS. Mortality, readmissions, and other outcomes were similar.

Conclusion: MIP non-PD has become the most common approach likely due to improved outcomes, lower costs, and lower technical complexity than PD resections. In contrast, MIP-PD has stagnant adoption which may be explained by higher technical complexity and similar outcomes to OS.

Figure. Trend utilization according to operative approach from 2013 to 2020. LS, laparoscopic surgery; RS, robotic-assisted surgery.



Trends In Instagram Content Amongst Private Practice Plastic Surgeons

Brian Sangalang[1], Yelissa Navarro[2], Bhavana Thota[3], Justin Camacho MBA[4], Kometh Thawanyarat[2], Connor Arquette MD[5], Rahim Nazerali MD MHS[5]
[1] University of California, Riverside School of Medicine, Riverside, CA
[2] Medical College of Georgia at Augusta University, Augusta, CA
[3] Sidney Kimmel Medical College at Thomas Jefferson University, Philadelphia, PA
[4] Drexel University College of Medicine, Philadelphia, PA
[5] Stanford University School of Medicine, Stanford, CA

Background: In a visual-reliant field such as plastic and reconstructive surgery, Instagram has changed the way that physicians attract new patients as it allows for easy display of photos, videos, and real time stories1,2. This type of engagement enhances the approachability of surgeons, and has been shown to directly increase referral stream.3,4 We aim to survey the content posted by physicians to create guidelines that can be used to grow their Instagram presence.

Methods: Sixty Instagram accounts belonging to board-certified private practice plastic surgeons were analyzed. Accounts were categorized into a "Low Follower Count" Group (0-3500 Followers) and a "High Follower Count" Group (≥3501 Followers). The most recent 30 posts were categorized into four categories: Patient Results, Educational, Advertising, and Non-Medical Content. Posts were further analyzed for the use of videos, hashtags, intraoperative pictures, representation of male-presenting patients, racial diversity, and follower engagement.

Results: 1800 posts were analyzed. The High Follower Count group posted more patient results (p =.01), less non-medical content (p =.03) , utilized more videos (p <.001), and depicted more diverse patients (p <.001). Accounts with Higher Follower Counts also replied to comments more often (p <.001).

Conclusion: Instagram accounts of plastic surgeons with a high follower count built a more interactive and personable community with patients through videos and comment engagement. They represented more racial diversity amongst their Instagram posts highlighting patient results and included more educational posts. These strategies may foster a sense of community between patients and surgeons that attracts potential patients into their practice.

References

Azoury SC, Mazzaferro DM, Piwnica-Worms W, Messa CA 4th, Othman S, Stranix JT, Serletti JM, Kovach SJ, Fosnot J. An Update on Social Media in Academic Plastic Surgery Training Programs: The Rising Trend of Likes, Shares, and Retweets. Ann Plast Surg. 2020 Aug;85(2):100-104. doi: 10.1097/SAP.0000000000002289. PMID: 32079812.

Irwin TJ, Riesel JN, Ortiz R, Helliwell LA, Lin SJ, Eberlin KR. The Impact of Social Media on Plastic Surgery Residency Applicants. Ann Plast Surg. 2021 Mar 1;86(3):335-339. doi: 10.1097/SAP.0000000000002375. PMID: 32349083.

Akash A Chandawarkar, MD, Daniel J Gould, MD, PhD, W Grant Stevens, MD, Insta-grated Plastic Surgery Residencies: The Rise of Social Media Use by Trainees and Responsible Guidelines for Use, Aesthetic Surgery Journal, Volume 38, Issue 10, October 2018, Pages 1145–1152, https://doi.org/10.1093/asj/sjy055

Montemurro P, Porcnik A, Hedén P, Otte M. The influence of social media and easily accessible online information on the aesthetic plastic surgery practice: literature review and our own experience. Aesthetic Plast Surg. 2015 Apr;39(2):270-7. doi: 10.1007/s00266-015-0454-3. Epub 2015 Feb 20. PMID: 25697277.

Outcomes of Procedural-Based Palliation for Malignant Bowel Obstruction

Nova Xu, BS, Beatrice Sun, MD, Tiffany Yue, BS, Kevin Einkauf, BA, Byrne Lee, MD

Introduction: Malignant bowel obstructions (MBO) are common sequelae of advanced malignancies. Mainstay therapy is symptom palliation, although no current guidelines exist. We aim to characterize both procedural and non-procedural management strategies and associated outcomes to better elucidate optimal MBO management.

Methods: A 5-year retrospective review (2017-2022) was performed at a tertiary institution to identify patients admitted for MBO due to peritoneal carcinomatosis. Patients were categorized by MBO management strategy: nonoperative (NONE), procedural (PROC), or surgical (SURG). Patient factors, inpatient outcomes, and mortality were analyzed.

Results: 210 patients were admitted with MBO: 134 NONE, 22 PROC, and 54 SURG. Demographics, primary cancer site, and prior treatment patterns were similar. SURG had a lower rate of patients on active chemotherapy/immunotherapy (SURG 33% vs NONE 53% and PROC 64%; p=0.020) and lower rate of malignant ascites on admission (SURG 50% vs NONE 61% and PROC 82%; p=0.036). SURG had more complications (SURG 28% vs NONE 3% and PROC 5%; p<0.001) and longer hospital stays (SURG 17.0 vs NONE 7.5 and PROC 14.8 days; p<0.001). 88% of patients received palliative care consults. 30-day mortality was lowest in SURG patients (SURG 7% vs NONE 27% and PROC 36%; p=0.036).

Conclusion: Patients who undergo procedural and surgical management for MBO have higher hospital lengths of stay, complications, and discharge resources. In select patients, surgical intervention for MBO is associated with longer survival with the cost of higher hospital resources and morbidity. Given the complexity of this disease process, early initiation of multidisciplinary discussions may aid in decision-making for palliative interventions.

Table 1: Surgical Management of MBO Patients

	Surgical n=54
Operating Service	
Surg Onc / HPB	26 (48.1%)
Gyn Onc	11 (20.3%)
Colorectal	13 (24.1%)
ACS / Trauma	4 (7.4%)
Operation Performed	
Gastrostomy tube	15 (27.8%)
Ostomy	29 (53.7%)
Ileostomy	18 (33.3%)
Colostomy	11 (20.3%)
Bowel resection	12 (22.2%)
Small bowel	7 (13.0%)
Colon	7 (13.0%)
Enteric bypass	10 (18.5%)
Aborted operation	2 (3.7%)
Readmission for MBO or complication	21 (38.9%)
Additional intervention during readmission	5/21 (23.8%)

Postoperative antibiotic prescribing practices and surgical site infections in twenty low- and middle-income country hospitals

Alex Zhuang, MS[1,2,3,4], Maia R. Nofal, MD MPH[1,4,5,6], Natnael Gebeyehu, MD[4,7], Nichole Starr, MD MPH[4,6,8], Sara Taye Haile[4], Habtamu Woldeamanuel[4], Assefa Tesfaye, MD[4,9], Senait Bitew Alemu[4], Abebe Bekele[2], Thomas G. Weiser, MD MPH[4,5], Tihitena Negussie Mammo, MD[4,7]
[1.] Department of Surgery, Boston Medical Center, Boston University School of Medicine, Boston, Massachusetts, USA
[2.] University of Global Health Equity, Kigali, Rwanda
[3.] Fogarty International Center, Harvard-BU-Northwestern-UNM Consortium (D43TW010543), Washington DC, USA
[4.] Lifebox Foundation, Addis Ababa, Ethiopia
[5.] Stanford University, Department of Surgery, Palo Alto, California, USA
[6.] Fogarty International Center, Global Health Equity Scholars Program (D43TW010540), Washington DC, USA
[7.] Addis Ababa University, Department of Surgery, Ethiopia
[8.] Department of Surgery, University of California San Francisco, San Francisco, California USA
[9.] St. Peter's Specialized Hospital, Addis Ababa, Ethiopia

Introduction: Worldwide, approximately 1 in 6 inpatient antibiotic prescriptions are for surgical prophylaxis, including postoperative prophylaxis.5and it unnecessarily exposes patients to risks associated with antibiotic use. In 2016, WHO recommended discontinuation of antibiotic prophylaxis after surgery. We aimed to update the evidence that formed the basis for that recommendation.\nMETHODS: For this systematic review and meta-analysis, we searched MEDLINE, Embase, CINAHL, CENTRAL, and WHO regional medical databases for randomised controlled trials (RCTs The World Health Organization recommends against prophylactic antibiotics for preventing postoperative surgical site infections (SSI).5and it unnecessarily exposes patients to risks associated with antibiotic use. In 2016, WHO recommended discontinuation of antibiotic prophylaxis after surgery. We aimed to update the evidence that formed the basis for that recommendation.\nMETHODS: For this systematic review and meta-analysis, we searched MEDLINE, Embase, CINAHL, CENTRAL, and WHO regional medical databases for randomised controlled trials (RCTs In low- and middle-income countries, postoperative antibiotic use is common due to perceptions that it reduces SSI rates, and that data informing these recommendations are largely derived from high-income countries.5–8and it unnecessarily exposes patients to risks associated with antibiotic use. In 2016, WHO recommended discontinuation of antibiotic prophylaxis after surgery. We aimed to update the evidence that formed the basis for that recommendation.\nMETHODS: For this systematic review and meta-analysis, we searched MEDLINE, Embase, CINAHL, CENTRAL, and WHO regional medical databases for randomised controlled trials (RCTs This study aims to describe postoperative antibiotic prescribing patterns and related SSI rates.

Methods: We included patients from 20 LMIC hospitals with wound class I or II without clinical sign of infection for 48 hours postoperatively. Patient data were collected as part of Clean Cut, a surgical quality improvement program, from 2019-2022.9 Clinical data on antibiotic administration, indication, SSI, length of stay (LOS), and adherence with perioperative infection prevention standards were collected by trained personnel. The association between postoperative antibiotic prophylaxis and SSI was analyzed via logistic regression, controlling for sex, wound class, case urgency, surgical specialty, and degree of adherence to perioperative infection prevention practices.

Results: Of 6,945 patients, 94.01% received antibiotics postoperatively; 90.96% were for prophylaxis. Patients receiving postoperative prophylaxis did not have lower SSI rates (RR 1.22, 95% CI 0.93-1.60, p=0.143) but LOS was 1.4 days higher.

Conclusion: In this large prospective cohort, postoperative antibiotics do not reduce SSI in LMICs, but pervasive use is associated with longer LOS in a resource-limited healthcare system. With the growing threat of antimicrobial resistance, surgical initiatives to implement antimicrobial stewardship programs in LMICs are critical.

Table 1. Relative risk of SSI by postoperative antibiotic prescribing, sex, intraoperative infection prevention compliance, wound class, case urgency, and surgical specialty

	Relative Risk (95% CI)	p-value*
Postoperative antibiotics		
Stopped within 24 hours	1.00 (reference)	
Continued beyond 24 hours	1.22 (0.93-1.60)	0.143
Sex		
Female	1.00 (reference)	
Male	1.94 (1.38-2.72)	0.000
Intraoperative infection prevention compliance score (of 6)§		
Score of 0	1.00 (reference)	
For 1 point increase	0.79 (0.73-0.87)	0.000
Wound class		
Clean	1.00 (reference)	
Clean contaminated	1.22 (0.95-1.56)	0.117
Case urgency		
Elective	1.00 (reference)	
Emergency	1.01 (0.77-1.32)	0.938
Missing	5.22 (0.51-53.32)	0.163
Specialty		
General surgery	1.00 (reference)	
Obstetric	0.36 (0.15-0.74)	0.000

*Logistic regression

§Intraoperative infection prevention compliance score is the number critical perioperative infection prevention standards met out of 6

PREVIOUS VISITING PROFESSORS

Previous Emile F. Holman Lecturers

Holman Lecture	Visiting Professor	Date	Division
23rd Annual Lecture	Daniela Ladner, MD	May 13, 2022	Transplant Surgery
22nd Annual Lecture	John Alverdy, MD	May 7, 2021	General Surgery
No lecture in 2020 due to COVID-19			
21st Annual Lecture	Melina Kibbe, MD	May 3, 2019	Vascular Surgery
20th Annual Lecture	Paul Cederna, MD	June 1, 2018	Plastic Surgery
19th Annual Lecture	Gerard Doherty, MD	June 9, 2017	Surgery
18th Annual Lecture	Selwyn M. Vickers, MD	June 3, 2016	Surgery
17th Annual Lecture	Thomas M. Krummel, MD	June 12, 2015	Surgery
16th Annual Lecture	Douglas Fraker. MD	June 6, 2014	General Surgery
15th Annual Lecture	Allan D. Kirk, MD	June 7, 2013	Transplant Surgery
14th Annual Lecture	Chris Breuer, MD	June 8, 2012	Pediatric Surgery
13th Annual Lecture	Eliot Chaikof, MD	June 7, 2011	Vascular Surgery
12th Annual Lecture	Monica Bertagnolli, MD	June 8, 2010	Surgery
11th Annual Lecture	Carlos Pelligrini, MD	June 9, 2009	Surgery
10th Annual Lecture	Michael Mullholland, MD	June 3, 2008	Surgery
9th Annual Lecture	Ron Maier, MD	June 5, 2007	Surgery
8th Annual Lecture	Barbara L. Bass, MD	June 6, 2006	Surgery
7th Annual Lecture	William Blaisdell, MD	March 7, 2006	Surgery
6th Annual Lecture	John Connelly, MD	March 4 2005	Surgery
5th Annual Lecture	Julie Freischlag, MD	March 5, 2004	Surgery
4th Annual Lecture	Norman Rich, MD	March 7, 2003	Surgery
3rd Annual Lecture	Thomas Russell, MD	March 8, 2002	Surgery
2nd Annual Lecture	John L. Cameron, MD	March 9, 2001	Surgery
Inaugural Lecture	Halsted Holman, MD	March 17, 2000	Surgery

Stanford MEDICINE | Surgery