

The Department of Surgery at Dartmouth Hitchcock Medical Center Presents

The 11th Annual Surgical Trainees Advancing Research Symposium (STARS)
&
The 3rd Annual Richard W. Dow Lecture in Surgery

Program Overview

Thursday, April 6, 2023, 5:30 – 7:30 PM *

Auditorium F

Reception and dinner featuring quickshot presentations by surgical trainees.

5:30 – 6:00 PM Reception

6:00 – 7:30 PM STARS quickshot presentations by residents & medical students

**RSVP required*

Friday, April 7, 2023, 6:30 – 8:30 AM

Auditorium H

Guest lecture and quickshot presentations by surgical trainees.

6:30 – 7:00 AM Refreshments

7:00 – 8:00 AM *Guest Lecture by Dr. Douglas Evans (see bio, p. 20)*

8:00 – 8:30 AM STARS quickshot presentations by residents

RSVP not required

For details and program updates, please visit: <https://www.dartmouth-hitchcock.org/strive/meetings-events>

Learning Outcome Statement:

Following this meeting, (at least 75% of) attendees will be able to discuss a minimum of three updates in research related to surgical intervention including the benefit of multidisciplinary/interprofessional collaboration.

Accreditation:

Dartmouth Health is accredited by the Accreditation Council for Continuing Medical Education to provide continuing education for physicians. Dartmouth Health designates this live activity for a maximum of 3.0 AMA PRA Category 1 Credit™.

Physicians should claim only the credit commensurate with the extent of their participation in the activity.

Schedule of Presentations

Thursday April 6, 2023, 5:30–7:30 PM. Auditorium F Reception and Dinner with Quickshot Presentations from Surgical Trainees

Ord	Time	Presenter	Title
1	6:00	María Cristina Gil-Díaz, BA	Impact of Residential Redlining and Neighborhood Trajectory in Treatment Equity of Non-Metastatic Lung Cancer
2	6:07	Torri Lee, BS	In Vivo Characterization of Oral Lesions Using Electrical Impedance
3	6:14	Kate Salotto, BSE	Characterization of Adeno-Associated Virus Tropism for Dorsal Root Ganglion Tissue
4	6:21	Adam Schwendt, MSc	Relationship Between Patient Characteristics and Force Distribution in Laryngoscopy
5	6:28	Ming Cai, MD, MEd	Colorectal ERAS: The Impact of Unique Updates in Opioid Administration
	6:35	Service Break	
6	6:45	Raysa G. Cabrejo, MD	Adipose Derived Stem Cells (ADSCs) as an Adjunct to Treat Recurrent Carpal Tunnel Syndrome
7	6:52	Britney L. Atwater, MD	Natural History of Observed Staghorn Calculi
8	6:59	Isabel A. Jarmel, BS	The Sustained Impact of the COVID-19 Pandemic on Vascular Surgical Care Delivery
9	7:06	Xavier Fowler, MD	Surgical acuity and procedure volumes before and during the COVID-19 pandemic
10	7:13	Brianna M. Krafcik, MD	Global Mortality from Aortic Aneurysm: What is Driving the Changes?

April 7, 2023 from 6:30 – 8:30 AM. Auditorium H Guest Lecture and Quickshot Presentations from Surgical Trainees

Ord	Time	Presenter	Title
1	7:00	Douglas B. Evans, MD <i>Medical College of Wisconsin</i>	Treatment Sequencing for Localized Pancreatic Cancer
2	8:00	Robin Cotter, MD	Laparoscopic Reverse Cholangiopancreatography (LRCP): Time for a Paradigm Shift in LCBDE? Robin Cotter
3	8:07	Cong Phan, MD	Eyes with higher baseline cup-to-disc ratio (CDR) might be at higher risk for ocular hypertension following intravitreal injection of corticosteroids
4	8:14	Aravind Ponukumati, MD	Disease-Specific Patient-Reported Quality of Life After Fenestrated/Branched Endovascular Aortic Aneurysm Repair
5	8:21	Ming Cai, MD, MEd	Call Night Long: The Educational Value of Overnight Call During Surgery Clerkship

Co-Directors: Philip P. Goodney, MD and Kari M. Rosenkranz, MD

Judges: Lawrence Dagrosa, MD; Doug Evans, MD; Philip P. Goodney, MD MS;
Dimosthenis Mantopoulos, MD; Kari M. Rosenkranz, MD; Rebecca Scully, MD, MPH

Prizes: \$500 / \$200 / \$100 (1st/2nd/3rd) - To be announced via email Friday, April 6th.

Impact of Residential Redlining and Neighborhood Trajectory in Treatment Equity of Non-Metastatic Lung Cancer

María Cristina Gil-Díaz, BA¹; Julie E. Weiss, MS²; Anita Nwiloh³, Heather A. Carlos, MS^{1,2}; Constance P. Fontanet, MPH¹; Rian M. Hasson, MD^{1,2,4}; Nirav S. Kapadia, MD^{1,2,5}; Andrew P. Loehrer, MD^{1,2,4}

1. Geisel School of Medicine at Dartmouth
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Introduction: Lung cancer is the leading cause of cancer mortality in the US, with Cancer Directed surgery (CDS) and radiation (RT) being primary curative-intent treatments. We poorly understand the impact of historic/structural racism, including residential redlining on lung cancer care. We explored the influence of Home Owners' Loan Corporation's (HOLC) grading and neighborhood socioeconomic trajectory on CDS and RT for patients with non-metastatic lung cancer.

Methods: Retrospective cohort study (2010-2015) used the Indiana state cancer registry to identify adult patients with stage 0 – III lung cancer in seven cities. US Census block groups were assigned a historic HOLC grade and neighborhood socioeconomic status using 2015 Area Deprivation Index (ADI). HOLC grade and ADI categories were combined to create four neighborhood trajectories. The primary outcomes were receipt of CDS, receipt of RT, and receipt of CDS with or without RT vs RT alone. Modified Poisson regression models estimated the relative risk (RR) and 95% confidence interval (CI) for block group characteristic's impact on cancer outcomes, controlling age, sex, year of diagnosis, city, and stage.

Results: The final cohort included 1,691 patients. The majority (70.9%) of patients lived in Disadvantage Stable neighborhoods (DSN). DSN had higher proportion of non-Hispanic Black patients. Residence in DSN was found to be associated with significantly lower RR of CDS (with or without RT) compared to RT alone (RR_{Disadvantage Stable} = 0.82, CI = 0.67 – 0.99). Non-Hispanic Blacks in DSN had a significantly lower risk of receiving RT compared to non-Hispanic Whites (RR_{Disadvantage Stable} = 0.83, 95% CI = 0.72 – 0.95).

Conclusion: Our data reveal a significant association between historic redlining and neighborhood socioeconomic trajectories with the modality of lung cancer treatment. Understanding the ramification of structural racism and differential pathways for disparate care is key to shaping policy and care delivery to ensure equitable outcomes for lung cancer patients.

01. María Cristina Gil-Díaz

Patients' block group characteristics	Cancer-directed Surgery		Radiation Treatment*		CDS +/- RT versus RT Alone	
	Unadjusted	Adjusted ^α	Unadjusted	Adjusted ^α	Unadjusted	Adjusted ^α
	RR (95% CI)					
Neighborhood Trajectory*, ^β						
Advantage Stable	Reference 0.88 (0.66 – 1.19)	Reference 0.90 (0.70 – 1.16)	Reference 1.12 (0.88 – 1.43)	Reference 1.08 (0.85 – 1.37)	Reference 0.87 (0.67 – 1.14)	Reference 0.89 (0.71 – 1.12)
Disadvantage Reduced	0.78 (0.52 – 1.16)	0.88 (0.61 – 1.26)	1.28 (0.94 – 1.69)	1.15 (0.88 – 1.51)	0.77 (0.53 – 1.161)	0.88 (0.64 – 1.22)
Advantage Reduced	0.86 (0.67 – 1.09)	0.83 (0.67 – 1.03)	1.19 (0.97 – 1.47)	1.16 (0.94 – 1.42)	0.82 (0.66 – 1.03)	0.82 (0.67 – 0.99)

Table: Relative Risk of Receipt of Cancer-directed Surgery, Radiation Treatment) and CDS +/- RT versus RT Alone by Patients' Block Group Characteristics

*Radiation treatment missing (N=22).

^αAdjusted for patient characteristics of age at diagnosis, sex, diagnosis year, city and stage.

^β Neighborhood Trajectory definitions:

Advantage Stable = HOLC (Best or Still Desirable) and ADI (Least or Less Deprived);

Disadvantage Reduced = HOLC (Definitely Declining or Hazardous) and ADI (Least or Less Deprived);

Advantage Reduced = HOLC (Best or Still Desirable) and ADI (More or Most Deprived);

Disadvantage Stable = HOLC (Definitely Declining or Hazardous) and ADI (More or Most Deprived).

In Vivo Characterization of Oral Lesions Using Electrical Impedance

Torri Lee, BS¹; Sophie Lloyd, BS²; Ryan Halter, PhD²; Joseph Paydarfar, MD¹

1. Department of Surgery, Dartmouth-Hitchcock Medical Center

2. Thayer School of Engineering, Dartmouth College

Introduction: No real-time quantitative devices are clinically used to assess oral lesions during routine examination, making in-clinic diagnostic and longitudinal monitoring challenging. Identifying premalignant and malignant oral lesions early is critical to ensuring effective treatment is provided to patients with malignancies. We hypothesize that sensing and imaging bioelectric properties in the context of oral lesions will enable us to accurately characterize and classify morphologically different benign, premalignant, and malignant oral lesions in real-time.

Methods: 11 subjects (mean age 60.8, SD 9.17) undergoing surgical resection of confirmed oral squamous cell carcinoma (OSCC) were recruited for this study. Using a novel small-field multi-electrode electrical impedance tomography (EIT) probe, three repeated spectral impedance measurements were acquired in-vivo and ex-vivo from the lesion center and normal appearing tissue margin. Impedance magnitude differences (averaged across the full frequency range) between OSCC lesions and matched healthy control tissue were assessed and the per-frequency differences were analyzed using paired t-test and ANOVA.

Results: 31 frequencies spanning 100-Hz - 100-kHz were recorded per measurement, totaling 1,178 impedance magnitudes (18 in-vivo samples, 20 ex-vivo samples). Impedances recorded from OSCC lesions were on average 47 and 406 ohms lower in ex vivo and in-vivo tissues, respectively, when compared to healthy control sites. Significant per-frequency impedance differences were identified between OSCC lesions and control-matched benign mucosal tissue for both in-vivo and ex-vivo tissue at frequencies 100-631 Hz and 15849-79433 Hz ($p < 0.05$).

Conclusion: EIT is a non-invasive, real-time method of differentiating malignant from benign tissue based on electrical properties. This technique has potential to be used both in surgery for margin detection and in clinic for lesion characterization pre-biopsy. This pilot study demonstrates the capability of this approach to differentiate malignant from benign tissues in-vivo.

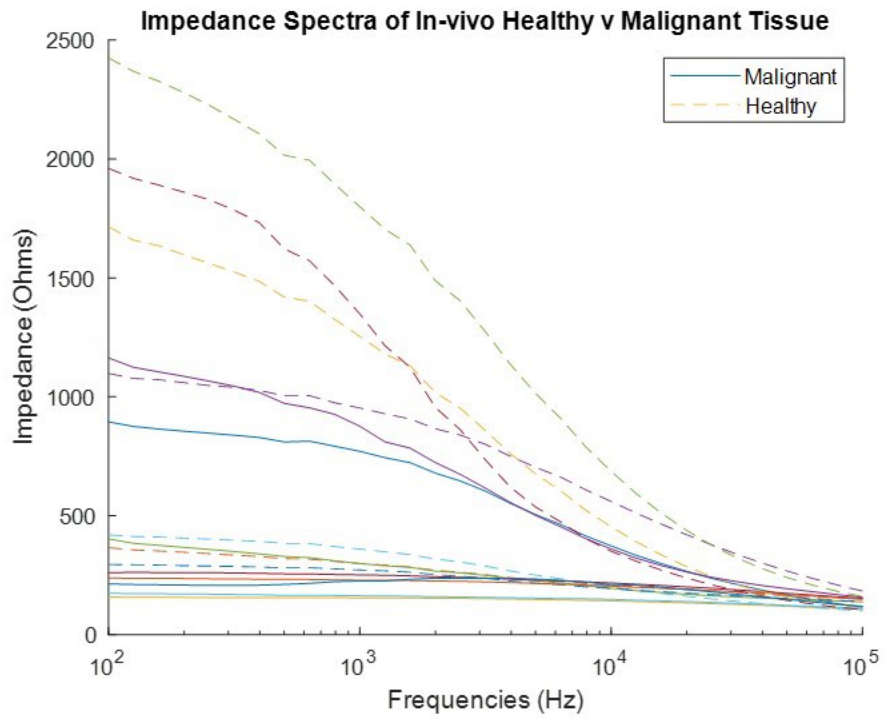


Figure 1: Impedance spectrum of in-vivo healthy vs malignant tissues. Data consists of averaged repeat measurements at each sample site, taken at 31 frequencies from 100 Hz- 100kHz.

Characterization of Adeno-Associated Virus Tropism for Dorsal Root Ganglion Tissue

Kate Salotto, BSE¹, and Jennifer Hong, MD^{1,2}

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2. Department of Surgery, Dartmouth-Hitchcock Medical Center

Introduction: Peripheral nerve injuries affect many individuals globally and are associated with debilitating, long-term consequences. Despite advances in bioengineering and in the elucidation of the peripheral nervous system (PNS), current therapies fail to restore clinical function to patients. Adeno-associated viruses (AAVs) are viruses that naturally infect cells and can be used as vectors for genetic modulation of cells in humans. Different AAV serotypes display varying affinities for certain cell types. AAV serotypes PHP.s and AAVrg have demonstrated tropism for the PNS, making these a promising avenue for the targeted delivery of gene therapies to the PNS. To what degree these AAV serotypes infect the PNS and the patterns of infection remain to be evaluated. This research characterizes the tropism of several constructs of AAV vectors for dorsal root ganglia (DRG) tissue following sciatic nerve injection in a rodent model.

Methods: To characterize the tropism of AAV vectors for DRG tissue, vectors were injected unilaterally into rodent model sciatic nerves. Combinations of two candidate AAV serotypes, PHP.s and AAVrg, with two promoters, CAG and hSyn, were tested. DRG specimens underwent immunohistochemical preparation for fluorescent microscopy imaging and analysis. Neuronal and satellite glial cell infection rates were quantified to assess tropism.

Results: In vivo, all four groups demonstrated successful transduction of neuronal cell bodies located within harvested DRGs across cervical, thoracic, lumbar, and sacral spinal cord levels, as well as evidence of satellite glial cell transduction. We found no significant difference in transduction rate between DRGs ipsilateral and contralateral to the sciatic nerve injection. The average neuronal infection rates for the vectors were PHP.s-CAG (9.60%), PHP.s-hSyn (14.7%), AAVrg-CAG (18.1%), and AAVrg-hSyn (18.5%). Overall, AAVrg confers a greater rate of neuronal transduction when compared to the PHP.s serotype, and the effect of the hSyn promoter was more pronounced for the PHP.s serotype.

Conclusions: We found all four AAV vectors travel robustly across the PNS from a peripheral injection as DRGs across all levels and both sides of the spinal cord showed neuronal infection. These results suggest that the AAV serotypes PHP.s and AAVrg paired with promoters CAG and hSyn can be used to selectively target the PNS as a delivery mechanism for gene therapies with applications to restore function in peripheral nerve injuries. In our assessment, the AAVrg-hSyn construct holds the most promise as a therapeutic vector to modulate cells in the PNS.

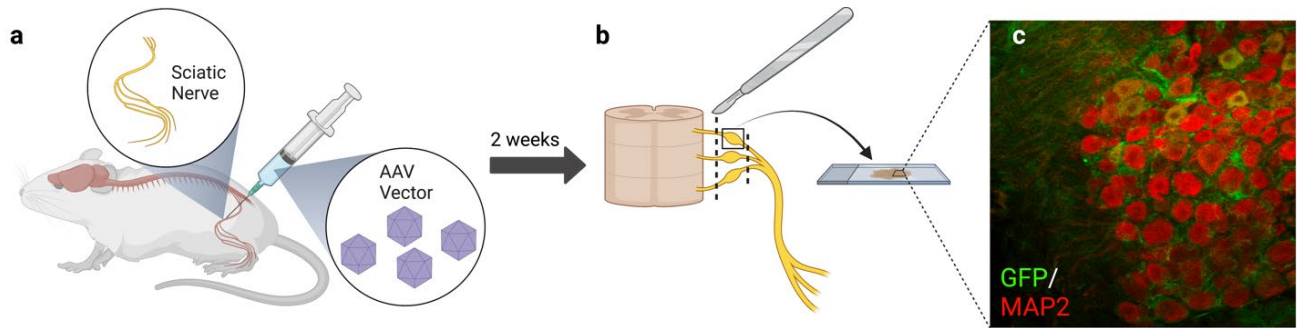


Figure: Experimental overview. (a) Schematic of mouse sciatic nerve unilateral injection with an AAV vector. (b) Schematic of dorsal root ganglia harvest and slide preparation 2 weeks after peripheral injection. (c) Image showing AAV-transduced neuron cell bodies expressing GFP, overlaid with MAP2-positive neuron cell bodies in a mouse dorsal root ganglion.

Relationship Between Patient Characteristics and Force Distribution in Laryngoscopy

Adam Schwendt, MSc¹; Yuan Shi, BS²; Kwame Wiredu, MD, PhD³; Ryan Halter, PhD²; Joseph Paydarfar, MD^{1,3}

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2. Thayer School of Engineering at Dartmouth
3. Department of Surgery, Dartmouth-Hitchcock Medical Center

Introduction: Forces applied onto soft tissue during operative laryngoscopy are highly predictive of iatrogenic tissue injury and resulting complications. Previously, we developed an integrated data acquisition system to gauge real-time intraoperative force distribution between surgical instruments and patient tissue. The relationship between patient characteristics, such as airway grade, BMI, dentition, and sex, with intraoperative forces remains to be elucidated. Here, we evaluate the relationship between important patient characteristics, such as airway grade, BMI, dentition, and sex, with forces experienced during laryngoscopy cases to help further appreciate tissue dynamics and tool-tissue interactions.

Methods: 15 baseline characteristics of study participants were recorded prior to laryngoscopy. Intraoperative forces, measured from 16 sensors on the laryngoscope and one chest scale over the entire procedure duration, were recorded for 65 patients. Downstream analyses were based on three clinically-meaningful groupings of all sensors. They included (1) maximum force recording over the initial 10-minute period during which maximum force would be expected, (2) discrete maximum force over the entire duration of the procedure, (3) force impulse, or total force over the procedure duration. Patient characteristics most predictive of measured forces were statistically determined using nested cross-validated sequential feature selection (SFS)

Results: Our data showed that each force measurement type and location had a unique set of predictive patient characteristics. We found BMI and full dentition to be most consistently predictive of the 10-minute window of max force on the laryngoscope, maxilla, and chest. Significant predictors of maximum force included BMI, full dentition, hyoid-mental distance, inter-incisive distance, and Mallampati score. Meanwhile, procedure duration consistently predicted total impulse regardless of force sensor locations.

Conclusions: This study represents the first investigation into the granular details of intraoperative tissue-tool force distribution and their relationship with patient characteristics. Patient features are predictive of force measurements that provide valuable insight into the tissue-tool dynamics that underlie procedure outcomes. Further characterization of tissue-tool and airway dynamics is a promising avenue for improving medical outcomes.

Colorectal ERAS: The Impact of Unique Updates in Opioid Administration

Ming Cai, MD¹, MSED; Jessica R. Henkin, MMS, PA-C¹; Sara W. Mayo, MD, MS¹

1. Department of Surgery, Dartmouth-Hitchcock Medical Center

Introduction: Enhanced recovery after surgery (ERAS) protocols have been widely studied in colorectal surgery patients. We incorporated emerging evidence regarding novel routes of opioid administration within a colorectal surgery ERAS protocol. We measured the effects of this intervention by evaluating inpatient postoperative opioid exposure and opioid prescriptions at time of discharge.

Methods: We collaborated with our anesthesia pain team through multidisciplinary team meetings to develop this intervention. We created a revised postoperative order set utilizing subcutaneous hydromorphone as the preferred route of administration, replacing intravenous hydromorphone. Nursing staff received education regarding these changes. We measured opioid use in the immediate postoperative period and by the proportion of new prescriptions at time of discharge.

Results: All patients undergoing elective colorectal resections were included (39 pre-intervention from July-September 2022 and 37 post-intervention October-December 2022). The most common indication for surgery was colon cancer (43.4%) and most operations were performed laparoscopically or robotically (84.2%). During the pre-intervention period, the mean morphine milligram equivalents (MME) given was 24.5 compared to 18.0 post-intervention. The proportion of patients prescribed opioid medications at discharge decreased from 41.0% to 21.6% pre- to post-intervention. The number of patient phone calls, emergency room visits, and 30-day readmissions did not significantly change between the two periods.

Conclusions: Changing the route of opioid administration is beneficial in reducing overall opioid use when implemented through a multidisciplinary team education program. We observed a decreased in opioids given during the immediate post-operative period, as well as opioids prescribed upon discharge after our intervention. Both measures are below the national averages previously reported for colorectal surgery patients.

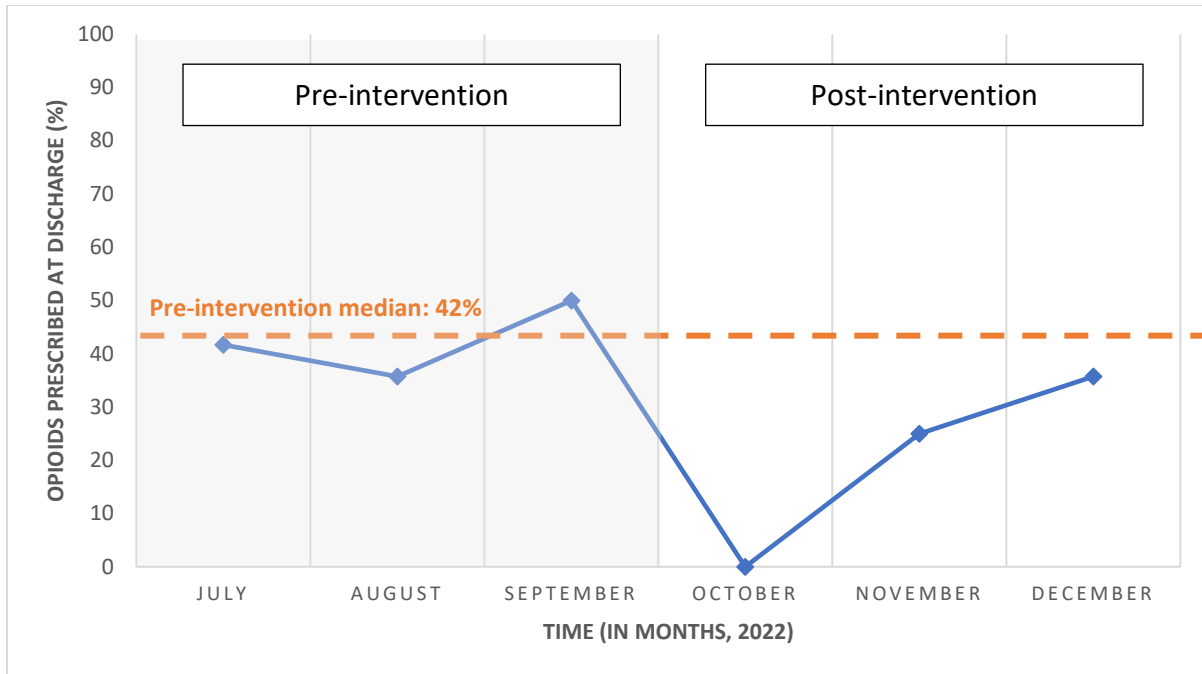


Figure 1. Percentage of patients discharging to home postoperatively with opioid medication prescription per month, pre-intervention (July-September 2022) and post-intervention (October-December 2022).

Adipose Derived Stem Cells (ADSCs) as an Adjunct to Treat Recurrent Carpal Tunnel Syndrome

Raysa G. Cabrejo, MD¹; Joseph Rosen, MD¹

1. Department of Surgery, Dartmouth-Hitchcock Medical Center

Introduction: The purpose of this study is to compare the surgical outcomes of treating recurrent carpal tunnel with secondary carpal tunnel release only compared to secondary carpal tunnel release with fat grafting as an adjunct. Fat grafting provides adipose derived stem cells, which have been proven to promote secretion of neurotrophic and anti-inflammatory factors and *in situ* differentiate to Schwann cells.

Methods: Retrospective case control study was performed of the recurrent carpal tunnels treated, excluding explicit nerve injury such as transections, neuromas in continuity, etc. Patients with recurrent carpal tunnel were treated with re-release of carpal tunnel only or utilizing fat grafting as an adjunct. The outcomes of both groups were compared utilizing chi-square analysis.

Results: A total number of 81 patients had recurrent carpal tunnel syndrome were managed with either release of the carpal tunnel alone, 16 patients, or release with fat grafting as adjunct, 65 patients. About 88% of patients had a nerve conduction studies that ruled out other pathologies, 80% had motor latencies of the median nerve greater than or equal to 4.2ms or absent at the wrist. The recurrence rate, defined as no improvement of symptoms, for performing a carpal tunnel release only was 50.0% and for performing carpal tunnel release with fat grafting was 8%, p-value <0.00.

Conclusion: Adipose derived stem cells as an adjunct to carpal tunnel release reduced the recurrence of carpal tunnel compression after recurrence compared to carpal tunnel release alone. Further studies need to be performed to confirm the validity of these findings.

Natural History of Observed Staghorn Calculi

Britney L. Atwater, MD¹, Vikram S. Lyall, MD¹, Michael E. Rezaee, MD, MPH², Eric Riedinger, MD³, Bodo E. Knudsen, MD³, Srinath-Reddi Pingle, MD, MS⁴, David Sanghyuk Han, MD, MS⁴, Ojas Shah, MD⁴, Kyochul Koo, MD, PhD⁵, Ben H. Chew, MD⁵, Amy Reed, MD⁶, Ryan Hsi, MD⁶, Samuel Sorkhi, BA⁷, Kevin Wymer, MD⁷, Karen Stern, MD⁷, Vernon M. Pais, Jr., MD, MS¹

1. Section of Urology, Department of Surgery, Dartmouth-Hitchcock Medical Center
2. The Brady Urological Institute, Johns Hopkins Medicine
3. Department of Urology, Ohio State University Medical Center
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5. Department of Urological Sciences, University of British Columbia
6. Department of Urology, Vanderbilt University Medical Center
7. Department of Urology, Mayo Clinic Arizona

Background: The AUA Guidelines recommend surgical treatment of staghorn calculi in patients fit for surgery; however, some patients opt for observation. Data from >40 years ago report that non-operative management of staghorn calculi is associated with 28% 10-year mortality and up to 70% risk of renal failure or urosepsis within 6 years. Counseling is currently based on non-contemporary data. Herein we provided a multi-institutional update on the natural history of observed staghorn calculi.

Methods: A multi-center retrospective review was performed of patients from 6 institutions with an observed staghorn calculus diagnosed on CT scan between 2007 and 2022, with a minimum 6 months of follow up. Data was analyzed regarding stone-related complications and the interval from diagnosis to complication.

Results: A total of 73 patients met inclusion criteria with a mean follow up of 49 months (range 6-162). At diagnosis, 89% patients (n=65) declined intervention, and the remaining 11% (n=8) initially elected delayed intervention with a delay of at least 6 months. The overall complication rate was 30% (n=22) for all patients. For the observation cohort, the complication rate was 27.3% (n=19) on average 34 ± 42 months after diagnosis. Of those observed, 19% developed sepsis (n=12, mean 24 ± 24 months), 9% required urgent stent placement (n=6, mean 47 ± 59 months), 2% required urgent nephrostomy placement (n=1, mean 33 months), 8% progressed to renal failure (n=5, mean 18 ± 25 months), and there was an 11% mortality rate (n=7, mean 36 ± 43) with a stone-related mortality rate of 3% (n=2, mean 6 ± 1 months).

Conclusions: Delaying or forgoing treatment for staghorn stones is associated with the potential for morbidity and mortality. This contemporary data suggests overall complication rate is approximately 30% with less than one in five patients developing sepsis. This updated data on the anticipated natural history of observed staghorn calculi may contribute to informed shared decision making.

The Sustained Impact of the COVID-19 Pandemic on Vascular Surgical Care Delivery

Brianna M. Krafcik, MD, MS^{1,2}; Isabel A. Jarmel, BS²; Barbara Gladders, MS³; David H. Stone, MD¹; Bjoern D. Suckow, MD¹; Jocelyn M. Beach MD¹; Louise Davies, MD^{2,5}; Philip P. Goodney, MD, MS^{1,2}; Jesse A Columbo, MD, MS^{1,2}

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5. Section of Otolaryngology, Geisel School of Medicine at Dartmouth

Introduction: The COVID-19 pandemic necessitated postponement of vascular surgery procedures nationally. Whether procedure volumes have since recovered remains undefined. Therefore, we sought to quantify changes in procedure volumes and determine whether surgical volume has returned to its pre-pandemic baseline.

Methods: We utilized the US Fee-for-Service Medicare 5% National Sample as part of the VA-funded Disrupted Care National Project. We analyzed abdominal aortic aneurysm (AAA) repair for intact aneurysms, carotid endarterectomy (CEA), and major lower extremity amputation (LEA) from 2018-2021. Each quarter of 2020 and 2021 was compared to its corresponding pre-pandemic quarter in 2019. We then performed a sub-analysis of these trends by sex, age, and race.

Results: We identified 15,921 procedures: 3,278 AAA repair, 6,399 CEA, and 6,244 LEA. The average percent change during the baseline period from 2018 to 2019 was -4.3% for AAA repair, -8.5% for CEA, and -2.6% for LEA. Compared to Q2 of 2019, Q2 of 2020 demonstrated that AAA repair procedures decreased by 47%, CEA by 40%, and LEA by 14%. While procedures initially rebounded in Q3 of 2020, volumes did not return to their pre-pandemic baseline, demonstrating a persistent volume reduction (-16% AAA, -22% CEA, and -11% LEA). Thereafter, procedure counts again declined in Q4 of 2021(-42% AAA, -54% CEA, and -41% LEA) (Figure 1).

Conclusion: Despite a perception that vascular surgical care was singularly disrupted at the outset of the pandemic, there has been a sustained reduction in vascular surgical volume since 2019. Not only have procedure volumes not returned to pre-pandemic baseline, but it also appears that there has been a cumulative incremental impact on overall procedure volume. The

impact of these findings on long term population health remain uncertain and necessitate a better understanding of post-pandemic care delivery.

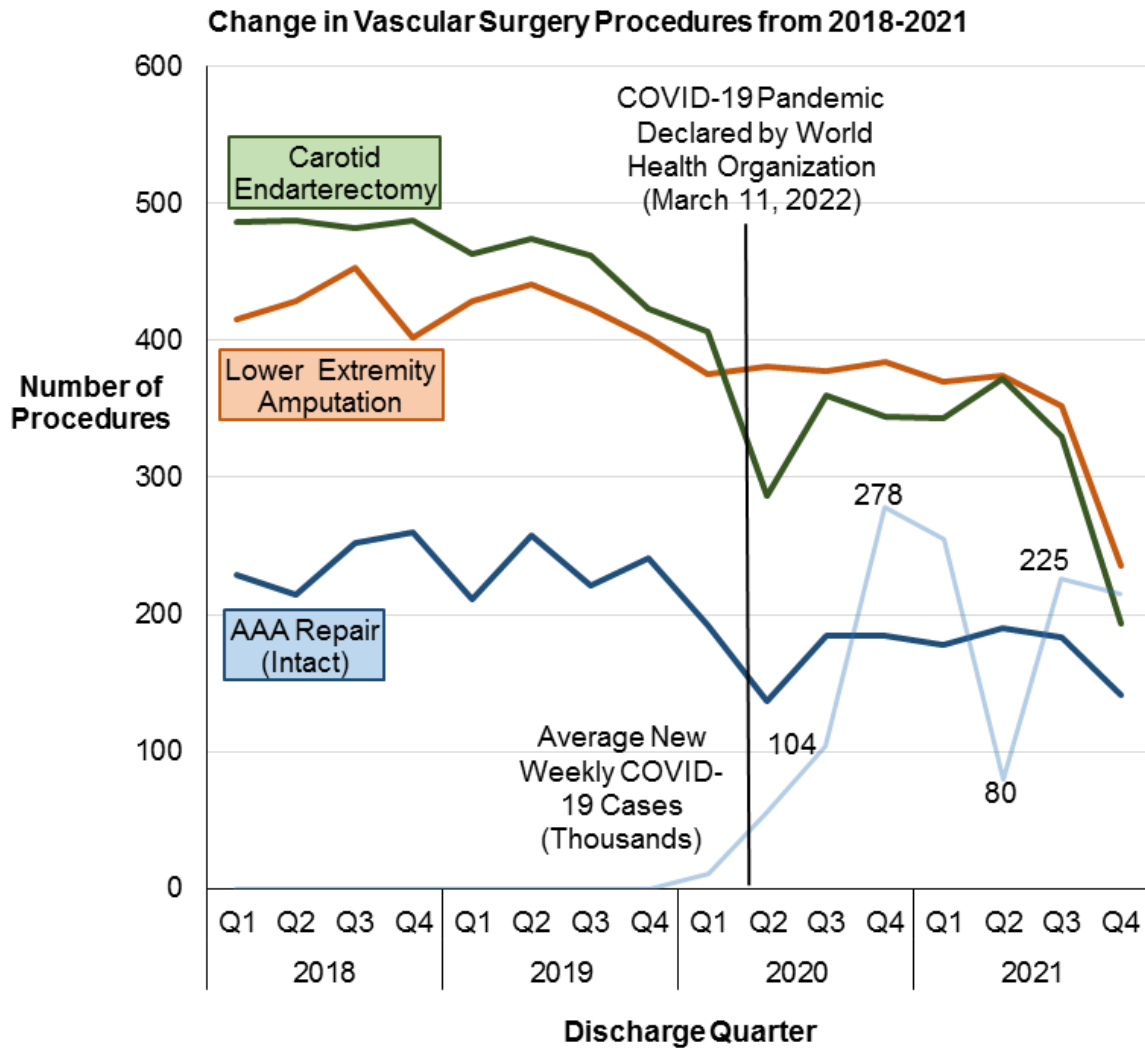


Figure 1. Change in Procedure Rate per 1000 Medicare Beneficiaries between 2018-2021 by Quarter. The light blue line reflects average weekly number of new COVID-19 cases per quarter in the United States.

AAA: Abdominal Aortic Aneurysm

Surgical Acuity and Procedure Volumes Before and During the COVID-19 Pandemic

Xavier Fowler, MD¹; Brianna Krafcik, MD¹; Ming Cai, MD, MSED¹; Barbara Gladders, MS¹, Jesse Columbo, MD, MS³; Kayla Moore, MPH²; David Stone, MD¹; Sandra Wong, MD, MS²; Philip P. Goodney, MD, MS³; David Soybel, MD, MS¹; Louise Davies, MD, MS³

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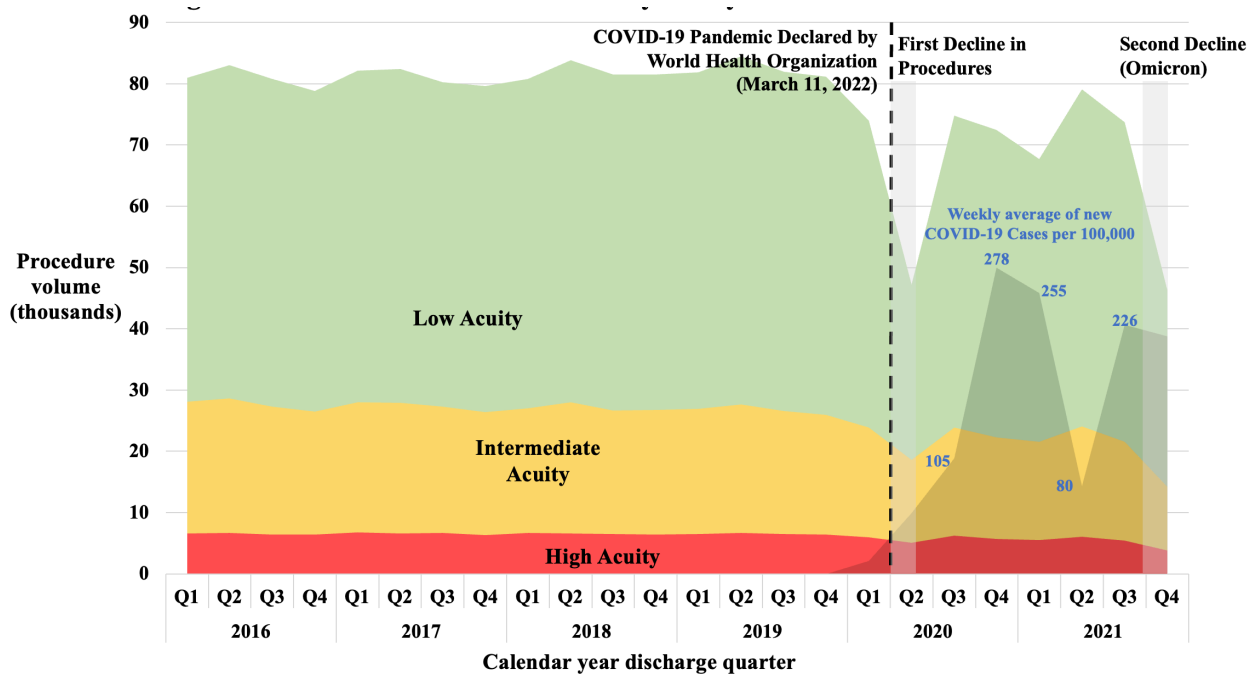
Introduction: The American College of Surgeons issued recommendations for the triage of procedures during the COVID-19 pandemic. To understand the impact of these changes, we measured procedure volume before and during the pandemic. We hypothesized that changes in procedure volume were not confined to lower acuity procedures and that volume changes extended beyond the early pandemic.

Methods: Using Medicare claims data we identified 37 common surgical and interventional procedures to broadly represent surgical practice. We classified procedures as low, intermediate, or high acuity using ACS guidelines. Procedure counts were examined and stratified by sex and race. Data were analyzed from January 1, 2016 through December 31, 2021.

Results: 1,840,577 procedures were identified for study. Procedure counts from respective 2019 quarters were used as the comparator. Overall, procedure counts declined by 44.2% during the first decline in 2020 (47,195 procedures in Q2 2020 versus 84,514 in Q2 2019, $p < 0.001$). These declines were largest in low acuity (-41.1%) and intermediate acuity (-30.8%) procedures; high acuity procedures declined the least (18.2%). Procedural volumes subsequently increased in Q3 2020, though not to baseline 2019 levels. A second decline in overall procedure volume (-43%) was observed in Q4 2021. During this second decline however, all acuity groups saw similar declines (low: -40.1%, intermediate: -44.2%, and high -46.9%). Procedure volumes stratified by sex and race demonstrated similar patterns of changes overall and across acuity tiers.

Conclusion: Two major declines in procedure volumes occurred between 2020 and 2022. While high acuity procedures were least affected in the first decline (Q2 2020), they were not spared during the second decline (Q4 2021). This suggests that the healthcare system was unable to preserve access to high acuity surgical care. Future efforts regarding access to surgical care during times of stress should focus on preserving high-acuity access over prolonged periods.

Figure: Medicare Procedure Volume by Acuity Status



Global Mortality from Aortic Aneurysm: What is Driving the Changes?

*Brianna M. Krafcik, MD, MS^{1,2}; Jesse A. Columbo, MD, MS^{1,2}; Philip P. Goodney, MD, MS^{1,2};
Michael F. Mayo-Smith, MD, MPH^{2,3}*

1. Section of Vascular Surgery, Dartmouth-Hitchcock Medical Center
2. VA Outcomes Group, Veterans Health Association
3. Department of Medicine, White River Junction VAMC

Objectives: Global deaths from aortic aneurysm (AA) have increased, and primary drivers of these changes remain unknown. We sought to characterize the impact of global changes in demographics and risk factors on AA deaths.

Methods: We queried the Global Burden of Disease Study (GBD) for AA deaths from 1990-2019 as well as percentage of deaths attributable to each risk factor identified by GBD modeling (smoking, hypertension, lead exposure, and high sodium diet). We then stratified data by age and Socio-Demographic Index (SDI) region. The expected mortality in 2019 due to overall population increase and shifts in age distribution were calculated. We then determined the change in deaths attributable to specific risk factors.

Results: Observed deaths from AA increased from 94,968 in 1990 to 172,427 in 2019. Expected AA deaths in 2019 from overall global population growth alone was 136,934 (+44.6% from 1990 observed mortality). Incorporating the shift in age distribution led to an estimated 210,031 deaths in 2019 (+121.8%). Overall, observed deaths in 2019 were 17.9% lower than the number expected due to demographic changes. The percentage of deaths attributable to smoking decreased from 45.6% to 34.6%, leading to an expected decrease of 23,103 deaths. The percent attributable to hypertension fell 38.7% to 34.7%, leading to an expected decrease of 8,401 deaths. When considering SDI region, low-middle and middle SDI regions had the most rapid growth in observed deaths (173.2% and 170.4%, respectively). Deaths attributable to hypertension increased in low-middle and middle SDI regions and globally hypertension surpassed smoking as the leading risk factor (Table I).

Conclusion: The increase in AA deaths was primarily driven by increases in global population and longevity. However, observed deaths in 2019 were lower than expected, suggesting that public health efforts have been effective. Continued risk factor modification, with heightened emphasis on hypertension, could lead to further improvements.

Table I. Change in Deaths from Aortic Aneurysm Globally and by Socio-Demographic Index (SDI) Region.

	A. Observed Deaths 1990	B. Expected Change from Overall Population Growth ¹	C. Expected Change from Aging of Population ²	D. Expected Change from Change in Smoking ³	E. Expected Change from Change in Hypertension ³	F. Expected Change from Change in Lead Exposure ³	G. Expected Change from Change in High Sodium Intake ³	H. Expected Change from Changes in Unidentified Risk Factors and/or Clinical Care ³	I. Observed Deaths 2019 ¹
Global	94,699	42,235 (+44.6%)	73,097 (+53.4%)	-23,103 (-11.0%)	-8,401 (-4.0%)	210 (+0.1%)	-210 (-0.1%)	-31,505 (-15.0%)	172,427 (+82.1%)
Low SDI	4,254	4,837 (+113.7%)	562 (+6.2%)	-202 (-2.1%)	314 (+3.2%)	19 (+0.2%)	-90 (-0.9%)	-1436 (-14.8%)	8,258 (+94.1%)
Low Middle SDI	7,618	6,602 (+86.7%)	4,507 (+31.7%)	-1,099 (-5.9%)	494 (+2.6%)	-60 (-0.3%)	-45 (-0.2%)	2,794 (+14.9%)	20,811 (+173.2%)
Middle SDI	11,971	4740 (+39.6%)	14,337 (+85.8%)	-1,757 (-5.7%)	925 (+3.0%)	-133 (-0.4%)	-375 (-0.1%)	2664 (+8.6%)	32,372 (+170.4%)
High Middle SDI	21,460	5,223 (+24.3%)	15,933 (+59.7%)	-3,102 (-7.3%)	-903 (-2.1%)	-89 (-0.2%)	-251 (-0.5%)	6757 (+15.9%)	45,028 (+98.2%)
High SDI	49,334	11,485 (+23.3%)	32,159 (+52.9%)	-15,397 (-17.1%)	-8,834 (-9.5%)	483 (+0.5%)	-214 (-0.2%)	-3169 (-3.4%)	65,848 (+33.5%)

1. Parenthesis = % change from observed deaths 1990, Column A

2. Parenthesis = % change from observed deaths 1990 + expected deaths from overall population growth, Columns A+B

3. Parenthesis = % change from observed deaths 1990 + expected deaths from overall population growth and from aging of the population, Columns A + B + C

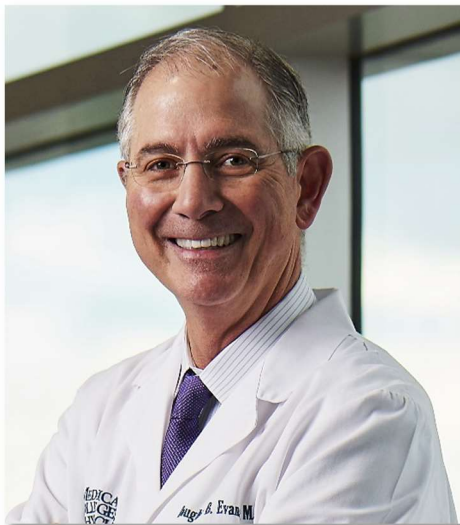
RICHARD W. DOW LECTURE IN SURGERY

“Treatment Sequencing for Localized Pancreatic Cancer”

Friday, April 7, 2023

7:00 – 8:00 AM

Auditorium H



Douglas B. Evans, MD

Donald C. Ausman Family Foundation Chair
Chair, Department of Surgery
Professor of Surgery
Medical College of Wisconsin

Douglas B. Evans, MD is the Donald C. Ausman Family Foundation Chair and Professor and Chair of the Department of Surgery at the Medical College of Wisconsin. Prior to joining the Medical College of Wisconsin in January 2009, he was the Hamill Foundation Distinguished Professor of Surgery at the University of Texas M.D. Anderson Cancer Center. Dr. Evans completed a general surgery residency at Dartmouth followed by a surgical oncology fellowship at the University of Texas M.D. Anderson Cancer Center. He received his medical degree from Boston University School of Medicine and his Bachelor of Science from Bates College. Dr. Evans has devoted his professional career to the research and treatment of pancreatic cancer and inherited and sporadic endocrine tumors. His interests include translational laboratory research in the biology of pancreatic cancer, clinical trial development and innovative technical solutions to the surgical management of cancer. Dr. Evans has authored or co-authored over 400 journal articles, over 90 book chapters and has edited 9 books. He has delivered countless invited and named lectureships nationally and internationally. Dr. Evans served as President of the American Association of Endocrine Surgeons (AAES) in 2010-2011, received the Andrew L. Warshaw Master Educator Award from the Society for Surgery of the Alimentary Tract (SSAT) in 2014, and in 2011 received the American Society for Radiation Oncology's (ASTRO) honorary member award.

Laparoscopic Reverse Cholangiopancreatography (LRCP): Time for a Paradigm Shift in LCBDE?

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Introduction: Laparoscopic common bile duct exploration (LCBDE) has equivalent safety and efficacy compared to endoscopic retrograde cholangiopancreatography (ERCP) plus cholecystectomy, but with decreased costs and hospital length of stay. Due to the limitations of “classic” transcystic LCBDE, however, many studies significantly utilize transcholedochal exploration, which although effective is more technically challenging and carries additional risks compared to transcystic. We report on our 9-year LCBDE experience and the evolution of our technique away from a “classic” transcystic and transcholedochal technique towards a transcystic, antegrade clearance technique which we term laparoscopic reverse cholangiopancreatography (LRCP).

Methods: We retrospectively reviewed LCBDE cases with confirmed CBD stones at a single Veterans Affairs hospital from 2014-2023. We defined three time periods for analysis according to major changes in our transcystic technique: the “classic” phase during which cystic duct balloon dilation with scope-guided basket retrieval was the primary approach, the “expansion” phase in which we abandoned cystic duct dilation but added sphincteroplasty and lithotripsy techniques, and our current “LRCP” phase in which transcystic, antegrade clearance is the primary approach. We defined success as transcystic ductal clearance without the need for choledochotomy or ERCP for retained stones.

Results: 71 LCBDE cases were performed. The median postoperative length of stay was 2 days (IQR 1 – 3 days). Success was 48% in the “classic” phase (n=27), 64% in the “expansion” phase (n=23), and 95% in the “LRCP” phase (n=21) ($p < 0.01$). Reliance on transcholedochal LCBDE decreased over time. There were no unplanned ERCs or readmissions for retained stones in the series.

Conclusions: Evolution of our transcystic technique towards LRCP dramatically improved our success rate and reduced reliance on transcholedochal clearance. We feel that LRCP represents a potential paradigm shift in LCBDE technique.

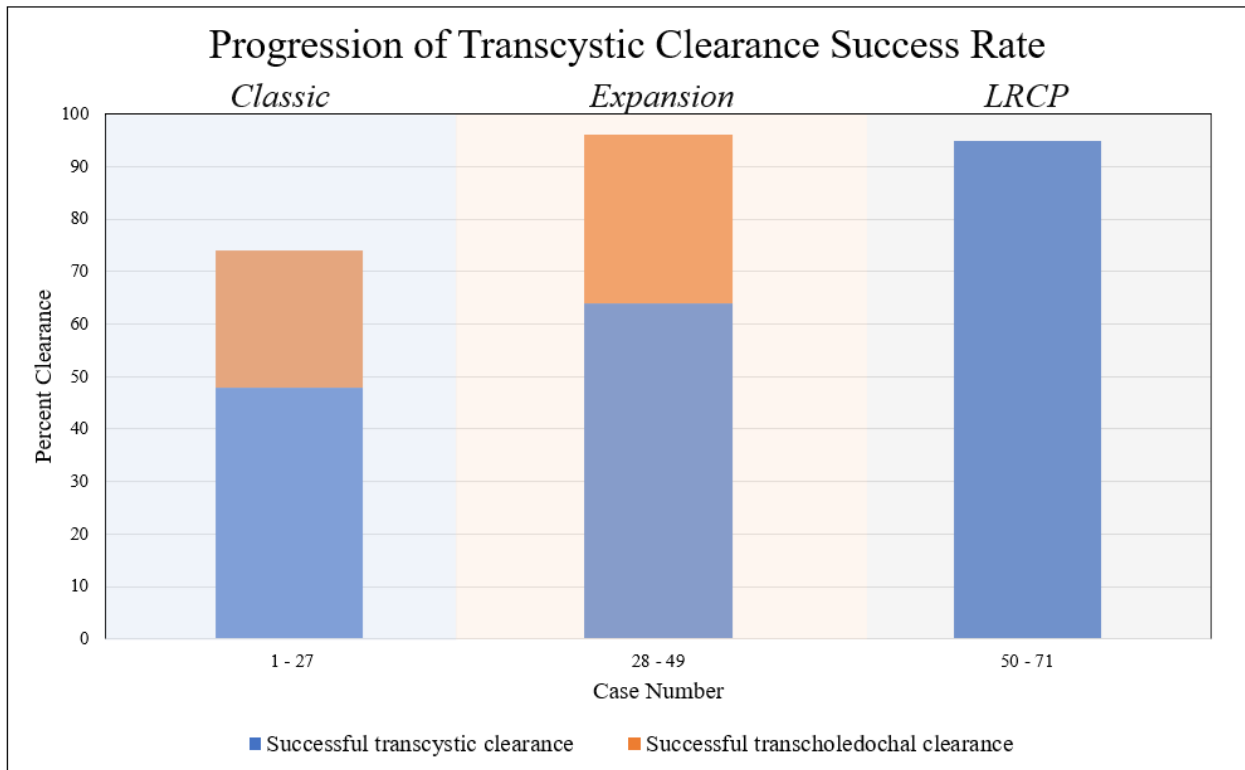


Figure 1: LCBDE cases from July 2014 to January 2023 highlighting the percent of cases with successful transcystic stone clearance as the LCBDE technique evolved. The “classic” phase included cases where cystic duct dilation was performed and had a successful transcystic clearance rate of 48% with 7 transcholedochal cases. The “expansion” phase, in which sphincteroplasty and lithotripsy were introduced, had a successful transcystic clearance rate of 64% with 7 transcholedochal cases. The current era focuses on transcystic antegrade clearance or “laparoscopic reverse cholangiopancreatography (LRCP)” and demonstrates a successful transcystic clearance rate of 95% with no transcholedochal cases.

13. Cong Phan

Eyes with Higher Baseline Cup-to-Disc Ratio (CDR) Might be at Higher Risk for Ocular Hypertension Following Intravitreal Injection of Corticosteroids

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Introduction: Intraocular hypertension is a recognized side effect of intravitreal injections of corticosteroid for treatment of a various conditions including diabetic macular edema, retinal vein occlusion and posterior uveitis. We hypothesize that eyes with higher baseline cup-to-disc ratio (CDR) might be at higher risk for ocular hypertension following intravitreal injection of corticosteroids. The purpose of this study is to evaluate the relationship between the optic nerve's cup-to-disc ratio and the risk for steroid response after intravitreal injection (IVI) of corticosteroids

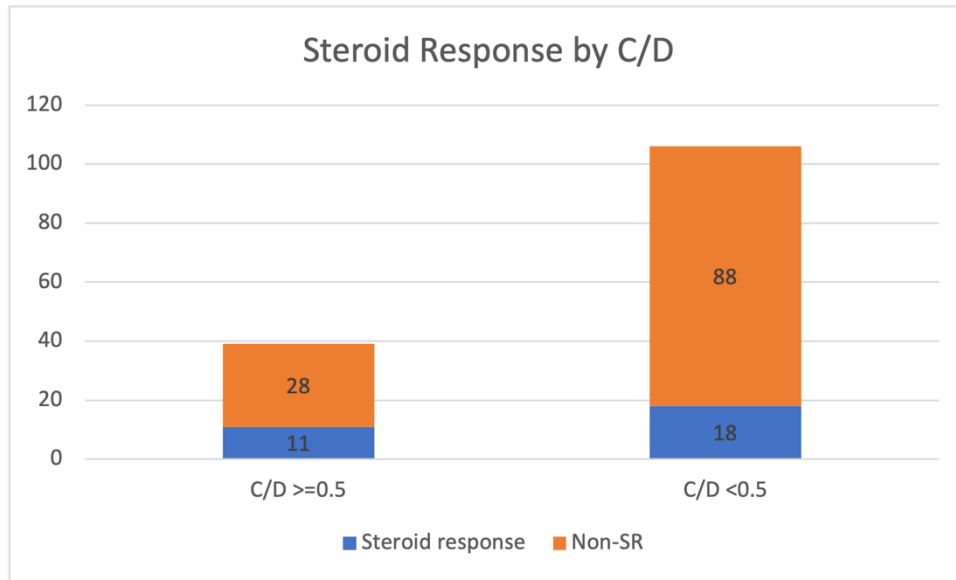
Methods: Retrospective chart review of eyes that underwent treatment with intravitreal corticosteroid injections for various indications. The study eyes were followed for 1 year prior to and 1 year after the first IVI treatment with either triamcinolone acetonide (4mg) or dexamethasone (0.7 mg).

The collected data included baseline CDR on fundus exam, indication for treatment, baseline IOP before IVI and IOP at all follow-up visits for up to 1 year. History of glaucoma, glaucoma suspect, family history of glaucoma, and use of pressure-lowering drops were also recorded. A steroid response was defined as an eye with an IOP of at least 25mmHg or an increase of 10mmHg from baseline during the first year following the injection. CDR between steroid response eyes and non-response eyes were then compared and analyzed.

Results: Among 145 eyes that met the inclusion criteria, steroid response (SR) was found in 20% (29/145) of injected eyes over a mean follow-up period of 12 months. IOP-lowering medication was deemed appropriate for 20.7% (6/29) of these eyes. Mean time to IOP spike was 106.2 days, with a median of 84 days. SR was found in 28.2% (11/39) of patients with CDR \geq 0.5 and in 16.9% (18/106) of patients with CDR < 0.5. Having a CDR \geq 0.5 at baseline was associated with 1.92 times increased odds of developing a steroid response (95% CI 0.81-4.54), ($p= 0.1341$). Rates of steroid response in eyes receiving triamcinolone acetonide and dexamethasone were found to be similar at 19.4% (21/108) and 21.0% (8/38) respectively.

Conclusions: Eyes with CDR \geq 0.5 at baseline might be at higher risk for steroid response and for that reason they should be carefully followed after IVI.

13. Cong Phan



Disease-Specific Patient-Reported Quality of Life After Fenestrated/Branched Endovascular Aortic Aneurysm Repair

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Introduction: Significant advances in technology and technique have facilitated minimally invasive repair of complex aortic aneurysms using fenestrated and branched endovascular devices(F/B-EVAR). This work examined patient-reported quality of life(QOL) in patients that have undergone F/B-EVAR using a survey instrument validated for aortic aneurysm repair.

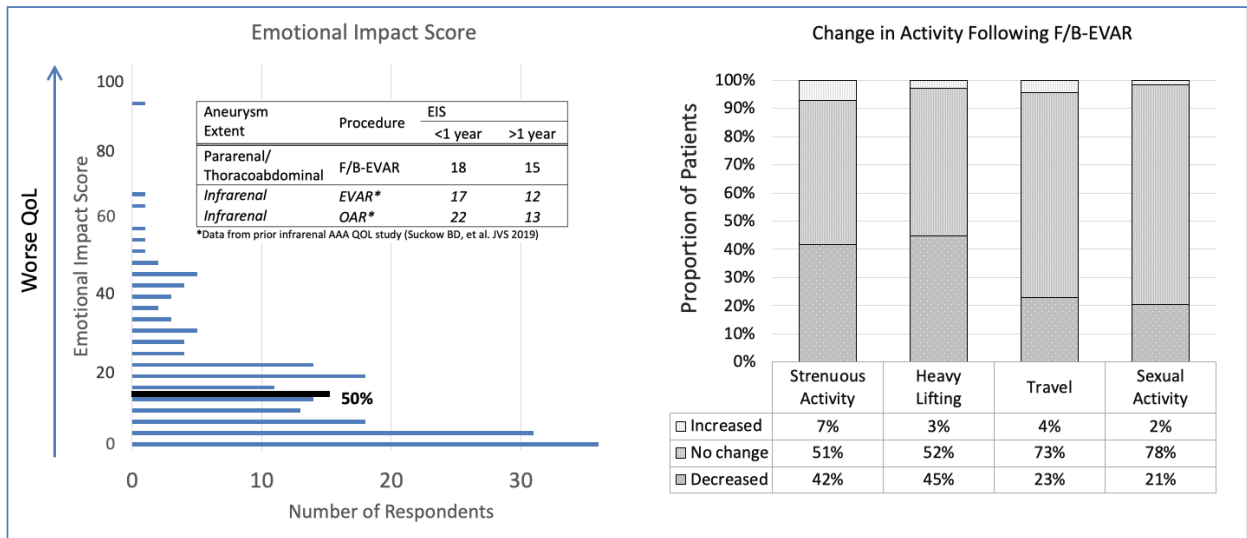
Methods: A prospectively maintained database was used to identify and contact living patients that underwent F/B-EVAR for pararenal or thoracoabdominal aortic aneurysms at two institutions. Eligible patients(n=286) were asked to complete a disease-specific QOL survey previously validated in patients that underwent open(OAR) or endovascular repair(EVAR) for infrarenal abdominal aortic aneurysm. An emotional impact score(EIS) was derived from a subset of survey questions and scored from 0-100 with higher scores indicating more adverse emotional impact and worse QOL. Respondent activity change following F/B-EVAR was evaluated in four activity domains associated with aneurysmal disease.

Results: A total of 216 patients(76%) completed surveys. Mean post-operative interval to survey completion was 3.3(+/-2.7) years. Mean EIS for all patients surveyed was 16(+/-15) with minimally better EIS for patients more than one-year post-F/B-EVAR (15 vs 18). EIS is similar after F/B-EVAR when compared to prior results in patients after infrarenal OAR and EVAR (Figure 1). Within the EIS range(0-96) for this cohort, most respondents demonstrated minimal or no adverse emotional impact after F/B-EVAR. A majority of patients reported no change in activity after F/B-EVAR with only a small portion reporting increase in activity. Over 40% of patients reported decrease in strenuous activity and heavy lifting after F/B-EVAR (Figure 1).

Conclusions: Patients undergoing F/B-EVAR demonstrate similar emotional QOL compared to EVAR, and slightly better emotional QOL compared to OAR. Patients most commonly report unchanged or decreased activity after F/B-EVAR. This study confirms feasibility of use for this disease-specific QOL instrument and prospective use may provide greater insights into the impact of F/B-EVAR on QOL.

14. Aravind Ponukumati

Table I: Emotional impact (left) and change in activity (right) following fenestrated-branched endovascular aortic repair (F/B-EVAR). Legend: QoL (quality of life), EIS (emotional impact score), OAR (open aortic repair), EVAR (endovascular aortic repair).



Call Night Long: The Educational Value of Overnight Call During Surgery Clerkship

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Introduction: Overnight call has become less common for medical student clinical rotations. Duty hour restrictions and concerns regarding the educational utility of overnight call are weighed against potentially greater exposure to trauma, acute and critical care, and preparedness for residency. We sought to characterize the educational scope of the overnight call experience at the surgery clerkship level.

Methods: Self-reports were completed by clerkship level students after each required call shift (4 total) during their surgery rotations. For each patient encounter on call, students were asked to report clinical diagnoses, the student's role in patient care, and one or more learning takeaway. Two independent coders analyzed 757 unique clinical encounters completed by 57 students from January through July 2022 using qualitative content analysis.

Results: Students encountered a diversity of clinical diagnoses; 53.4% of encounters involved core general surgery concepts (hernia, appendicitis, gallbladder disease, trauma), 28.0% critically ill patients, and 23.4% operative cases. For 50.7% of encounters, students reported actively participating in patient evaluations (obtained history and/or conducted physical exam) and performed procedures 17.4% of the time. However, 33.8% of responses indicated purely observational roles or did not specify a clear role. Common themes that emerged from learning takeaways included new insights on surgical vs. medical clinical decision making, imaging interpretation, as well as the importance of triage skills, communication, and multidisciplinary teamwork particularly during encounters with high acuity and complexity.

Conclusions: Overnight surgery call provided exposure to core general surgery experiences for most students. As surgical rotations become more subspecialized, overnight call offers a more uniform exposure to trauma and acute care to augment daytime learning activities. Despite opportunities for involvement in surgeries and procedures, many students' experiences were passive or non-specific. Medical students may require more guidance in understanding appropriate roles to increase the educational merit of overnight call.

