

Division of General Surgery

*37th Annual Resident Research Day*



Friday, April 12<sup>th</sup>, 2024

The Fairmont Hotel Macdonald  
Wedgwood Room



**UNIVERSITY OF ALBERTA**  
**FACULTY OF MEDICINE & DENTISTRY**  
Department of Surgery

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**Christopher M. Schlachta, BSc, MDCM, FRCSC, FACS**

Professor, Department of Surgery  
Professor, Department of Oncology  
Medical Director, CSTAR (Canadian Surgical Technologies & Advanced Robotics)  
Site Chief of Surgery, University Hospital, London Health Sciences Centre



**Dr. Christopher M. Schlachta** is a Professor of Surgery, Division of General Surgery, at the Schulich School of Medicine and Dentistry, Western University. He is also Medical Director of CSTAR and Site Chief of Surgery at University Hospital, London Health Sciences Centre, where his specialty area is minimally invasive gastrointestinal surgery.

A McGill graduate, he trained in General Surgery, Advanced MIS, and Clinical Epidemiology at Western and University of Toronto. He is currently completing the Executive MBA program at Brandeis University in Boston.

A multi-award winner for teaching, Dr. Schlachta also has over 275 peer-reviewed papers and abstracts, 7 textbook chapters, and a textbook. He has received \$13.5 million in research funding and delivered 150 invited talks and visiting professorships.

After serving as President of the Canadian Association of General Surgeons, Chair of the Canadian Surgery Forum, and Governor of the American College of Surgeons, his latest energies have been focused at the Society of American Gastrointestinal and Endoscopic Surgeons (SAGES) where he is Chair of the Technology Council and President-elect. He is also the founding President of SAGES Ingenuity Inc, the for-profit subsidiary of SAGES.

**Erica Lester, MD, MSc, FRCSC**

Clinical Assistant Professor, Surgery  
Division of General Surgery  
Trauma and Acute Care Surgery  
University of Alberta



**Dr Erica Lester** is a Trauma and Emergency General Surgeon practicing at the University of Alberta hospital. She attended medical school at Memorial University of Newfoundland and completed General Surgery training at the University of Alberta. During her General Surgery training she completed a MSc in Health Economics from the London School of Economics, completing thesis work on the cost effectiveness of obesity therapy.

She subsequently completed a Trauma and Surgical Critical Care Fellowship at Cook County Hospital in Chicago. Her clinical practice focuses on Trauma and Acute Care Surgery, while her academic interests pertain to the application of her economics training to various areas in medicine. She collaborates with other clinicians and applied scientists to evaluate the economic impact of new practices and technologies. Dr Lester is particularly focused on health economic literacy in medicine, and is involved in numerous initiatives to increase economic understanding amongst physicians in Alberta.

**Vanessa Fawcett, MD, MSc, FRCSC**

Assistant Clinical Professor, Surgery  
Division of General Surgery  
Trauma and General Surgery  
University of Alberta



**Dr. Vanessa Fawcett** is an Associate Professor in the Department of Surgery at the University of Alberta. She is a General and Trauma Surgeon based out of the Royal Alexandra Hospital.

She completed her general surgery residency at the University of British Columbia; She also completed a Masters of Public Health in Global Health during this time at Harvard. She trained as a fellow in trauma and surgical critical care at Harborview Medical Centre in Seattle.

Dr. Fawcett has a strong interest and presence within Global Health. She collaborates with the College of Surgeons of East, Central and Southern Africa (COSECSA) to provide education and training to physicians and trainees of all levels. Nationally she is an active member of the Canadian Network for International Surgery, and with the Global Health Committee of the Canadian Association of General Surgeons

## Prizes

1 <sup>st</sup> Prize	\$500
2 <sup>nd</sup> Prize	\$400
3 <sup>rd</sup> Prize	\$300
4 <sup>th</sup> Prize	\$200
5 <sup>th</sup> Prize	\$100

## Scoring Criteria

Content	8
Organization	4
Originality	4
Presentation	4
<b>Total</b>	<b>20</b>

## 2023 General Surgery Resident Research Day Winners

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Congratulations to last year's winners:

		<u>Preceptor(s)</u>
1 <sup>st</sup>	<b>Matthew Connell</b> Adequacy of Thromboprophylaxis in Trauma Patients Receiving Standard Versus Updated Dosing of low Molecular Weight Heparin: A Prospective Cohort Study	Dr. Ram Anantha
2 <sup>nd</sup>	<b>Samantha Albacete</b> A 5-Year Characterization of Trends and Outcomes in Elderly Patients Undergoing Elective Bariatric Surgery	Drs. Daniel Birch, Shahzeer Karmali & Noah Switzer
3 <sup>rd</sup>	<b>Uzair Jogiat</b> Changes in Sarcopenia Status Predict Survival Among Patients with Resectable Esophageal Cancer	Dr. Eric Bédard
4 <sup>th</sup>	<b>Kevin Verhoeff</b> Suspension Culture Improves iPSC Expansion and Pluripotency Phenotype	Dr. James Shapiro
5 <sup>th</sup>	<b>Susan Muncner</b> Development of a Canadian Colorectal Robotic Surgery Program: The First Three Years	Dr. Haili Wang

# Research Day Schedule

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0930	Armin Rouhi	Impact of Auto-Islet Transplantation on 30-day Post-Operative Outcomes in Patients Undergoing Total Pancreatectomy: A NSQIP Retrospective Cohort Analysis of 1,101 Patients	<a href="#"><u>9</u></a>
0945	Kieran Purich	A Prospective Canadian Gastric Cancer Database, What We Have Learned	<a href="#"><u>10</u></a>
1000	Daniel Skubleny	Feature-Specific Quantile Normalization and Feature-Specific Mean-Variance Normalization Deliver Robust Bi-Directional Classification and Feature Selection Performance Between Microarray and RNAseq Data	<a href="#"><u>11</u></a>

## 1015 Coffee Break

### Session 1 | Moderator: Dr A Chow

1030	Uzair Jogiat	The Impact of Pre-operative Nutritional Intervention on Post-Operative Morbidity among Sarcopenic Patients Undergoing Esophagectomy: A Prospective Cohort Study	<a href="#"><u>12</u></a>
1045	Meagan Kirkland	Tumour Microenvironment Score but not the Cancer Genome Atlas or Asian Cancer Research Group classification is an Independent Prognostic factor for Disease-Free Survival in Non-Metastatic Gastric Cancer	<a href="#"><u>13</u></a>
1100	Odelle Ma	Environmental Sustainability in the Operating Room: Perspectives and Practice Patterns of General Surgeons in Canada	<a href="#"><u>14</u></a>
1115	Zofia Czarnecka	Evaluating the Safety and Tumorigenicity of Stem Cell-Derived Islet Cells in Immunodeficient Mice	<a href="#"><u>15</u></a>

## Research Day Schedule cont...

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### 1130 Lunch and Group Photos

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1245	Andrea Lin	Pathologic Correlation Required: Assessing the Accuracy of Pelvic Magnetic Resonance Imaging in Rectal Cancer	<u>17</u>
1300	Anna Mierzwa	Does Delaying Emergent Cholecystectomy Affect Outcomes? An Analysis of 46,931 Patients in the NSQIP Database	<u>18</u>
1315	Dunavan Morris-Janzen	Impact of Hypoalbuminemia on Outcomes Following Hepatic Resection: A NSQIP Retrospective Cohort Analysis of 26,394 Patients	<u>19</u>

### 1330 Coffee Break

#### **Session 2 | Moderator: Dr J Hopkins**

1345	Esther Lee	Should we be Performing Cholecystectomies in Octogenarians?	<u>20</u>
1400	Andrea Lin	Operating Room Sustainability Project: Quantifying the Surgical Environmental Footprint for a Laparoscopic Cholecystectomy	<u>21</u>
1415	Susie Muncner	Improving Surgical Care for Rectal Cancer Through the Development of an Automated Artificial Intelligence Algorithm for Magnetic Resonance Imaging Interpretation	<u>22</u>
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### 1445 Adjournment and Closing Statement – Dr. David Bigam





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# **ABSTRACT SESSIONS 1 & 2**

**Modified Brain Injury Guidelines Improve Resource Utilization in a Public Healthcare System****Presented by: Tyrell Wees, PGY-2****Preceptor: Dr. R. Anantha****Category: Clinical**

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**Background:**

The management of traumatic brain injury (TBI) and intracranial hemorrhage (ICH) can be resource-intensive and present considerable challenges in a public healthcare system. The modified Brain Injury Guidelines (mBIG) provide an algorithmic approach to determine which patients need additional computed tomography (CT) scans of the head, neurosurgical consultation, and hospitalization. Although mBIG has demonstrated improved resource utilization in several studies, it has not been evaluated within a publicly-funded healthcare model.

**Hypothesis:**

We sought to determine whether implementation of mBIG at two tertiary-care trauma centres in Canada would reduce repeat imaging and unnecessary neurosurgical consultations, without adverse outcomes.

**Methods:**

We conducted a retrospective review of all adults ( $\geq 18$  years) presenting to two university-affiliated tertiary-care trauma centres in Edmonton with ICH or TBI, between July 1, 2022 and March 31, 2023. Patients were excluded if their initial Glasgow Coma Score (GCS) was less than 13, did not receive a CT head scan, or had focal neurological findings. mBIG score (mBIG 1,2, or 3) was assigned based on imaging and clinical findings on arrival to hospital. Clinical characteristics, including the number of repeat CT scans, neurosurgical consultation, and neurological deterioration in hospital, were evaluated.

**Results:**

We reviewed 911 charts, of whom 322 patients had ICH on imaging. Among this group, 29 (9%) were mBIG1; 62 (19%) were mBIG2; 231 (72%) were classified as mBIG3. Among the 91 patients with mBIG1 or mBIG2 ICH, 66 (73%) received unnecessary neurosurgical consultation, and 50 unnecessary repeat CT scans were performed. There was no neurological deterioration among mBIG1 or mBIG2 patients, and repeat imaging did not change management. A sizeable proportion of patients with ICH may be managed without repeat imaging or neurosurgical consultation, without suffering adverse outcomes. Modified Brain Injury Guidelines (mBIG) are a safe and resource-efficient tool for managing patients with TBI and ICH within a public healthcare system.

**Impact of Auto-Islet Transplantation on 30-day Post-Operative Outcomes in Patients Undergoing Total Pancreatectomy: A NSQIP Retrospective Cohort Analysis of 1,101 Patients**

**Presented by: Armin Rouhi, PGY-2**

**Preceptor: Dr. K. Verhoeff**

**Category: Clinical**

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**Background:**

Total pancreatectomy (TP) offers a surgical option for recurrent and refractory pancreatitis, yet confers substantial long-term morbidity associated with resultant brittle diabetes. While total pancreatectomy with islet auto-transplantation (TPAIT) offers an intuitive solution for these patients, data evaluating its safety have been limited to single-center studies. The aim of this study is to evaluate whether the addition of auto-islet transplantation to TP confers additional post-operative morbidity.

**Hypothesis:**

We hypothesize that auto-islet transplantation does not confer additional post-operative morbidity compared to total pancreatectomy alone.

**Methods:**

This is a retrospective cohort study of prospectively collected cases from the National Surgical Quality Improvement Program (NSQIP) database. Cases of TP with or without auto-islet transplantation from 2016 – 2021 were included. Baseline demographics, and a comprehensive list of 30-day postoperative outcomes were evaluated. Multivariable logistic regression models were constructed to evaluate the impact of each factor on 30-day complications.

**Results:**

A total of 1,101 cases were included with 171 (15.5%) patients undergoing TPAIT. TPAIT patients were younger ( $39.5 \pm 14.1$  vs.  $61.8 \pm 13.0$ ;  $p < 0.0001$ ), and less likely to be ASA class 4 or higher (1.2% vs. 9.0%;  $p = 0.009$ ). TPAIT patients also had lower incidences of diabetes (19.9% vs. 45.7%;  $p < 0.0001$ ) and hypertension (24.6% vs. 52.0%;  $p < 0.0001$ ) at baseline. TPAIT cohort had longer operative times (544.9 minutes vs. 399.8 minutes;  $p < 0.0001$ ), longer length of stay (12.2 days vs. 10.5 days,  $p = 0.001$ ). The overall serious complication rate was higher in the TP cohort (55.3% vs. 45.0%;  $p = 0.013$ ). After adjusting for demographic differences between cohorts using multivariable logistic regression models, auto-islet transplantation was not found to be associated with serious complications (OR 0.66;  $p = 0.064$ ) compared to TP alone.

**Conclusion:**

The results from this study suggest that TPAIT does not appear to be associated with increased 30-day morbidity, and should be considered in patients to mitigate the long-term morbidity associated with diabetes mellitus post TP.

## A Prospective Canadian Gastric Cancer Database, What We Have Learned

**Presented by: Kieran Purich, PGY-4**

**Preceptor: Dr. D. Schiller**

**Category: Clinical**

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### Background:

Minimal literature exists on the outcomes for Canadian patients with gastroesophageal adenocarcinoma (GC). The objective of our study was to establish a prospective clinical database to evaluate demographics, presentation and outcomes associated with GC for patients treated in Edmonton and Northern Alberta.

### Methods:

Patients diagnosed with GC from January 30, 2017 to August 30, 2020 were asked to participate in the study. All patients had adenocarcinoma of the stomach, gastroesophageal (GE) junction or distal esophagus. Data collected included demographics and comorbidities and we explored each patient's clinical course looking at their presentation, diagnosis, treatment and survival. A multivariable model for overall survival (OS) in patients treated with curative intent was created using gender, lymph node status, resection margin status, age and tumor location (GE junction vs. not) as variables. Separate analyses were conducted for the entire cohort (n=122) as well as the subgroup of patients treated with curative intent (n=74).

### Results:

A total of 122 patients with adenocarcinoma of the stomach or GE junction were included. Median age was 65 years (interquartile range [IQR] 59-74), 70% of patients were male and 26% were born outside of Canada. Patients had a median of 127.5 days (65-247) of symptoms prior to diagnosis. Sixty-one patients (50%) had tumors in the distal stomach, 53 (43%) had tumors in the proximal stomach and 8 (7%) had tumors involving the entire stomach. Median follow up time was 14.5 months.

Following staging CT, 88% of patients were deemed to have potentially resectable disease. Eighty-one (76%) received staging laparoscopy. Ultimately only 61% were treated with curative intent surgery. Of those undergoing surgery 47% had a subtotal distal gastrectomy, 38% received total gastrectomy, and 15% had distal esophagectomy. Thirty day surgical mortality was 1%. Forty-six (62.2%) patients had nodal metastases and the median number of nodes harvested was 22 (17-30). Sixty-one patients (82.4%) had R0 resection margins.

Three year overall survival (OS) for patients who received curative intent treatment was 63% and OS was 38% for all patients included in the study. On multivariable analysis, female sex (hazard ratio [HR] 3.88, p=0.01), positive nodal status (HR 3.58, p=0.02), positive margins (HR 3.11, p=0.03) and tumour location (HR 3.00, p=0.03) were associated with decreased overall survival.

This is the first prospective Canadian database for patients with GC. We demonstrate that many of our patients are diagnosed with advanced disease and there is significant delay from symptom onset to diagnosis. Only 61% are able to receive curative intent surgery, but these patients can achieve good long term survival. A prospective national GC database involving multiple centers has now been established.

**Feature-Specific Quantile Normalization and Feature-Specific Mean-Variance Normalization Deliver Robust Bi-Directional Classification and Feature Selection Performance Between Microarray and RNAseq Data**

**Presented by: Daniel Skubleny, PGY-4**  
**Preceptor: Dr. G. Rayat**  
**Category: Clinical**

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Background:

Cross-platform normalization seeks to minimize technological bias between microarray and RNAseq whole-transcriptome data. Incorporating multiple gene expression platforms permits external validation of experimental findings, and augments training sets for machine learning models. Here, we compare the performance of Feature Specific Quantile Normalization (FSQN) to a previously used but unvalidated and uncharacterized method we label as Feature Specific Mean Variance Normalization (FSMVN). We evaluate the performance of these methods for bidirectional normalization in the context of nested feature selection.

Hypothesis:

FSQN and FSMVN cross-platform normalization provides equivalent molecular subtype classification performance.

Methods:

Gene expression data from The Cancer Genome Atlas for colon and breast cancer were retrieved from cBioPortal. Patient samples measured using both RNAseq and gene expression microarray were included. Supervised machine learning classifiers for molecular subtypes in colon and breast cancer were generated using 10-fold nested cross-validation. Model performance was assessed between cross-platform normalization techniques FSQN and FSMVN and compared to within-platform data (i.e. positive control) and  $\log_2$  transformed cross-platform data (i.e. negative control). Differences between groups were assessed using Dunn's test and p-values for multiple comparisons were adjusted using the Holm method.

Results:

FSQN and FSMVN provided clinically equivalent bidirectional model performance with and without feature selection for colon CMS and breast PAM50 classification. Using principal component analysis, we determine that these methods eliminate batch effects related to technological platforms. Without feature selection, no statistical difference was identified between the performance of FSQN and FSMVN of cross-platform data compared to within-platform distributions. Under optimal feature selection conditions, balanced accuracy for FSQN and FSMVN was statistically equivalent to the within-platform distribution performance in multivariable linear regression analysis.

In the context of generating supervised machine learning classifiers for molecular subtypes, FSQN and FSMVN are equally effective. Under optimal modeling conditions, FSQN and FSMVN provide equivalent model performance on cross-platform normalization data compared to within-platform data. Using cross-platform data should still be approached with caution as subtle performance differences may exist depending on the classification problem, training, and testing distributions.

**The Impact of Pre-operative Nutritional Intervention on Post-operative Morbidity among Sarcopenic Patients Undergoing Esophagectomy: A Prospective Cohort Study**

**Presented by: Uzair Jogiat, PGY-3 (CIP)**

**Preceptor: Dr. E. Bédard**

**Category: Clinical**

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**Background:**

Sarcopenia has emerged as a predictor of post-operative complications among patients with esophageal cancer undergoing esophagectomy. The current literature is limited by a lack of prospective studies evaluating the impact of peri-operative nutritional parameters on addressing the association between sarcopenia and adverse clinical outcomes. The objective of this study was to evaluate how peri-operative nutritional interventions effect the association between sarcopenia and adverse clinical outcomes.

**Hypothesis:**

We hypothesize that sarcopenic patients treated with pre-operative nutritional intervention, in the form of a nasogastric feeding tube, will experience a lower rate of anastomotic leak (AL) compared to sarcopenic patients without feeding tube placement.

**Methods:**

A prospective cohort of patients with esophageal cancer undergoing tri-modality therapy was created from November, 2019 to February, 2024. Body composition parameters from the staging scan and the post-neoadjuvant re-staging scan were measured, and sarcopenia was defined as  $52.4 \text{ cm}^2/\text{m}^2$  in males and  $38.5 \text{ cm}^2/\text{m}^2$  in females. Baseline clinical characteristics, oncologic data, operative characteristics, and 30-day morbidity and mortality were prospectively collected. Nutritional data collected included weight change over time, pre-operative albumin, clinical history of dysphagia and weight loss, date and duration of pre-operative feeding tube, and duration of post-operative jejunostomy feeding. A multivariable logistic regression model was developed to determine the effect of peri-operative nutritional and clinical variables on the development of AL.

**Results:**

In total, 140 patients were included. Sarcopenia was present among 79 (56.43%) patients at the staging scan and 103 (73.57%) patients at the re-staging scan after neoadjuvant chemoradiation. There was no significant difference in the proportion of sarcopenic patients by pre-operative feeding tube status ( $p = 0.743$ ). Of the cohort, 48 (34.29%) received a pre-operative feeding tube. There was no significant difference in weight loss ( $p = 0.386$ ) or SMI loss ( $p = 0.150$ ) by pre-operative feeding tube status. In the overall cohort, sarcopenia at the staging CT was associated with increased odds of AL (2.89 95% CI 1.19-7.00,  $p = 0.019$ ). Strata-specific estimates by pre-operative feeding tube status demonstrated that sarcopenic patients who did not receive a pre-operative feeding tube had increased odds of AL compared to those who did (OR 3.60 95% CI 1.20-10.83,  $p = 0.023$  vs. OR 1.89 95% CI 0.42-8.43,  $p = 0.405$ ). This was sustained on multivariable analysis (OR 3.93 95% CI 1.20-12.86,  $p = 0.024$  vs. OR 2.74 95% CI 0.67-11.19,  $p = 0.237$ ) adjusting for anastomosis type (neck vs. chest; OR 4.90 95% CI 1.80-13.34  $p = 0.002$ ) and hypoalbuminemia (OR 3.7 95% CI 1.01-9.33).

**Tumour Microenvironment Score but not the Cancer Genome Atlas or Asian Cancer Research Group Classification is an Independent Prognostic Factor for Disease-Free Survival in Non-Metastatic Gastric Cancer**

**Presented by: Megan Kirkland, PGY-1**

**Preceptor: Dr. D. Schiller**

**Category: Clinical**

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Background:

Molecular classification in gastric cancer has identified relevant disease heterogeneity with prognostic implications. However, limited comparative analysis of molecular classification systems has occurred. We assessed the effect of the Tumour Microenvironment Score (TME), the Cancer Genome Atlas (TCGA) and Asian Cancer Research Group (ACRG) classification systems on disease-free survival (DFS) in non-metastatic gastric cancer patients.

Hypothesis:

Integrated molecular classification in gastric cancer provides an independent prognostic factor for disease free survival in stage I-III gastric adenocarcinoma.

Methods:

Previously characterized machine learning models were created for TCGA, ACRG and TME classes using 10-fold nested cross validation. Each patient in the ACRG and TCGA datasets were assigned molecular classes using these models. DFS in stage I-III patients was assessed using univariable and multivariable Cox Proportional Hazards models. Sensitivity analyses were performed to assess the strength of effects to confounders.

Results:

Mean model classification accuracy was 89.5% (TCGA), 84.7% (ACRG) and 89.3% (TME). Similar proportions of TCGA, ACRG and TME molecular classes were present between TCGA and ACRG cohorts (Chi-squared test,  $p > 0.05$ ). The proportion of TME high tumours was greatest for TCGA microsatellite instability high (MSI-H) (70%), ACRG MSI-H (67%) and TCGA Epstein-Barr virus type (64%). In mesenchymal type tumours such as ACRG epithelial-mesenchymal-transition and TCGA genomically stable, TME high was present in 3.1% and 0% of tumours, respectively. Using available data for 454 gastric cancer patients and 135 DFS events, only TCGA MSI (Hazard Ratio (HR) 0.54 [95% CI 0.30, 0.97];  $p < 0.05$ ) and TME High (HR 0.29 [95% CI 0.16, 0.52];  $p < 0.001$ ) were statistically significant factors in univariable models. In a multivariable Cox model including TCGA, ACRG and TME subtypes, only a high TME score was associated with improved DFS (HR 0.22 [95% CI 0.11, 0.45];  $p < 0.001$ ). The significant effect of TME high score was maintained after sensitivity analysis that adjusted for stage, age, sex, chemotherapy, radiation, tumour location, and study (TME High HR 0.36 [95% CI 0.18, 0.74];  $p < 0.01$ ).

In an integrated analysis comparing TCGA, ACRG and TME scores, a high TME score is the only independent molecular prognostic factor for DFS in non-metastatic gastric cancer. Additional investigation into implications of the heterogeneity of the TME score relative to the TCGA and ACRG classifications may yield additional insight into gastric cancer biology and treatment.

**Environmental Sustainability in the Operating Room: Perspectives and Practice Patterns of General Surgeons in Canada**

**Presented by: Odelle Ma, PGY-3**  
**Preceptors: Drs. S. Karmali & D. Bigam**  
**Category: Clinical**

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**Background**

The aim of this study is to explore the current perspectives of Canadian general surgeons on environmental sustainability and to examine surgical choices in the operating room (OR) that may impact sustainability.

**Methods**

A list of Canadian general surgeons was generated using publicly available national and provincial databases. An anonymous survey was electronically distributed in August 2023 to all practicing general surgeons in Canada using Qualtrics XM. The survey was closed in January 2024. Basic demographic data was collected including year and country of medical school graduation, age, gender, subspecialty, and academic versus community practice. The survey contained open-ended and 5-point Likert scale type questions pertaining to attitudes on environmentalism, barriers to sustainability in the OR and specific practice preferences (as they relate to sustainability) when performing a laparoscopic cholecystectomy. Statistical analyses were conducted using Stata and open-ended responses were analyzed thematically.

**Results**

Early results include 100 surgeon responses spanning 11 provinces and territories. 63% of respondents are male, 61% graduated after 1999, 87% are Canadian medical graduates and 50% operate primarily in a community setting. Of the 91 surgeons who routinely perform laparoscopic cholecystectomies in practice, 59 of 91 (65%) respondents reported always using disposable gowns, 69 (76%) always use disposable drapes, and 70 (77%) always use disposable square-offs. 45 respondents (49%) reported using disposable laparoscopic ports at least some of the time. The most frequently selected reason for use of disposable items was a lack of other options. 54 respondents (59%) reported having reusable ports always available at their hospital, while only 14 (15%) reported having reusable drapes always available and only 25 (27%) reported having reusable gowns always available. The majority of respondents strongly agreed that there is room to improve sustainability in the OR in their own practice (70%) and across Canada (84%). 39% of respondents would be somewhat willing to choose more sustainable alternatives even if it increased OR time by up to 30 minutes. 55% would be somewhat willing even if it increased OR cost by 1.25x.

**Conclusions**

Early results suggest that Canadian general surgeons agree that OR sustainability is an area that needs improvement and have made efforts to try to reduce waste. However, there is also shared sentiment among surgeons that sustainability needs to be addressed at a systemic level through national guidelines to impact meaningful and lasting change.



**Evaluating the Safety and Tumorigenicity of Stem Cell-Derived Islet Cells in Immunodeficient Mice****Presented by: Zofia Czarnecka, PGY-3****Preceptor: Dr. J. Shapiro****Category: Basic**

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**Background:**

Type 1 Diabetes (T1D) is characterized by the autoimmune destruction of insulin-producing pancreatic  $\beta$ -cells. If poorly controlled, fluctuating glucose levels can lead to end-stage complications of renal failure, vascular and heart disease, with early mortality. The Edmonton Protocol, developed in 2000, revolutionized islet cell transplantation for T1D. However, it is limited by donor islet cell supply and the need for chronic immunosuppression. A new direction of study has emerged with the use of induced pluripotent stem cells (iPSCs) which, if autologous, could potentially be transplanted without immunosuppression. iPSCs are differentiated into islet-like cells through a six-stage process. Cellular heterogeneity remains a challenge across all stages of differentiation leading to off-target cell populations forming tumors and cysts after transplantation. Before considering human clinical trials, further work is needed to understand the *in-vivo* growth of off-target cell populations.

**Hypothesis:**

We hypothesize that with more efficient early differentiation in the pancreatic progenitor stage, stage 4 (S4), we will generate fewer off-target cells upon maturation to SC-islets, in stage 6 (S6). Enriched S6 cells will likely form fewer and more manageable microscopic cysts without the risk of teratogenicity. Furthermore, the microvascular environment at different transplant sites may impact the frequency, size and formation of tumors or cysts across pancreatic progenitor and mature islet stages.

**Methods:**

iPSCs derived from a non-diabetic patient were expanded in PBS Vertical Wheel® bioreactors and differentiated to S4 and S6. At both stages, proteomic marker expression was confirmed using flow cytometry. Cells were transplanted into immunodeficient SCID beige mice in the following sites: kidney capsule, portal vein, subcutaneous tissue, epididymal fat pad, and omentum. Mice were tested for intraperitoneal glucose tolerance (8 and 12 weeks). Serum samples were analyzed for the presence of human C-peptide. At 12 weeks post-transplant (wpt), grafts were harvested and assessed for histology to characterize endocrine maturation and off-target growth.

**Results:**

87.5% (14/16) of S6 transplanted mice and 75.0% (9/12) of S4 transplanted mice survived to endpoint. Our pilot study demonstrates that iPSC-derived S4 cells result in large cystic and teratogenic growths in 100% of mice transplanted under the kidney capsule (n=3) and omentum (n=3) and 50% of mice transplanted at the epididymal fat pad (n=2). The graft was visualized at 12 wpt in all 9 mice. Preliminary histological analysis suggests the presence of non-endocrine tissue formation with retinal, gastric, alveolar, and intestinal tissue types seen. IHC staining for endocrine markers INS, GCG, CHGA is pending along with off target markers CDX2, SOX9 and pluripotency markers OCT4 and SOX2. Staining will also be performed for CD31 to assess vascularity of grafts. Intraportal S4 cell infusion resulted in fatty liver pathology with no apparent cystic or tumor growth (n=2). There was no detectable human C-peptide at 8 weeks post-transplant, however at 12 wpt measurable C-peptide (4-10 pmol) was detected in all mice, irrespective of transplant site confirming *in-vivo* maturation of the transplanted cells. S6 cell implantation demonstrated minimal simple cyst formation in only 21.4% (3/14) of surviving mice at 12 wpt (kidney capsule (n=2) and omentum (n=1)). However, mice

transplanted with S6 cells did not secrete human C-peptide, suggesting that S6 cells did not survive post-transplantation. Further work is underway to optimize late stages of differentiation to improve graft survival.



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# **ABSTRACT SESSIONS 3 & 4**

**Establishment of a National Surgical Tissue Biobank for Pediatric Crohn's Disease in Canada****Presented by: Paul Lerner, PGY-3****Preceptor: Dr. T. Perry****Category: Basic**

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**Background:**

Crohn's disease (CD) is a lifelong gastrointestinal inflammatory disease that often requires surgery, especially when patients are diagnosed in childhood. The pathophysiology and etiology involves an interplay of genetics, the immune system and the enteric microbiome. Consequently, a comprehensive research approach combining analysis of clinical data with tissue analysis to profile alterations in the gene expression, immune cell function, and the microbiome is required. Each pediatric surgical center in Canada averages very few CD resections per year, so a multicenter collaborative national biobank is an ideal platform to conduct this research.

**Objectives:**

We provide a framework for establishing a surgically-oriented biorepository, sharing our experience in developing ethical, logistical, and bench science structures and protocols. Preliminary findings are presented from bulk RNA sequencing as an example of potential biobank-based research applications.

**Methods:**

Ethics for surgical biobanking were an extension of the Canadian Children Inflammatory Bowel Disease Network (CIDsCaNN). Pediatric surgeons from 10 children's hospitals across Canada were trained virtually, assisted by videos on tissue collection, handling, and shipping. Inclusion criteria include diagnosed CD, scheduled intestinal resection, age 5-17.2 at the time of surgery, and CIDsCaNN consent. Exclusion criteria include acute intra-abdominal sepsis and IBD with a known monogenic cause. Full-thickness bowel, mesenteric fat, and lymph nodes are collected in the OR and fixed in formalin and RNAlater. National overnight shipping protocols were developed so that tissue collected at any site is processed and analyzed consistently in Edmonton. Detailed surgical, perioperative, hospitalization, and postoperative medical treatment data are collected. Pediatric CD activity scores, anthropometry and biomarkers will be collected at specified intervals with scheduled postoperative endoscopic assessment and intestinal US at sites with this capability. Similar data will be collected at time of flares.

**Results:**

Tissue was collected from 10 patients in Edmonton as proof-of-concept prior to national launch in 2023. Between November 2023 and January 2024, tissue was collected from five patients (2 sites) and analyzed in Edmonton. Using bulk RNA sequencing on 9 of the first 10 patients, 560 genes were identified that discriminate between inflamed and non-inflamed bowel. Reactome analysis implicates upregulation of several anti-inflammatory pathways in the inflamed bowel.

**Conclusions:**

Development of a national biobank for surgically resected pediatric CD is feasible with careful planning, stepwise development of protocols, and coordination of multidisciplinary multicenter collaboration. Preliminary bulk RNA sequencing analysis comparing inflamed and non-inflamed bowel demonstrates the potential for promising research using this biobank.

**Pathologic Correlation Required: Assessing the Accuracy of Pelvic Magnetic Resonance Imaging in Rectal Cancer**

**Presented by: Andrea Lin, PGY-3**

**Preceptor: Dr. H. Wang**

**Category: Clinical**

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**Background:**

Local staging of rectal cancer relies on pelvic magnetic resonance imaging (MRI). Over-staging could mean unnecessary neoadjuvant radiation with long-term consequences. Under-staging could result in higher risk of local recurrence, or an unexpected need for adjuvant therapy. Post-operative radiation has higher risk of long-term complications than neoadjuvant radiation. At our center, most rectal cancer MRIs are reviewed at Multidisciplinary Tumour Boards (MTB) before a final decision is made between proceeding directly to surgery or first to neoadjuvant therapy.

**Hypothesis:**

We compared the T and N stage of the initial MRI interpretation, MTB MRI review, and final surgical pathology to evaluate preoperative staging accuracy.

**Methods:**

This was a cross-sectional study of patients with rectal cancer who underwent elective oncologic rectal cancer surgery at a single center between November 2018 and February 2023 who either went straight to surgery or received neoadjuvant short course radiation therapy followed closely with surgery.

**Results:**

Forty-nine patients were included in our study. Six patients received surgery without MTB review. 33% (2/6) of these patients were upstaged after surgery and received adjuvant therapy.

Eighteen patients received surgery without neoadjuvant therapy. 50% (9/18) had congruent MTB and pathology results, 33% (6/18) were upstaged post-operatively and referred for adjuvant therapy, and 17% (3/18) had a lower pathologic stage than MTB staging.

Twenty-five patients underwent short-course neoadjuvant radiation followed by surgery. 32% (8/25) of patients had congruent MRI and pathology readings. 32% (8/25) were upstaged post-operatively and received adjuvant therapy. 36% (9/25) were downstaged after surgery, with 7 receiving unnecessary radiation. In 9/17 patients with congruent MRI and pathology evaluations, MTB changed the patient to the correct management.

**Conclusion**

57% (28/49) of patients undergoing rectal cancer surgery had significant discrepancies between their pre-operative radiographic staging and post-operative pathologic staging. In 45% (22/49) of patients, this resulted in unnecessary neoadjuvant therapy or unplanned adjuvant therapy. 12% (6/49) of patients had incongruencies but still received the correct overall management. Strategies to improve the accuracy of pre-operative MRI interpretation would be beneficial in improving patient care and outcomes in rectal cancer.

## **Does Delaying Emergent Cholecystectomy Affect Outcomes? An Analysis of 46,931 Patients in the NSQIP Database**

**Presented by: Anna Mierzwa, PGY-5**

**Preceptor: Dr. J. Shapiro**

**Category: Clinical**

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### Background:

Delaying emergent cholecystectomy (EC) for cholecystitis beyond 3 days after admission has been shown to increase morbidity and mortality. However, the impact of each day of delay has not been studied. It is also unclear whether this trend is true for other diagnoses that require EC.

### Hypothesis:

To evaluate the outcomes of patients undergoing EC for cholecystitis or biliary obstruction on post-admission day 0 through 5.

### Methods:

Patients undergoing urgent/emergent laparoscopic cholecystectomy for any indication from 2016 to 2021 were identified in the NSQIP database. Patients were grouped based on their delay to surgery. Standard demographics, risk factors, and outcomes were extracted. Multivariate modelling identified factors associated with delayed discharge, serious complications, and mortality. Subgroup analysis of patients with cholecystitis and biliary obstruction was completed.

### Results:

Overall, 46,931 patients were included. The average age was  $50.0 \pm 18.2$  and 63.1% were female. Most patients were ASA 2 (52.4%) or 3 (33.5%). A delay to surgery of 0-5 days was observed in 39.5%, 33.8%, 13.8%, 7.3%, 3.6%, and 2.0% of patients, respectively. Most patients had a diagnosis of cholecystitis (77.7%), with fewer having choledocholithiasis (10.7%) and gallstone pancreatitis (5.5%). Patients with longer delays to surgery were more likely to be comorbid (ASA 3/4 31.8% at 0 days vs. 55.8% at 5 days;  $p < 0.001$ ). Outcomes demonstrated increased operative time (75.7 minutes at 0 days vs. 85.6 minutes at 5 days;  $p < 0.001$ ), length of stay (1.4 days at 0 day vs. 2.5 days at 5 day;  $p < 0.001$ ), and serious complications (7.7% at 0 days vs. 14.2% at 5 day;  $p < 0.001$ ).

Delay to surgery was an independent predictor of serious complications (OR 1.46;  $p = .001$ ) and mortality (OR 2.04;  $p = .045$ ) after 5 day but not after a 1-4 day delay. However, subgroup analysis of patients with cholecystitis demonstrated that even a 1-day delay was associated with serious complications (OR 1.11;  $p = 0.032$ ) with an increasing effect size following longer delays (OR 1.77 at 5 days;  $p < 0.001$ ). A delay of 4 (OR 3.07;  $p = 0.005$ ) or 5 (OR 3.91;  $p = 0.003$ ) days was associated with increased mortality. Conversely, delay to surgery had no impact on serious complications or mortality in patients with biliary obstruction.

**Impact of Hypoalbuminemia on Outcomes Following Hepatic Resection: A NSQIP  
Retrospective Cohort Analysis of 26,394 Patients**

**Presented by: Dunavan Morris-Janzen, PGY-1**  
**Preceptor: Drs. J. Shapiro, D. Bigam, K. Dajani, B. Anderson**  
**Category: Clinical**

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**Background:**

Efforts to preoperatively risk stratify and optimize patients before liver resection allow for improvement in postoperative outcomes, with hypoalbuminemia being increasingly researched as a surrogate for nutrition, overall health and functional status. Given the lack of studies of this important factor in this population, this study aims to determine the impact of hypoalbuminemia on outcomes following liver resection using a large multicenter database.

**Methods:**

The American College of Surgeons-National Surgical Quality Improvement Program (2017-2021) database was used to extract patients who underwent hepatic resection, comparing those with hypoalbuminemia (<3.0 g/L) to those with normal albumin. Baseline characteristics and 30-day postoperative complications were compared between the two cohorts. Multivariable modeling evaluated factors including hypoalbuminemia to characterize their independent effect on serious complications and mortality.

**Results:**

We evaluated 26,394 patients who underwent liver resection with 1,347 (5.1%) having preoperative hypoalbuminemia. Patients with hypoalbuminemia were older (62.3 vs 59.8;  $p<0.001$ ) and were significantly more likely to be of ASA class 4 or higher (13% vs. 6.5%;  $p<0.001$ ). Patients with hypoalbuminemia had significantly more complications such as increase length of stay, readmission, reoperation, sepsis, surgical site infection, bile leak and transfusion need. After controlling for demographics and comorbidities, hypoalbuminemia remained a significant independent predictor associated with 30-day serious complications (OR 2.93 [CI 95% 2.36-3.65,  $p<0.001$ ]) and mortality (OR 2.15 [CI 95% 1.38-3.36,  $p=0.001$ ]).

**Discussion:**

In this large, retrospective database analysis, preoperative hypoalbuminemia was significantly associated with 30-day morbidity and mortality following hepatic resection. Preoperative albumin may serve as a useful marker for risk stratification and optimization. Future studies should consider the risk mitigation impact of prehabilitation in these patients and mechanisms to improve outcomes in this high risk cohort.

## Should we be Performing Cholecystectomies in Octogenarians?

Presented by: Esther Lee, PGY-3

Preceptors: Drs. D. Bigam, J. Shapiro, K. Dajani & B. Anderson

Category: Clinical

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### Background:

Perioperative risks in geriatric patients are much higher, which is a serious consideration given our aging population. Surgeons are faced with the challenges of weighing the risk and benefits of life-saving emergency surgeries for the geriatric patients. We studied the association of age and common comorbidities on the perioperative risk for cholecystectomy, one of the most common emergent general surgical procedures performed.

### Hypothesis:

We hypothesized that age would be associated with increased risk for death and serious post-operative complications, independent of other comorbidities.

### Methods:

A retrospective cohort study was performed using a 5-year data on cholecystectomy, extracted from National Surgical Quality Improvement Program. The data included perioperative data including 30 days post op from over 600 sites worldwide. The cohort of interest was defined to be patients aged greater than or equal to 80 (“octogenarians”). Other factors of interest included in analysis were patient demographics, operative factors, and patient comorbidities. A multivariable logistic regression model was used to test the association of these factors on the risk of mortality or serious complications. Serious complications were defined to include any of the following within 30 days of the patient’s operation: unplanned intubation, PE, ARF, stroke, CPR, MI, reoperation, significant bleeding requiring transfusion, septic shock, persistent admission beyond 30 days.

### Results:

Cholecystectomy data from 288,705 patients were included in the study. 4.9% of these patients were octogenarian with their mean age at 84.2. Unsurprisingly, the octogenarians were more likely to have associated comorbidities, higher functional dependence, and lower BMI. Octogenarians were more likely to receive open cholecystectomies, and they had longer operative time and hospital stay. They were also more likely to be readmitted or have a re-operation. Furthermore, they had higher rates of developing serious complications post op. Multivariable logistic regression demonstrated that being an octogenarian alone was independently associated with increased risk of mortality (OR 3.29, CI 2.70-4.01) and serious complications (OR 1.54, CI 1.42-1.67) after cholecystectomy. Notably, for octogenarians, a minimally invasive surgical approach was significantly protective against serious complications (OR 0.20; CI 0.20-0.24) and mortality (OR 0.31; CI 0.25-0.38). This data suggests that simply being an octogenarian, regardless of the patient’s associated health status, increases the perioperative risks. For these high-risk patients, the importance of minimally invasive approaches to reduce risks should be highlighted.

## **Operating Room Sustainability Project: Quantifying the Surgical Environmental Footprint for a Laparoscopic Cholecystectomy**

**Presented by: Andrea Lin, PGY-3**  
**Preceptors: Drs. D. Bigam & S. Karmali**  
**Category: Clinical**

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### Introduction

Operating rooms (ORs) generate significant greenhouse gas (GHG) with a significant portion due to surgical equipment. Surgical carts for common operations are typically based on a standard list that can be modified to surgeon preferences. The carts include preferred surgical items and whether they should be opened in advance versus opened during the case upon surgeon request. Items opened in advance are disposed or sterilized post-procedure, even if not used, resulting in excess GHG emissions. Presently, there is a lack of comprehensive, site-specific data to quantify the extent of GHG emissions related to surgical equipment for common OR procedures at our center. This knowledge gap hinders efforts to implement sustainable practices in the OR.

### Objective

We endeavored to quantify average GHG emissions associated with the generation, disposal, and sterilization of surgical equipment for a laparoscopic cholecystectomy. We then compared the average versus a minimal laparoscopic cholecystectomy case cart at two tertiary surgical centers to identify opportunities to reduce amount of unused, open equipment for each laparoscopic cholecystectomy and decrease the overall carbon footprint for this procedure.

### Methods

Itemized lists for each surgeon's cart for a laparoscopic cholecystectomy at the Royal Alexandra Hospital (RAH) and University of Alberta Hospital (UAH) in Edmonton, Alberta were obtained. Each item was weighed on a digital scale in kilograms (kg). Items were then sorted into "open" if they were to be opened in preparation for the case or "as needed" if they were to be opened mid-case, if needed. Each item was additionally classified into "disposable" or "reusable", with "disposable" items further classified into the material they are predominantly composed of. Upstream and downstream GHG emissions for each disposable and reusable item were calculated by multiplying the weight of the item by the coefficient of emission assigned to each material. A minimal case cart for a laparoscopic cholecystectomy was created based off staff expertise from both hospitals. The coefficient of emissions were then compared between the average surgeon's cart at each site and the minimal cart.

### Results

18 case carts from the UAH and 15 case carts from the RAH were analyzed. The case cart with the lowest calculated GHG emissions of "open" items had a total consumption value of 21.7 kgCO<sub>2</sub>/tonne (t) and the highest had a value of 31.9 kgCO<sub>2</sub>/t. The mean value of the "open" items was 25.3 kgCO<sub>2</sub>/t at the UAH and 28.0 kgCO<sub>2</sub>/t at the RAH. Disposable items comprised 60% of "open" items at both sites. The calculated GHG emissions of the "open" items of the minimal cart was 10.9 kgCO<sub>2</sub>/t, with disposable items comprising 32%.

### Conclusion

There is great variance among surgeons at RAH and UAH in the amount of surgical equipment opened pre-operatively in laparoscopic cholecystectomy procedures, some of which goes unused. The calculated GHG emissions related to surgical equipment from the average surgeon's cart is higher than the minimal

surgeon's cart created. We suggest that increasing surgeon awareness about the contents of their case cart opened pre-operatively would decrease the overall amount of equipment-related GHG emissions from the OR.



## **Improving Surgical Care for Rectal Cancer Through the Development of an Automated Artificial Intelligence Algorithm for Magnetic Resonance Imaging Interpretation**

**Presented by: Susie Muncner, PGY-2**  
**Preceptors: Drs. H. Wang & J. Jaremko**  
**Category: Clinical**

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### Background:

Pelvic magnetic resonance imaging (MRI) is the preferred method for characterizing rectal cancer (RC) stage. Accurate evaluation of stage is critical for treatment decision making. Inaccurate preoperative staging may lead to increased complications if patients receive unnecessary treatment or conversely, do not receive appropriate treatment. Assessing pelvic MRI can be challenging; expertise in reading these MRIs is scarce and interpretations vary widely. However, review by two trained interpreters can improve diagnostic precision. Multidisciplinary team (MDT) meetings are an accepted ‘gold standard’ for RC care. At the University of Alberta Hospital (UAH), most RC MRIs are reviewed at MDT tumour boards, where discussion may lead to changes in MRI interpretation and treatment decisions. A preliminary review of 49 robotic RC patients at the UAH showed 57% (n=29) had significant discrepancies between preoperative MRI and post-operative pathologic staging. Of those, 49% received unnecessary neoadjuvant therapy or unplanned adjuvant therapy. Thus, strategies to improve MRI interpretation at our centre will improve patient care. Artificial intelligence (AI) has been applied successfully in the interpretation of a variety of imaging modalities, including RC MRI. However, incorporating AI imaging interpretation at MDT boards has not yet been demonstrated. Integrating an automated AI algorithm as an additional imaging interpreter for MDT meetings could help mitigate discrepancies, ease decision making and ultimately, improve patient outcomes.

### Hypothesis:

We hypothesize that RC patients from November 2018 – 2023 who went straight for surgery or short course neoadjuvant at the UAH whose MRIs were inaccurately staged pre-operatively experienced significantly more adverse outcomes than patients with accurate MRI staging. Further, we hypothesize that an automated AI algorithm will be able to interpret and stage RC MRI with similar or improved accuracy in comparison to human expert interpretation.

### Methods:

This multiphase study focused on improving RC care at UAH by implementing an automated AI algorithm at MDT boards will be conducted from July 1, 2024 to June 30, 2026. The established colorectal robotic surgery database will be employed for this study. Initially, a retrospective review of RC patients who went directly for surgery or short-course radiation from Nov 2018 – 2023 will be conducted, including patient outcomes. Then, an automated AI algorithm will be validated using this retrospective MRI data. Lastly, a prospective trial will include all new RC patients at the UAH whose treatment includes direct surgery or short-course radiation.

### Results:

Preliminary results from initial AI algorithm development show AI is capable of visually appropriate identification of rectal mucosal and serosal borders and rectal cancer tumor masses on selected 2D images, confirming feasibility and providing labeling data for us to proceed to further automate MRI analysis.

**Comparison of Minimally Invasive Versus Open Pancreaticoduodenectomy in Obese Patients, a NSQIP Analysis**

**Presented by: Natalie Gugala, PGY-1**  
**Preceptors: Drs. J. Shapiro, B. Anderson, D. Bigam, & K. Dajani**  
**Category: Clinical**

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Background:

Minimally invasive surgery (MIS) is often advocated for in obese patients as a safer alternative. There has been increasing interest in MIS pancreaticoduodenectomy, however, limited evidence exists in patients with obesity. As such, this study aims to compare the postoperative outcomes of MIS versus open pancreaticoduodenectomy in obese patients.

Hypothesis:

The National Surgical Quality Improvement Program database was used to compare the outcomes for patients who underwent a pancreaticoduodenectomy between 2017-2021. Patients with BMI  $\geq 35$  were included and divided into open and MIS cohorts. Baseline characteristics and outcomes were compared using a bivariate analysis, whereas factors associated with 30-day serious complications and mortality were identified using multivariate logistic regression. A propensity matching analysis was also completed.

Methods:

In this study, 1859 patients were included, with 1785 undergoing open and 74 undergoing MIS pancreaticoduodenectomy. Only patients with congestive heart failure were more likely to undergo MIS. Open surgery was associated with decreased operative time (392min vs. 474min,  $p < 0.001$ ). Multivariate analysis revealed similar likelihood of serious complications (OR 1.11;  $p = 0.760$ ) and mortality (OR 2.54;  $p = 0.176$ ) for patients undergoing MIS compared to open pancreaticoduodenectomy. Propensity matched analysis further supported these results MIS procedures having longer operative duration (+86.6 minutes;  $p < 0.001$ ), but with similar rates of serious complications, comprehensive complication index, and mortality.

Results:

For patients with BMI  $\geq 35$ , MIS pancreaticoduodenectomy does not significantly decrease the 30-day serious complication or mortality rate. Results should be contextualized in the setting of a learning curve and ongoing studies will be required to better characterize populations who may benefit from MIS approaches in the future.

# General Surgery Alumni

## 1988

David Callahan  
Norman Causton  
Owen Heisler  
Ciaran McNamee

## 1989

Mark Cattral  
Harold Chyczij  
Robert Hagerman  
David Sigalet  
Gary Soenen

## 1990

Don Buie  
Gary Gelfand  
Franco Leoni  
Michael Meier  
John Urschel

## 1991

Wojciech Brzezinski  
Kelly Dabbs  
Lawrence Farries  
William Sanden

## 1992

Abdulaziz Al-Baradai  
Faiz Daudi  
Neil MacEachern  
Douglas May  
Katherine McCuaig

## 1993

Paul Hardy  
Helen MacRae  
Douglas Matheson  
Carole Spread

## 1994

Saud Al-Jadaun  
Winston Chan  
Deepak Katyal  
Grant O'Keefe  
Walter Yakimets

## 1995

Antony Gomes  
Andrew Graham  
James Okamura  
Robert Turnbull  
Michael Willerth  
Emmanuel Rozenthal

## 1996

Saad Al-Shehri  
Jon Just  
Randy Moore  
Natalie Yanchar

## 1997

George Chang  
David Bigam  
Martin Friedlich  
Alan Sobey  
Gerritt Winkelaar

## 1998

Michael Chatenay  
Camille Hancock Friesen  
James Shapiro  
David Williams  
Geoff Porter

## 1999

Syed Ahsan-Ud-Din  
Christopher Blewett  
Damien Byrne  
Michael Gorman  
Morad Hameed  
Michael Moser  
Cort Pagenkopf  
Randy Pulis  
Kenneth Stewart

## 2000

Dale Berg  
Sandrasekeram Parameswaran

## 2001

Karim Alibhai  
Jana MacLeod  
Shane Mortimer  
Edward Solano  
Peter Miles

## 2002

Coreen Dyck  
Abdulrahman Al-Zahem  
Brian Louie  
David Mercer

## 2003

Jessica Abraham  
Jennifer Andruchow  
James Baughan  
Matthew Muirhead  
Sean Norris  
Clifford Sample  
Daniel Schiller

## 2004

Jeffrey Gaboury  
Tina Mele  
David Olson  
Ronald St Germaine  
Naureen Wasey

## 2005

Mona Saleh  
David Hochman  
Kyriacos Panayides  
Drew Sutherland  
Mansour Tawfeeq

## 2006

Maurice Blitz  
Erika Haase  
Belinda His Dickie  
Hossein Shayan  
Rafat Taher

## 2007

Alhassan Asiri  
Anise Barton  
Bryan Dicken  
Kamran Fathimani  
Rachel Khadaroo  
Todd McMullen  
Sulaiman Nanji  
Panayiotis Panayides  
Karim Somani  
Tom Wallace

## 2008

Musaed Al-Ghamdi  
Abdulmutalib Al-Masloom  
Panayiotis Panayides  
Paul Engels  
Scott Johnson  
Lorraine Law  
James Stewart  
Haili Wang

## 2009

Matthew Butler  
Bushr Mrad  
John Paton-Gay

## 2010

Saleh Al-Ghamdi  
Parveen Boora  
Sonia Cader  
Wayne Truong  
Harvey Hawes

## 2011

Akram Al-Jahdali  
Athena Bennett  
Anna Borowiec  
Ali Cadili  
Daniel Kopac  
Dereck Mok  
Jean-Sebastien Pelletier

## 2012

Rani Al-Sairafi  
Basem Al-Shareef  
Kevin Klingbeil  
Sarah Lai  
Corey Tomlinson

## 2013

Chieh Chiu  
Namdar Manouchehri  
Bonnie Tsang

## 2014

Talal Ali  
Richdeep Gill  
Myung Hwae Kim  
Allison Maciver  
Michael McCall  
Dana Mihalicz  
Simon Turner  
Andrey Vizhul  
Sharon Chiu

## 2015

David Al-Adra  
Tyler Alford  
Ahmed Almamar  
Johan Bolton  
Sayf Gazala  
Allison Hobbs  
Shaheed Merani  
Tyler Parrington  
Abdullah Saleh  
Amir Taheri

## 2016

Suzana Kupper  
Mike Saba

## 2017

Brandi Ilo  
Blair Anderson  
Johnny Chau  
David Ko  
Troy Perry  
Rene Razzak  
Jed Scharf  
Brenden van der Westhuizen  
Pang Young  
Courtney Fulton

## 2018

Sameer Apte  
Angela Chan  
Mark Dykstra  
Girma Gamme  
Erica Lester  
David Lim  
Noah Switzer

## 2019

Amandeep Bajwa  
Simon Byrns  
Sidian Chen  
Gilgamesh Eamer  
Fady Kamel  
Taylor Smart  
Kevin Whitlock

## 2020

Alreem Al-Hinai  
Ariella Kleiman  
Michael Laffin  
Mackenzie Lees  
David Lesniak  
Lanny Li  
Ashley Shaw

## 2021

Nasser Abualhassan  
Elizabeth Clement  
Mustafa El-Hadi  
Jessica Hopkins  
Krista Lai  
Igor Mihajlovic  
Bianka Saravana-Bawan  
Iran Tavakoli

## 2022

Shaun Cowan  
Jerry Dang  
Ashley DiPasquale  
Chantalle Grant  
Farah Ladak  
Awrad Nasralla  
Jordan Nostedt

## 2023

Hayley Forbes  
Christine Li  
Andrew MacDonald  
Alyssa MacLean  
Warren Sun

*\*Alumni recognition page is a work in progress – please let us know if any errors or omissions have been made*