Canadian Journal of Surgery
Journal canadien de chirurgie

Vol. 61 (4 Suppl 2) August/août 2018
DOI: 10.1503/cjs.010618

Canadian Surgery Forum 2018

St. John's, NL
Sept. 13–15, 2018

ABSTRACTS

The Canadian Surgery Forum Steering Committee acknowledges and thanks the following organizations for their support of the 2018 Forum:

Platinum Partner: Ethicon
Gold Partners: Olympus, Merck and Stryker

Abstracts

CANADIAN ASSOCIATION OF GENERAL SURGEONS (CAGS)

01

Laparoscopic splenectomy with management of intraoperative hemorrhage. ***S. Jayaraman.* From the University of Toronto, Toronto, Ont.**

This video demonstrates a laparoscopic splenectomy for ITP with safe management of intraoperative hemorrhage.
YouTube video link: www.youtube.com/watch?v=6vYkOy3UePQ

02

Incisional hernia after midline versus transverse specimen extraction incision: a randomized trial in patients undergoing laparoscopic colectomy. ***L. Lee, J. Mata, R. Droeser, P. Kaneva, S. Liberman, P. Charlebois, B. Stein, G. Fried, L. Feldman*. From the McGill University Health Centre, Montreal, Que.**

A midline specimen extraction incision is most commonly used in laparoscopic colectomy but has a high incidence of incisional hernia (IH). IH may be lower for transverse incision. The objective of this trial was to compare the incidence of IH between midline and transverse specimen extraction site in patients undergoing laparoscopic colectomy. A single-centre parallel-arm non-blinded superiority trial was conducted. Eligible patients undergoing laparoscopic colectomy were randomly assigned to midline or transverse specimen extraction site. The main outcome measure was incidence of IH at 1 year. The power calculation required 76 patients per group to detect a reduction in IH from 20% to 5%. Secondary outcomes included perioperative outcomes, postoperative pain scores and quality of life (SF-36) and cosmesis (Body Image Questionnaire) at 1 year. A total of 165 patients were randomly assigned to transverse (n = 79) or midline (n = 86) specimen extraction site, of which 141 completed 1-year follow-up (68 transverse, 73 midline). Patient, tumour, surgical data and perioperative morbidity were similar. Pain scores were similar on each postoperative day. On intention-to-treat analysis, there was no difference in the incidence of IH at 1 year (transverse 2% v. midline 8%, p = 0.065) or after a mean 30.3 months (SD 9.4) of follow-up (6% v. 14%, p = 0.121). In per-protocol analysis there were more IH in the midline group after longer follow-up (15% v. 2%, p = 0.013). Quality of life was similar between the 2 groups, but cosmesis was better for patients undergoing midline incision (20 [IQR 16–20] v. 17 [IQR 15–21], p = 0.016). A transverse specimen extraction site has a lower incidence of IH compared with midline with longer follow-up but has worse cosmesis.

03

Spleen-preserving distal pancreatectomy in trauma. ***M. Schellenberg, K. Inaba, V. Cheng, J. Bardes, L. Lam, E. Benjamin, K. Matsushima, D. Demetriades*. From the LAC+USC Medical Center, Los Angeles, Calif.**

Traumatic injuries to the distal pancreas are infrequent. Universally accepted recommendations about the need for routine splenectomy with distal pancreatectomy do not exist. The objectives of this study were to compare outcomes after distal pancreatectomy and splenectomy versus spleen-preserving distal pancreatectomy and to define the appropriate patient population for splenic preservation. All patients who underwent distal pancreatectomy (Jan. 1, 2007 – Dec. 31, 2014) were identified from the National Trauma Data Bank (NTDB). Patients with concomitant splenic injury and those who underwent partial splenectomy were excluded. Demographics, clinical data, procedures and outcomes were collected. Study groups were defined by surgical procedure: distal pancreatectomy and splenectomy versus spleen-preserving distal pancreatectomy. Baseline characteristics between groups were compared with univariate analysis. Multivariate analysis was performed with logistic and linear regression to examine differences in outcomes. Over the 8-year study period, 2223 patients underwent distal pancreatectomy. After excluding 1381 patients with concomitant splenic injury (62%) and 8 (< 1%) who underwent partial splenectomy, 834 (38%) remained for analysis. Median age was 23 years (range 0–86) and 634 (77%) were male. Mechanism of injury was penetrating in 413 patients (50%). Of the 834 patients, 469 (56%) underwent splenectomy and 365 patients (44%) did not. Compared with patients who underwent distal pancreatectomy and splenectomy, those who underwent spleen-preserving distal pancreatectomy were younger (p < 0.001), were more likely to have sustained blunt trauma (p < 0.001) and had a lower Injury Severity Score (p < 0.001). On multivariate analysis, only hospital length of stay (LOS) was significantly shorter among patients undergoing spleen-preserving distal pancreatectomy (p = 0.017). Complications, mortality and LOS in the intensive care unit were not significantly different. In young patients after blunt trauma who are not severely injured, a spleen-preserving distal pancreatectomy should be considered to allow for conservation of splenic function and a shorter hospital LOS. In all other patients, the surgeon should not hesitate to remove the spleen with the distal pancreas.

04

Injuries sustained during contact with law enforcement: an analysis from US trauma centers. ***M. Schellenberg* (LAC+USC Medical Center, Los Angeles, Calif.), *K. Inaba* (LAC+USC Medical Center, Los Angeles, Calif.), *J. Cho* (LAC+USC Medical Center, Los Angeles, Calif.), *A. Strumwasser* (LAC+USC Medical Center, Los Angeles, Calif.), *D. Grabo* (LAC+USC Medical Center, Los Angeles, Calif.), *C. Bir* (LAC+USC Medical Center, Los Angeles, Calif.), *A. Eastman* (UT Southwestern Medical Center, Dallas, Tex.), *D. Demetriades* (LAC+USC Medical Center, Los Angeles, Calif.).**

Injuries sustained by civilians during interaction with police are a polarizing contemporary sociopolitical issue. Few comprehensive studies have been published using national hospital-based data. The aim of this study was to examine the epidemiology of these injuries to better understand this mechanism of injury. Patients entered into the National Trauma Data Bank (NTDB) (January 2007 – December 2012) with injuries sustained during interaction with law enforcement in the course of legal action (ICD-9 E970.0–E976.0) were enrolled. Patient demographics, injury characteristics, procedures and outcomes were collected and

analyzed. Patients injured by other civilians (E960.0–E968.0) were used for comparison. Of 4 146 428 patients in the NTDB, 7203 (0.17%) were injured during interaction with police. The incidence of these injuries was stable over time (0.17%–0.18%) (p = 0.129). Patients had a median age of 31 years (range 0–108) and 94.3% were male. Median Injury Severity Score (ISS) was 9 (IQR 4–17). The most common mechanism of injury was gunshot wounds (GSW) (44%). Patients were 43% white, 30% black, 17% Hispanic, 1% Asian and 9% other. As a proportion of the total race-specific NTDB trauma population, there was an average of 1.13 white patients, 2.71 Hispanic patients and 3.83 black patients per 1000. Mechanism, ISS and outcomes did not vary by race. Compared with patients injured by civilians, patients injured by police are more likely to be white (43% v. 25%, p < 0.001) and injured by GSW (44% v. 32%, p < 0.001). Based on data from trauma centres across the United States, the rate of injuries sustained during interactions with police has been stable over time. Gunshot wounds are the most common mechanism of injury. Proportionally, black patients are the most frequently injured race. When compared with patients injured by civilians, however, patients injured by police are more likely to be white. This study provides a step toward a better understanding of police-associated injuries.

05

The combined utility of EFAST and CXR in blunt thoracic trauma. ***M. Schellenberg, K. Inaba, J. Bardes, N. Orozco, J. Chen, C. Park, T. Kang, D. Demetriades*****. From the LAC+USC Medical Center, Los Angeles, Calif.**

Portable chest x-ray (CXR) and extended FAST (EFAST) screen patients for thoracic injury in the trauma bay. It is unclear if 1 test alone is sufficient, if both are required or if the 2 investigations are complementary. Study objectives were to define the combined diagnostic yield of EFAST and CXR among stable blunt thoracic trauma patients and to determine if a normal EFAST and CXR might obviate the need for CT scan of the chest. All blunt trauma patients ≥ 15 years presenting to our high-volume level I trauma centre in 2016 were screened. Only patients who underwent CT Thorax were included. Patients were excluded if they presented > 24 hours after injury, were transferred or did not undergo EFAST/CXR. Demographics, physical exam (PEx) of the thorax, investigations, procedures and outcomes were collected. EFAST, CXR and PEx findings were compared with the gold standard CT Thorax to calculate the diagnostic yield of each investigation and combinations thereof in the assessment for clinically significant thoracic injury. Over the study period, 1311 patients met inclusion/exclusion criteria. The most common mechanisms of injury were motor vehicle collision (n = 385, 29%) and auto versus pedestrian (AVP) (n = 379, 29%). Mean Injury Severity Score was 11 (1–75), with mean Abbreviated Injury Scale (AIS) Chest of 2 (1–6). The sensitivities of EFAST, CXR and PEx, either individually or in combination, were < 0.73 in the detection of clinically significant thoracic injury. The most common missed clinically significant injuries were sternal fractures, scapular fractures, clavicular fractures and pneumothoraces. Motorcycle collisions and AVPs resulted in the highest rates of missed injury. Even in conjunction with the physical exam, the sensitivity of EFAST+CXR in the detection of clinically significant thoracic injury is low. Therefore, if clinical suspicion for injury exists after blunt thoracic trauma, a normal EFAST+CXR is insufficient to exclude injury and CT scan of the chest should be performed.

06

Factors associated with surgeons' perception of distraction in the operating room. ***J. Jung, J. Elfassy, T. Grantcharov*****. From the University of Toronto, Toronto, Ont.**

Distractions in the operating room (OR) can create stress among surgeons and lead to higher chances of errors and adverse events. The objective is to determine intraoperative factors that are associated with surgeons' perception of distraction. We conducted a prospective cohort study in 287 consecutive patients undergoing elective laparoscopic general surgery during the 2 years after the implementation of a data capture system called the OR Black Box to identify intraoperative sources of distraction. At the end of each operation, human factor surveys were administered to assess whether surgeons felt distracted. Using a multivariable logistic mixed model with random intercepts for individual surgeons, we determined which intraoperative sources of distraction were associated with the surgeons feeling distracted in the OR. Surgeons reported feeling distracted in 125 of 287 operations (44%). Auditory sources of distraction, such as the OR door opening, occurred at a median of 41 times per case (interquartile range [IQR] 32–54) and external noise occurred at a median of 95 times per case (IQR 65–133). Cognitive distractions such as teaching (155 operations [54%]), device malfunction (100 [35%]), irrelevant conversations (75 [26%]), management of the next case (44 [15%]) and time pressure (22 [8%]) occurred in a significant number of operations. In a multivariable analysis, the presence of irrelevant conversations (odds ratio 1.89, p = 0.03) and longer procedure duration (1.02, p < 0.01) were independently associated with increased likelihood of the surgeons feeling distracted. Irrelevant conversation in the OR is a modifiable factor that was independently associated with surgeons' perception of distraction.

07

Impact of distractions on intraoperative adverse events during laparoscopic general surgery. ***J. Jung, T. Grantcharov*****. From the University of Toronto, Toronto, Ont.**

Adverse events occur frequently in the operating room (OR) and can lead to serious disability or death in patients. Although it has been assumed that distractions in the OR are important contributors of adverse events, empirical data are lacking on the relationship between distractions and intraoperative events. We conducted a prospective cohort study in 187 consecutive patients undergoing elective laparoscopic general surgery involving 4 attending surgeons during the 16 months following implementation of a data capture system called the OR Black Box. Expert analysts identified intraoperative events and distractions using validated measurement tools. Using a multivariable linear mixed model with random intercepts for individual surgeons, we assessed the relationship between distractions and frequency of intraoperative events after adjusting for patient factors, procedure types and procedure duration. A median of 9 intraoperative events per operation (interquartile range [IQR] 5–14) was identified. The OR door opening occurred a median of 42 times per operation (IQR 32–54), along with other auditory distractions, including loud

noise (a median of 19 times per operation [9–31]), machine alarm (67 [42–97]) and telephone ring (6 [3–9]). Device malfunction occurred in 32% of operations along with other cognitive distractions, such as irrelevant conversations (26%), management of the next case (14%), late or absent team member (13%) and time pressure (10%). In a multivariable analysis, loud noise ($p < 0.005$) was independently associated with increased frequency of intraoperative events after risk adjustment. Elective laparoscopic operations with a high amount of loud noise distractions were associated with an increased number of intraoperative events.

08

Non-technical skills and device-related interruptions in minimally invasive surgery. *J. Jung*, *T. Grantcharov*. From the University of Toronto, Toronto, Ont.

Device-related interruptions in the operating room (OR) create stress among health care providers and cause delays. Although non-technical skills (NTS) of teams, such as situational awareness and communication, are expected to influence occurrence of device-related interruptions, empirical data on this relationship are lacking. We performed a prospective cohort study of 144 consecutive elective laparoscopic operations involving 1 attending surgeon during 13 months. A data capture system called the OR Black Box was used to characterize device-related interruptions, NTS and distractions. Device-related interruptions were classified according to a priori established categories. Positive and negative NTS instances were identified according to 2 validated rating tools specific for nurses and surgeons. We assessed the relationship between NTS ratings and device-related interruptions after adjusting for patient factors, requirement for advanced devices in procedures, and distractions. A total of 86 device-related interruptions occurred in 48 of 144 operations (33%). They were most frequently classified as device failure (54%) followed by improper assembly (19%) and disconnection (14%). Medians of 1 (interquartile range [IQR] 0–3) and 1 (IQR 0–2) negative NTS instance per operation were demonstrated by nurses and surgeons, respectively. Medians of 28 (15–38) and 40 (28–118) positive NTS instances per operation were demonstrated by nurses and surgeons. In a multivariable analysis, a higher frequency of negative NTS instances demonstrated by nurses was associated with device-related interruption after risk adjustment (odds ratio 1.33, $p = 0.02$). In elective laparoscopic operations, an increased likelihood of device-related interruption in the OR was associated with more frequent negative NTS demonstrations by nursing teams.

09

The safety of outpatient stoma closure: On the verge of a paradigm shift? *J. Taylor* (Johns Hopkins University School of Medicine, Baltimore, Md.), *M. Stem* (Johns Hopkins University School of Medicine, Batimore, Md.), *D. Yu* (Queen's University, Johns Hopkins School of Public Health), *S. Chen* (Johns Hopkins University School of Medicine, Baltimore, Md.), *S. Fang* (Johns Hopkins University School of Medicine, Baltimore, Md.), *S. Gearhart* (Johns Hopkins University School of Medicine, Baltimore, Md.), *B. Safar* (Johns Hopkins University School of Medicine, Baltimore, Md.), *J. Efron* (Johns Hopkins University School of Medicine, Baltimore, Md.).

Controversy exists regarding the safety of outpatient stoma closures (OSC). This study aims to review trends, assess safety and identify appropriate candidates for OSC. Patients undergoing stoma closure were queried from the American College of Surgeons' National Surgical Quality Improvement Program database (2005–2016). Primary outcomes included 30-day Clavien–Dindo (C–D) grade III–V complications and readmission. Outpatient stay was defined as hospital stay < 1 day. Timing and reasons for readmission were assessed. Multivariable logistic regression analysis was used to identify risk factors for C–D III–V complications and readmission. Of 24 393 patients, 668 (2.74%) underwent OSC, with an increasing trend over the last decade (3.16% in 2005 to 4.14% in 2016, $p < 0.001$). OSC patients had significantly lower ASA class and fewer comorbidities than inpatients. OSC complications were significantly lower than inpatient stoma closure (ISC) (2.99% v. 7.25%, $p < 0.001$). Readmission rates were comparable (8.92% OSC, 9.77% ISC, $p = 0.539$). Patients were readmitted at a median of 5 days after discharge (OSC 6 days, ISC 5 days; NS). The leading causes for readmission included intestinal obstruction without hernia (25.37%), surgical or medical complications (16.94%) and surgical site infection (11.24%). Patient factors significantly associated with increased risk of complications and readmission included ASA > II, current smoking status, history of chronic obstructive pulmonary disease, dyspnea, steroid use, bleeding disorder,and partial/total physical dependency. Patients without any risk factors represented 42.56% of the sample and had lower complication (4.75%) and readmission rates (8.22%) than those with ≥ 2 risk factors (11.5% complication and 15.71% readmission rate, $p < 0.001$). There is an increasing trend in OSCs. Patients undergoing OSC are healthier and have fewer comorbidities. These data suggest there is no significant difference in readmissions and less morbidity associated with OSC. We found highly selective performance of OSC to be safe and acceptable, and identified risk factors may help predict readmission and complications.

10

Electronic databases may be an efficient and valuable method of increasing accrual to gastrointestinal randomized clinical trials. *P. Serrano* (McMaster University, Hamilton, Ont.), *S. Parpia* (McMaster University, Hamilton, Ont.), *D. McCarty* (McMaster University, Hamilton, Ont.), *N. Solis* (McMaster University, Hamilton, Ont.), *M. Valencia* (McMaster University, Hamilton, Ont.), *S. Jibrael* (McMaster University, Hamilton, Ont.), *A. Wei* (University of Toronto, Toronto, Ont.), *S. Gallinger* (University of Toronto, Toronto, Ont.), *M. Simunovic* (McMaster University, Hamilton, Ont.).

In each jurisdiction, accrual to gastrointestinal randomized clinical trials is often very low. We tested if rates would improve using population-based electronic databases. The ePATH database, maintained by Cancer Care Ontario, collects and codes cancer pathology reports from across Ontario, including hospitals and clinics in the Local Health Integration Network 4 (LHIN4). OneView is an electronic repository of diagnostic imaging performed in Southwestern Ontario, funded by participating hospitals and the federal government. "Real-time" pathology reports and radiological images are uploaded. The study objective was to compare traditional methods of patient accrual, including letters to clinicians

(surgeons, medical and radiation oncologists, and gastroenterologists in the LHIN4 region) and prospective collection of cases discussed at multidisciplinary tumour boards versus using ePATH and OneView to identify potential participants for the "Resection of Colorectal Cancer with Synchronous liver metastases" (RESECT) study, a trial evaluating postoperative complications and quality of life following simultaneous resection of colon cancer and liver metastases. ePATH was prospectively reviewed on a biweekly basis to identify patients diagnosed with primary colorectal cancer from January to November 2017 and these cases were linked to OneView files. A hepatobiliary surgeon reviewed OneView to identify patients with potentially resectable liver metastases and absence of extrahepatic disease. A priori identification ratio of ≥ 1.3 would be clinically significant (the ratio of potentially eligible cases using electronic databases versus traditional methods). ePATH abstracted 235 patients with a diagnosis of primary colorectal cancer, with 25 identified through OneView as potentially eligible for the RESECT trial. Traditional methods identified 16 patients, resulting in a population-level identification ratio of 1.6 (25/16). We identified more cases for the RESECT trial using population-based electronic databases versus traditional methods. The use of electronic databases may be an efficient and valuable method of increasing accrual to gastrointestinal randomized clinical trials.

11

Mesenteric cysts revisited: an ever-intriguing issue. ***A. Hummadi, M. Rabie, M. Al Skaini, H. Shamshad, S. Shah*. From the Armed Forces Hospitals – Southern Region, Khamis Mushayt, Saudi Arabia.**

Mesenteric cysts continue to intrigue surgeons and radiologists alike. This rarely encountered lesion may be clinically and radiologically indistinguishable from other intraabdominal cystic lesions. In this report, we describe the clinical course of 4 patients seen in our unit in a span of 10 months, from February 2014 to October 2014. Surprisingly, we had no such encounter for several years before or after these dates. All patients were women with a median age of 41.5 years. The most common presenting symptom was abdominal pain with other nonspecific abdominal complaints, and 1 patient presented with subacute bowel obstruction. Three patients underwent open surgical excision of the intact cyst, and laparoscopic excision was attempted in 1 but converted to open surgery to avoid rupture of the extremely thin-walled cyst, which had as yet no defined pathology. The cyst location was in the transverse mesocolon in 1 case, the right mesocolon in 1 case, the ileal mesentery in 1 case and the retroperitoneum of the lesser sac in the fourth. Histopathological examination showed simple mesothelial cyst in 2 cases, a pseudocyst in 1 and a cystic lymphangioma in 1. The patients tolerated surgery well with no complications. The primary goal of treatment should be excision of the intact cyst without rupture. This could be conveniently done by open surgery, although minimally invasive methods, especially laparoscopic surgery, are being increasingly employed. This should be entertained with care as malignant forms have been reported, though rarely.

12

Implementation and adoption of advanced care planning in the elderly trauma patient. ***K. Verhoeff, P. Glen, A. Taheri, B. Min, B. Tsang, V. Fawcett, S, Widder*. From the University of Alberta, Edmonton, Alta.**

Geriatric trauma has high morbidity and mortality, often requiring extensive hospital stays and interventions. The number of geriatric trauma patients is also increasing significantly and accounts for a large proportion of trauma care. Specific geriatric trauma protocols exist to improve care for this complex patient population, who often have various comorbidities, pre-existing medications and extensive injury within a trauma perspective. These guidelines for geriatric trauma care often suggest early advanced care planning (ACP) discussions and documentation to guide patient- and family-centred care. A provincial ACP program was implemented in April 2012, which has since been used by our level 1 trauma centre. We applied a before and after study design to assess the documentation of goals of care (GOC) in elderly trauma patients following implementation of the standardized provincial ACP tool on Apr. 1, 2012. We also aimed to outline benefits and drawbacks of this approach and identify areas for improvement to assist others who wish to implement an ACP system within their trauma systems. Documentation of ACP in elderly major trauma patients following the implementation of this tool increased significantly from 16% to 35%. Additionally, secondary outcomes demonstrated that many more patients received GOC documentation within 24 hours of admission, and 93% of patients had GOC documented before intensive care unit (ICU) admission. The number of trauma patients who were admitted to the ICU also decreased from 17% to 5%. Despite these successes, ongoing improvement is required to support patient-centred care for the injured geriatric patient. Here, we have provided a framework for others to implement and further develop.

13

The effect of peripherally acting μ opioid receptor antagonists (PAMORAs) on opioid induced bowel dysfunction: a systematic review and meta-analysis. ***M. Yang, K. Wanis, O. Gilani, K. Vogt, M. Ott, J. VanKoughnett, C. Vinden*. From Western University, London, Ont.**

The use of opioids has been on a concerning rise, and opioid usage is associated with significant gastrointestinal (GI) adverse effects. Peripherally acting μ-opioid receptor antagonists (PAMORAs) are a class of medications that inhibit peripheral effects of opioids without reversing the central analgesic effects. This systematic review aims to study the effect of methylnaltrexone, alvimopan and naloxegol on opioid-induced constipation (OIC) and postoperative ileus (POI) in surgical patients. A literature search was conducted using Ovid Medline, Cochrane Database of Systematic reviews, PubMed, CINAHL and Embase. Two independent reviewers analyzed the abstracts of identified articles for inclusion criteria. Disagreements led to a formal review of the entire article until an agreement was reached. Forty-seven studies met inclusion criteria and 7 studies were included in the meta-analysis. Methylnaltrexone, alvimopan and naloxegol all have been shown to be efficacious for OIC, with all 10 randomized controlled trials (RCTs) demonstrating a significantly higher proportion of patients with return of spontaneous bowel movement (BM) in the intervention groups. Intervention groups also had significantly more BMs/week. For POI, alvimopan significantly decreases time to discharge order written and return of gastrointestinal function as demonstrated by meta-analysis of 7 RCTs (HR 1.33 [95% CI 1.19–1.49]; HR 1.36 [95% CI 1.21–1.53]). Methylnaltrexone was not effective for POI and naloxegol has not been assessed for POI

effects. Both methylnaltrexone and naloxegol have been proven to be efficacious for return of spontaneous BMs in patients with OIC. Alvimopan has been shown to improve return of GI function after surgery and decrease hospital length of stay. In the United States, alvimopan is the gold standard for prevention of POI; however, it is not approved for use for this indication in Canada and elsewhere. Given similar pharmacologic mechanisms, there may be utility of naloxegol on POI and this warrants further study.

14

Systematic review of surgical postoperative adverse outcome grading systems. ***S. Balvardi*** **(McGill University, Montreal, Que.),** ***E. St. Louis*** **(McGill University, Montreal, Que.),** ***Y. Yousef*** **(McGill University Health Centre, Montreal, Que.),** ***A. Toobaie*** **(McGill University, Montreal, Que.),** ***E. Guadagno*** **(McGill University Health Centre, Montreal, Que.),** ***R. Baird*** **(University of British Columbia, Vancouver, B.C.),** ***D. Poenaru*** **(McGill University, Montreal, Que.).**

The Clavien–Dindo complication grading system has been validated and used extensively in the literature. Its key limitations include the notable absence of patients' perspective and an inability to provide overall morbidity burden for a given procedure. We conducted a systematic review of the literature to enumerate and assess alternative comprehensive postoperative adverse outcome grading systems. With librarian oversight, 9 databases (Africa-Wide Information, Biosis, Cochrane, Embase, Global Health, LILACS, Medline, PubMed and Web of Science) were searched for studies that aimed to develop a new, or improve upon an already existing, generalizable postoperative adverse outcome grading system. Study selection was duplicated as per PRISMA recommendations. Procedure-specific grading systems were excluded. The framework, strengths and weaknesses of the systems were qualitatively assessed. We identified 9 studies on 8 postoperative adverse outcome grading systems with frameworks generalizable to any surgical procedure (Table 1). Most systems have not been widely incorporated in the literature. All systems focused on complications only, without consideration of other postoperative adverse outcomes (sequelae or failure). The majority of these systems were produced without including patients' perspectives. Half of the systems allowed the derivation of a composite morbidity score, which, however, had limited concrete communicable significance for patients. There is a need for developing more comprehensive patient-centred postoperative adverse outcome grading systems. Such systems might use utility weighting measures for generating concrete burden estimates of postoperative morbidity and would generate meaningful scores for shared operative decision-making.

15

Development and implementation of a Gastrografin protocol in patients presenting with uncomplicated adhesive small bowel obstruction: a preliminary review. ***A. Kleiman***, ***B. Mador***, ***S. Widder*****. From the University of Alberta, Edmonton, Alta.**

There is a growing body of evidence suggesting that oral administration of a water-soluble contrast agent, such as Gastrografin, plays both a diagnostic and therapeutic role in the management of adhesive small bowel obstruction (SBO). A Gastrografin protocol was developed and instituted at our site during the spring of 2017. The current study reports development and preliminary implementation of our protocol. An initial protocol was prepared based on the available literature and surgeon consensus. The protocol was amended in an iterative fashion based on consultation and feedback from various stakeholders including surgeons, pharmacy, nursing staff and radiology. Gastrografin was made directly available on the surgical ward for nursing administration, education was provided and a finalized preprinted order set was distributed widely. We then conducted a retrospective chart review of all patients admitted with uncomplicated adhesive SBO within the first 6 months after full implementation of our protocol. Of the 32 patients who met inclusion criteria, 27 underwent a Gastrografin challenge, for a compliance rate of 84.4%. We saw no Gastrografin-specific morbidity. Overall, 3 (11.1%) patients did not have a successful Gastrografin challenge; of these, 2 underwent operative intervention. One patient (3.7%) had a successful Gastrografin challenge but required operation due to failure to resolve clinically. In total, 3 patients (11.1%) required operative intervention. Our initial protocol, which was designed with input from a variety of stakeholders, was met with a high rate of compliance and resulted in no increase in adverse events, suggesting that Gastrografin protocols are safe while reducing variance in care. The accuracy of predicting nonoperative resolution of SBO was high (96.3%). Despite the inherent limitations, these results, along with a growing body of literature, support the ongoing introduction of SBO protocols at centres across Canada.

Table 1. General characteristics of adverse outcome grading systems selected for inclusion

Author (year)	Classification	Frequency of citation	Composite score	Perspective
Clavien et al. (1992)	Clavien–Dindo 1992	1069	No	Health care
Pomposelli et al. (1997)	Surgical Complication Outcome (SCOUT) Score	51	Yes	Health care
Trotti et al. (2003)	Common Terminology Criteria for Adverse Events version 3.0 (CTCAE 3.0)	2081	No	Health care
Dindo et al. (2004)	Clavien–Dindo	10 649	No	Health care
Porembka et al. (2010)	Postoperative Morbidity Index (PMI)	114	Yes	Health care
Qassemyar et al. (2010)	Plastic Surgery Complication Grading System	2	No	Health care
Sata et al. (2012)	Congenital Heart Disease Morbidity Score	9	Yes	Health care
Shanmugam et al. (2012)	Pediatric Cardiac Surgical Complication Assessment tool	7	Yes	Health care
Slankamenac et al. (2013)	The Comprehensive Complication Index (CCI)	177	Yes	Patient and health care

16

Effect of PET-CT on disease recurrence and its management in patients with potentially resectable colorectal cancer liver metastases. The long-term results of a randomized controlled trial. ***P. Serrano*** **(McMaster University, Hamilton, Ont.),** ***C. Moulton*** **(University of Toronto, Toronto, Ont.),** ***E. Lee*** **(McMaster University, Hamilton, Ont.),** ***C. Li*** **(McMaster University, Hamilton, Ont.),** ***K. Beyfuss*** **(Sunnybrook Health Sciences Centre, Toronto, Ont.),** ***H. Solomon*** **(University of Toronto, Toronto, Ont.),** ***N. Sela*** **(Western University, London, Ont.),** ***V. McAlister*** **(Western University, London, Ont.),** ***A. Ritter*** **(Queen's University, Kingston, Ont.),** ***S. Gallinger*** **(University of Toronto, Toronto, Ont.),** ***J. Hallet*** **(University of Toronto, Toronto, Ont.),** ***M. Tsang*** **(University of Toronto, Toronto, Ont.),** ***G. Martel*** **(University of Ottawa, Ottawa, Ont.),** ***D. Jalink*** **(Queen's University, Kingston, Ont.),** ***M. Husien*** **(Grand River Regional Cancer Centre, Kitchener, Ont.),** ***C. Gu*** **(McMaster University, Hamilton, Ont.),** ***M. Levine*** **(McMaster University, Hamilton, Ont.).**

PETCAM, a randomized trial evaluating the effect of preoperative PET-CT (v. no PET-CT) on surgical management in patients with colorectal cancer liver metastases, found an 8% change in surgical management, including a higher proportion of major liver resections in the PET-CT arm. The current study compares 5-year disease-free (DFS) and overall survival (OS) and their long-term clinical course. Trial recruitment occurred between 2005 and 2010, with last follow-up in 2013. Data on recurrence, management and mortality from 2013 to 2017 were collected from patients' charts. Site of recurrences and management were described. Cox proportional hazard models were used to calculate the risk for recurrence and death. OS was calculated with the Kaplan–Meir method and compared with log-rank test. At 5 years, 157 of 404 (39%) patients were still alive and 19 patients were lost to follow-up. Median follow-up was 4.2 years. There were no differences in DFS (HR 1.12, 95% CI 0.88–1.42) or OS (HR 0.97, 95% CI 0.74–1.28) between groups. Median DFS for the 372 patients who had surgery was 17 months, (95% CI 14.7–19.4). Risks factors for recurrence were extrahepatic disease, liver tumour size and nodal stage. Median OS for all patients was 50 months (95% CI 43.5–64.3). Risks factors for death also included age and prior use of chemotherapy. During the follow-up, 287/404 (71%) patients recurred (mostly liver and lung); 137 (48%) were treated solely with chemotherapy and 35% were treated with surgery with curative intent. The most important risk factors for death following recurrence were disease-free duration < 5 months (time from liver resection to recurrence), nodal stage and number of recurrence sites. PET-CT did not improve DFS or OS. Surgery following recurrence after liver resection is feasible in one-third of patients, with the best long-term results in patients with long disease-free duration, node-negative disease and 1 recurrence site.

17

Factors affecting efficiency of operating theatre utilization in Kenyatta National Hospital, Nairobi, Kenya. ***S. Otiti, J. Nginyangi.*** **Kenyatta National Hospital, Nairobi, Kenya.**

Inefficient theatre utilization is a problem worldwide, with Africa being the hardest hit. Turnaround time and staff-, institution- and patient-related factors are known to affect efficiency. We set out to determine factors affecting efficiency of operating theatres in a national referral hospital with the aim of understanding the status of utilization and identify gaps that would be used to establish areas of improvement, leading to better quality of care offered to surgical patients and reduction in their cost recovery. We conducted a cross-sectional study in Kenyatta National Hospital (KNH)'s main theatres and collected data between December 2016 and February 2017 on start time of first case, anesthetic care time, cancellation, end time of the last case and reasons for delays using standard pre-formed checklist and data forms. The study population comprised all elective and emergency cases scheduled for surgery in the main operating theatres. Systematic random sampling was used to select the 367 cases. Approval was sought from the KNH-UoN Ethics Research Committee. There were 306 elective and 61 emergency cases. The average preop waiting time was 66.5minutes. Hospital-related reasons were the main causes of delay, accounting for 45% (n = 74) mainly due to operating theatre equipment delays (32.4%) and patient transportation delays (25.7%). Surgeons coming late was the major reason (58.5%) under staff-related causes. Inefficient utilization of operating theatres was mainly due to hospital non-clinical factors. Further studies should be conducted to assess the hospital-related factors that influence underutilization of operating theatres.

18

Surgery tutor for assessment of technical proficiency in soft-tissue tumour resection. ***C. Yeo, J. Ring, M. Holden, T. Ungi, G. Fichtinger, B. Zevin.*** **From Queen's University, Kingston, Ont.**

In competency-based medical education, progression between milestones requires reliable and valid methods of assessment. Surgery Tutor is an open-source motion-tracking platform developed to objectively assess technical proficiency during open soft-tissue tumour resections in the simulation setting. The objective of our study was to provide evidence of reliability and construct validity for Surgery Tutor. We hypothesize that Surgery Tutor can discriminate between novice, intermediate and experienced surgeons. Thirty participants were assigned to "novice," "intermediate" or "experienced" groups, based on the number of prior soft-tissue resections performed. Each participant resected a total of 4 lesions from a soft-tissue phantom. Surgery Tutor was used to track hand and instrument motion, number of tumour breaches and time per resection. Mass of excised specimen and margin status were also recorded. Test–retest reliability was calculated using the interclass correlation coefficient (ICC) to compare consecutive tumour resections by the same participant. Surgery Tutor metrics were compared between novice, intermediate and experienced groups for evidence of construct validity (one-way ANOVA or Kruskal–Wallis tests). Statistical significance was set to $p < 0.05$. Surgery Tutor demonstrated "moderate" to "good" rest–retest reliability for novice, intermediate and experienced groups (ICC = 0.596, 0.569, 0.737; $p < 0.01$). Evidence in support of construct validity was demonstrated for number of hand and instrument motions (690 ± 190, 597 ± 169, 469 ± 110; $p < 0.01$), number of tumour breaches (29 ± 34, 16 ± 11, 9 ± 6; $p < 0.01$), time per resection (677 ± 331 s, 561 ± 210 s, 449 ± 148 s; $p < 0.01$), mass of completely excised specimens (22 ± 7 g, 21 ± 11 g, 17 ± 6 g; $p = 0.04$) and rate of positive margin (68%, 50%, 28%; $p < 0.01$). Surgery Tutor shows evidence of reliability and

construct validity for assessment of technical proficiency during open soft-tissue tumour resections in the simulated setting. This platform has the potential to provide formative feedback and objective assessment of surgical proficiency in the simulated setting without the presence of a proctor.

19

Laparoscopic Nissen fundoplication: a step-by-step educational video. ***B. Fang, J. Dang, S. Karmali*. From the University of Alberta, Edmonton, Alta.**

Laparoscopic Nissen fundoplication is a key component in the management of gastresophageal reflux disease and an essential procedure in the training of general surgery residents. However, volume and exposure can vary among surgical residency programs. Particularly in the case of advanced laparoscopic procedures, studies have demonstrated low exposure rates at many teaching hospitals. There is a need for alternative methods for surgical trainees to learn about procedures such as the Nissen fundoplication. The objective of this video was to provide an educational tool for surgical trainees to learn the operational steps of laparoscopic Nissen fundoplication. We present an educational video of Nissen fundoplication performed by an experienced, fellowship-trained minimally invasive surgeon. Each step of fundoplication is explained and demonstrated for the optimal trainee learning experience.
YouTube video link: www.youtube.com/watch?v=_5Ouk3yJc7k

20

Incidence of splanchnic vein thrombosis following abdominal surgery: a systematic review and meta-analysis. ***P. Serrano* (McMaster University, Hamilton, Ont.), *M. Kim* (McMaster University, Hamilton, Ont.), *B. Zhang* (McMaster University, Hamilton, Ont.), *E. Duceppe* (Centre Hospitalier de l'Université de Montréal, Montreal, Que.).**

Splanchnic vein thrombosis (SVT) is an uncommon but potentially life-threatening condition. Abdominal surgery increases the risk of SVT; however, its incidence is not known. This study's objective was to determine the SVT incidence following open and laparoscopic abdominal surgery and evaluate the groups at risk. We searched Medline and Embase for clinical studies evaluating the incidence of postoperative SVT. Study selection and data abstraction were carried out in duplicate. Risk of bias assessment was completed using the MINORS tool. Statistical heterogeneity was calculated using the χ^2 and I^2 tests and clinical heterogeneity was explored with subgroup analysis. Of 5549 abstracts screened, 74 full-text articles were reviewed and 48 met the inclusion criteria. The proportion of SVT in hepatobiliary, pancreatic, colorectal and bariatric surgery was 2.68% (95% CI 2.24–3.11) with 1390 events in 54 873 patients undergoing surgery. The heterogeneity was high (I^2 = 96%). The proportions of highest risks of SVT after were 24.17% in splenectomy with devascularisation, 8.76% in hepatectomy complicated by malignancy and cirrhosis and 4.75% in pancreatectomy with venous resection. The lowest proportion of SVT was seen in bariatric procedures (0.36%). Subgroup analysis explained some degree of heterogeneity. Ten studies compared the number of symptomatic SVT with the number of nonsymptomatic SVT. The proportion of SVT in these studies was 1.97%, of which 1.00% SVTs were symptomatic and 0.962% were asymptomatic. Analysis of mortality secondary to postoperative SVT included irreversible thrombosis, bowel ischemia, hepatic failure and gastrointestinal bleed. Most included studies were retrospective and at a high risk of bias. Incidence of SVT after abdominal surgery is low but this remains a relevant complication. Patients undergoing procedures involving mechanical manipulation of the venous system and splenectomy are at the highest risk. Given the life-threatening risks associated with SVT, close postoperative monitoring may be beneficial for certain surgeries.

21

An ounce of prevention is worth a pound of cure: the total cost associated with complications of general surgery procedures at the Toronto General Hospital. ***S. Rieder, A. Maeda, A. Okrainec, T. Jackson*. From the University of Toronto, Toronto, Ont.**

There has been an increased focus on improving the quality of surgical care and overall improvement of patient outcomes. In a resource-constrained environment, it is important to understand the fiscal burden of complications in addition to their impact on patient outcomes. The purpose of the study was to identify the costs associated with general surgery complications at the Toronto General Hospital. The institutional National Surgical Quality Improvement Program (NSQIP) was used to identify all patients undergoing surgery from April 2015 to March 2017. The total cost for each visit was then calculated by adding all aggregate costs of inpatient care. Complications that occurred during the hospital stay were identified for each patient in the NSQIP database. Among 2054 cases, 561 had at least 1 complication. The average number of complications noted during the hospital stay was 1.8 per patient. Complications were associated with a higher cost and longer length of stay; for example, complications after appendectomy and pancreaticoduodenectomy increased the cost by $5270 and $11 439, respectively. Postoperative complications incurred a significant cost in all types of general surgery in our study. Quality programs designed to mitigate complications could significantly reduce costs in addition to improving patient outcomes.

22

A systematic review of economic evaluations of intraoperative perfusion assessment using indocyanine green immunofluorescence angiography. ***F. Kegel, S. Lachance, T. Landry, L. Feldman, G. Fried, C. Mueller, L. Lee, F. Kegel*. From McGill University, Montreal, Que.**

Intraoperative immunofluorescence angiography (IFA) with indocyanine green (ICG) can assess tissue perfusion and potentially prevent wound and anastomosis complications; however, cost-effectiveness data are limited. Therefore, the objective of this study was to perform a systematic review of the economic impact of ICG IFA for tissue perfusion. A systematic literature search identified all comparative studies up to January 2018 that performed an economic evaluation of ICG IFA used for tissue perfusion assessment. Studies were excluded if ICG IFA

was used for tumour localization or anatomic delineation. Study quality was assessed using the Consensus on Health Economic Criteria (CHEC, scored 0–19). A total of 871 citations were identified, of which 5 studies were included for qualitative synthesis. Three studies described use of ICG IFA to assess viability of flaps in patients undergoing mastectomy and 2 studies assessed anastomotic perfusion in colorectal surgery. All studies originated from the United States. The sample size of the intervention groups ranged from 152 to 3315 for mastectomy and from 27 to 238 for colorectal surgery. Improved postoperative outcomes in patients who underwent ICG IFA were reported in 4 studies, whereas 1 study in colorectal surgery patients reported no significant difference. Cost savings were reported in 2 studies ($614 per mastectomy patient and $1216 per colorectal patient) while 1 study reported increased hospital charges (+$9080 per mastectomy patient) and 1 study (colorectal) reported no difference in total costs. Only 1 study conducted a formal cost-effectiveness analysis, revealing an incremental cost-effectiveness ratio of $3516.64 per quality-adjusted life year after free autologous breast reconstruction. The overall quality was low, with a mean CHEC score of 8.2 (range 5–16). There are limited published data to properly assess the cost-effectiveness of ICG IFA for tissue perfusion. More high-quality studies are needed before the value of this technology can be evaluated.

23

A curious inguinal hernia. ***F. Kegel*, *S. Lachance*, *L. Lee*. From McGill University, Montreal, Que.**

Serious and potentially life-threatening conditions can sometimes present as inguinal hernias. We present an uncommon case of a 50-year-old male patient with a large, right-sided reducible inguinoscrotal bulge with overlying erythema, warmth and tenderness. A strangulated inguinal hernia was suspected. The patient was brought to the operating room for an emergency diagnostic laparoscopy and laparoscopic hernia repair with possible conversion to open anterior approach. Intraoperatively, it was discovered that the patient's clinical features were not due to a strangulated inguinal hernia but rather from pus tracking into an inguinal hernia sac from a perforated duodenal ulcer. The patient underwent a laparoscopic omentopexy and abdominal washout. The postoperative course was uneventful, and the patient was discharged on the fourth postoperative day with triple therapy for *Helicobacter pylori*. Unfortunately, the patient was lost to follow-up. We recommend that continued use of diagnostic laparoscopy is beneficial in some emergent surgical conditions that may require definitive diagnosis. As well, clinicians should continue to be cognizant of diseases that may unusually present as inguinal hernias.
YouTube video link: https://youtu.be/1ymK_XQmK8g

24

The burden of surgical disease at a remote referral hospital in Southeastern Liberia. ***S. Joharifard* (Partners in Health, Vancouver, B.C.), *E. Nyiemah* (JJ Dossen Memorial Hospital, Harper, Liberia), *C. Howe* (JJ Dossen Memorial Hospital, Harper, Liberia), *C. Dobbob* (JJ Dossen Memorial Hospital, Harper, Liberia), *L. Gizzie Kortimai* (JJ Dossen Memorial Hospital, Harper, Liberia), *A. Kabeto* (Partners in Health, Liberia), *J. Beste* (Partners in Health, Boston, Md.), *N. Garraway* (University of British Columbia, Vancouver, B.C.), *R. Riviello* (Brigham and Women's Hospital, Boston, Mass.), *S. Hameed* (University of British Columbia, Vancouver, B.C.)**

Liberia has just 11 surgeons serving a population of 4.7 million. There are no subspecialty surgeons or physician anesthetists. The purpose of this study is to describe the burden of surgical disease at JJ Dossen Memorial Hospital, a remote referral hospital supported by Partners in Health. We examined operative case logs between September 2017 and March 2018 since the arrival of a Canadian general surgeon and simultaneous establishment of an outpatient surgery clinic. Descriptive statistics were used to characterize patient demographics, diagnoses, procedures and 2-week outcomes. Referral data were examined to identify surgical cases transferred to tertiary facilities. A total of 309 cases were performed on 260 patients. Of these, 70.0% of cases were emergencies. A total of 146 patients were seen in the surgery clinic and 80 cases (25.9%) were booked from the clinic; 52.4% of patients were female. The mean age was 29.6 years and 68 cases (22.0%) were performed in children ≤ 18 years. A total of 186 cases (60.2%) were performed by the surgeon, while the remainder were performed by general practitioners; 96 cases (31.1%) were cesarean sections. Of the non-obstetric cases, 45.5% were general surgery, 14.1% burns and plastic surgery, 12.7% pediatric surgery, 9.4% gynecology and 7.5% orthopedic surgery; the remaining 10.8% were a mixture of urology, ENT and neurosurgery. With respect to anesthesia, 46.0% of cases were performed under spinal, 30.7% general, 15.5% sedation and 6.8% local. Two-week follow-up visits were conducted for 93.2% of cases performed by the surgeon; among these patients, the all-cause mortality rate was 3.3% (n = 5) and the surgical site infecion rate was 8.1% (n = 15). Twenty patients were referred to tertiary facilities for further surgical consultation. There is a significant but undefined burden of surgical disease in Liberia. General surgeons are desperately needed in rural and remote hospitals. Data identifying commonly encountered surgical conditions can inform training for nurses, physicians, surgeons and anesthetists.

25

Laparoscopic paraesophageal hernia repair: 1-year quality of life and pulmonary function outcomes, a single-centre experience. ***S. Shinde*, *G. Marcil*, *S. Prasad*, *J. Arminan*, *E. Debru*, *N. Church*, *R. Gill*, *P. Mitchell*. From the University of Calgary, Calgary, Alta.**

Laparoscopic hiatal hernia repair (LHR) with partial fundoplication is an effective treatment for symptomatic paraesophageal hernia (PEH). Dyspnea, dysphagia, regurgitation and chest pain can be part of the symptom complex. This study aims to analyze the effect of LHR on pulmonary function. The secondary aims were to calculate the radiological recurrence of PEH and to assess if LHR demonstrated improvement in symptomatology. Patients who underwent elective LHR for symptomatic PEH repair at our institution over an 8-year period were included. Patient characteristics, type of hiatus hernia, type of fundoplication and hernia recurrences were analyzed. Pulmonary function tests (PFT) were performed

preoperatively and 6–12 months postoperatively. PFT pre- and postoperatively were compared using Wilcoxon signed rank sum test and paired *t* tests. Upper gastrointestinal (UGI) contrast studies performed at 1 year postoperatively were analyzed for radiological recurrence. Descriptive statistics were used to analyze quality of life (QoL) data obtained with a standardised gastric surgery QoL questionnaire. There was a significant improvement in total lung capacity, vital capacity, FEV1 and forced vital capacity postoperatively. There was a nonsignificant improvement in DLCO values. No significant associations were found with improvement of PFTs between age, gender, BMI, smoking, chronic obstructive pulmonary disease, operation type and preoperative PEH type. At 1-year follow-up, there were no radiological recurrences in 87.5% of patients, and 97.3% of patients had no recurrent symptoms at 1-year follow-up. LHR with anterior 180 degree Dor fundoplication without gastropexy, or use of hiatal prosthesis results in mild improvement in PFT for patients who have a symptomatic PEH. Additionally, primary closure LHR has a low radiological recurrence rate and demonstrates excellent symptom alleviation at 1 year. Systematic reviews and meta-analyses analyzing risk factors for PEH recurrence following LHR, need for hiatal prosthesis and optimal type of fundoplication are needed to optimize postoperative results for this effective but challenging operation.

26

Canadian general surgery residents need formal curricula and objective performance assessments in gastrointestinal endoscopy training: a program director census. ***M. Delisle, C. Chernos, J. Park, K. Hardy, A. Vergis*****. From the University of Manitoba, Winnipeg, Man.**

Methods of developing and determining general surgery (GS) residents' competency in gastrointestinal endoscopy in Canada are not currently standardized. The aim of this study was to assess the status of gastrointestinal endoscopy training in Royal College of Physicians and Surgeons of Canada (RCPSC) GS residency programs. A 35-question survey was developed using GS gastrointestinal endoscopy curricula guidelines. All 17 RCPSC GS program directors were contacted to complete the questionnaire via the Web-based SurveyMonkey.ca platform. All 17 program directors completed the survey (100% response rate). Sixteen programs reported having dedicated endoscopy rotations with a mean duration of 2.8 months (range 0–4, SD 1.1). Upon completion of dedicated endoscopy rotations, 4 programs (25%) reported having formal skills assessments and 3 (18.8%) reported formal knowledge examinations. All programs required endoscopy procedures be logged throughout residency, but only 3 (21.4%) included quality indicators. Only 1 program required residents to obtain Fundamentals of Endoscopic Surgery certification. The reported estimated mean number of procedures during residents' endoscopy rotations was 82 (range 10–150, SD 33.6) gastroscopies and 156 (40–350, 76.3) colonoscopies. The mean number of procedures during residents' entire residencies was 150 (20–400, 98.6) gastroscopies and 241 (50–500, 76.3) colonoscopies. The number of months of dedicated endoscopy training significantly correlated with the total estimated number of endoscopic procedures performed ($r = 0.67$, $p = 0.02$). Eleven program directors (73.3%) believed residents were prepared for independent endoscopy practice, while 4 disagreed (26.7%). Program directors' perceptions of residents' preparedness were significantly correlated with the number of endoscopic procedures performed by residents ($p < 0.01$) but not the robustness of the endoscopy curriculum ($p = 0.72$). Endoscopy training in RCPSC GS residency programs is highly variable. Program directors' perceptions of residents' competency appear to be significantly correlated with procedure numbers and few have adopted formal curricula and performance assessments.

27

Laparoscopic duodeno-jejunostomy for SMA syndrome. ***M. Guez*** **(St. Joseph's Healthcare, McMaster University, Hamilton, Ont.),** ***D. Hong*** **(St. Joseph's Healthcare, Hamilton, Ont.).**

Superior mesenteric artery syndrome (SMA) is an infrequent cause of proximal small bowel obstruction. SMA syndrome is characterized by a reduced angle between the aorta and SMA because of loss of mesenteric fat between the SMA and aorta. This causes compression of the third portion of the duodenum by the SMA. We present a video of a laparoscopic duodeno-jejunostomy in a 21-year-old woman who presented to hospital with progressive obstructive symptoms and chronic weight loss. A CT angiogram revealed reduction of the aorto-mesenteric angle consistent with SMA syndrome. In this video, the technique of a laparoscopic duodeno-jejunostomy is described in 3 steps: identification of Treitz and selection of a jejunum loop 30 cm distal to it, mobilization of the duodenum (Kocherisation) and the creation of a duodeno-jejunostomy. The patient was discharged on postoperative day 1 tolerating a full diet.
YouTube video link: https://youtu.be/6tPGdHVe1gg

28

POEM. ***M. Guez, D. Hong*****. From St. Joesph's Healthcare, Hamilton, Ont.**

The standard treatment of achalasia is the surgical Heller myotomy. Per oral endoscopic myotomy (POEM) is a novel technique that has produced equivalent results to Heller myotomy in the United States, Europe and Asia. This minimally invasive procedure has demonstrated its safety and immediate relief of achalasia symptoms in numerous studies. This video shows the POEM procedure technique in a 47-year-old man with achalasia. The POEM procedure is divided into 5 steps: measures, mucosectomy, submucosal tunnelling, myotomy and mucosectomy closure. The gastroscopy is done with CO insufflation. Dissection of vessels as well as bleeding management are shown in the video. The patient left the hospital on postoperative day 0 after a gastrografin swallow didn't demonstrate the presence of a leak or obstruction.
YouTube video link: https://youtu.be/GqWN-KKlGJQ

29

Withdrawn.

30

Surgeon attitudes toward point-of-care ultrasound for biliary disease. ***J. Koichopolos, R. Hilsden, D. Thompson, F. Myslik, J. Vandeline, R. Leeper*. From Western University, London, Ont.**

Point-of-care ultrasound (POCUS) has become an avenue for diagnosis of gallstone disease. Multiple studies confirm that POCUS has a high sensitivity and specificity for cholelithiasis (89.8% and 88.0%, respectively) and acute cholecystitis (87% and 82%, respectively). However, there is a gap between the actual and perceived reliability of biliary POCUS by surgeons who provide definitive care. This study assesses surgeons' opinions on the use of POCUS in gallstone disease and what barriers exist to its institution. A survey was distributed to all 18 Canadian general surgery residency programs (11 participated, totalling 114 responses). Respondents ranged from trainees (58%) to staff (42%). Most occasionally used POCUS results in their practice (37%) and received 5–10 consults for POCUS-diagnosed biliary disease yearly (25%). Most never personally performed POCUS (33%) and had no formal training (56%). Canadian general surgeons have a significant lack of faith in POCUS for biliary disease, with 60% of respondents being entirely unconfident. Most felt the sensitivity of POCUS was very poor: 79% believed the sensitivity for cholelithiasis was < 80%, and 49% believed the sensitivity for cholecystitis was < 50%. If offered ideal clinical and laboratory findings combined with POCUS results, only 4% of surgeons would definitely operate for unremitting biliary colic and 5% for cholecystitis. Univariate analysis identified the frequency a surgeon personally performs POCUS (4.49, $p = 0.05$) to predict for surgeon confidence in biliary POCUS. Regression analysis was also performed to identify modifiable factors that affect a surgeon's willingness to clinically act on POCUS findings. Ability to replicate findings consistently independently affected their decision-making. Findings suggest there is significant distrust in biliary POCUS but that specific ultrasound training for the surgical workforce may prove beneficial by improving their ability to trust the POCUS skills of their referring colleagues and to personally perform ultrasound to make and confirm diagnoses.

31

Geographic variation in appendiceal perforation rates in Canada: a population-based cohort study. ***A. Doumouras, S. Govind, D. Hong, S. Govind*. From McMaster University, Hamilton, Ont.**

Appendiceal perforation in cases of appendicitis is known to increase morbidity, mortality and cost of care. We hypothesized that patients living in rural neighbourhoods experience delayed access to surgical services manifesting in increased perforation rates. This was a population-based cohort of all adult patients with acute appendicitis in Canada (excluding Quebec) between April 2008 and March 2015. The main outcome of interest was the rate of perforation. Predictors of interest included socioeconomic and geographic variables and individual predictors of perforation. Spatial analysis was used to analyze significant spatial clustering of perforation. Multilevel logistic regression was used to model predictors. We identified 143 191 patients throughout the course of the study. The average perforation rate across our entire study population was 35.9%. Cluster analysis identified 286 (24%) neighbourhoods with perforation rates that were greater than the population average. Rural neighbourhoods had a 1.89 times higher odds of being in a high-perforation cluster (95% CI 1.08–3.08, $p = 0.024$). Additionally, compared with neighbourhoods > 75 km from the admitting hospital, closer neighbourhoods were significantly less likely to be a high perforation cluster (0–35 km OR 0.64, 95% CI 0.38–0.98, $p = 0.049$; 36–75 km OR 0.60, 95% CI 0.37–0.92, $p = 0.019$). On an individual level, after adjustment for comorbidities, income and distance, patients who were admitted to small community hospitals had a 0.51 times lower odds of perforation than those admitted to academic centres (95% CI 0.48–0.55, $p < 0.001$) and those who lived in high perforation clusters had a 42% higher odds of perforation (95% CI 1.39–1.46, $p < 0.001$) Rural neighbourhoods and those located far away from hospitals have increased appendiceal perforation rates. In addition, when patients are treated at small community hospitals, the odds of perforation are significantly lower. From a policy point of view, patients with symptoms of appendicitis can be safely treated at the nearest hospital.

32

Coaching for skill acquisition and refinement among practising surgeons — a systematic review. ***S. Valanci, N. Alhassan, L. Lee, L. Feldman, G. Fried, C. Mueller*. From McGill University, Montreal, Que.**

Once formal training ends, longitudinal personalized feedback essentially ceases for practising surgeons. Most continuing education modalities offer little if any individualized advice, and self-regulation is known to be inferior to practice guided by an experienced third party. Learner-centred peer coaching has recently been proposed as a means to enable ongoing skill refinement for practising surgeons, yet it remains largely underutilized. The purpose of this review is to summarize characteristics of, and barriers to, coaching programs for practising surgeons. A systematic review was conducted to identify all studies evaluating coaching programs for practising surgeons up to March 2018. Coaching was defined as any form of skill refinement done in a structured manner using goal setting and feedback from a predefined expert. Review articles, editorials and self-guided training programs were excluded. Of 2858 unique citations, 13 were included in the final analysis. Six (46%) dealt with refinement of skills and acquisition of new skills, respectively; 1 (8%) reported coaching for non-technical skills such as judgment and communication and 1 (8%) centred on perceptions related to coaching in general. Studies varied widely with respect to procedures coached, program length and design, and outcomes analyzed. When participant feedback was reported (8 articles), 73 (100%) participants rated the activity to be globally positive. Of the 4 articles that reported long-term outcomes, all found that participants had incorporated the coached skills into their practice. Reported barriers to receiving coaching included perceived loss of autonomy, fear of appearing incompetent, fear of being judged by peers and feeling intimidated. Both recipients and providers of coaching reported time constraints and logistics as barriers to coaching participation. Coaching is highly rated

by participants and may provide a mechanism for ongoing skill development for surgeons in practice. Future coaching programs should take these findings into consideration during program planning.

33

Frailty in emergency general surgery patients: comparison of Fried's criteria and Modified Frailty Index. ***T. Wong, N. Nadkarni, S. Chia, D. Seow*. From the Duke-National University of Singapore – Singapore General Hospital, Singapore.**

Frailty is a risk factor for poor outcomes after surgery. The goal of our study was to examine the use of modified Fried's frailty criteria and the Modified Frailty Index-11 (MFI-11) in older emergency surgery patients. Patients aged 65 years and over undergoing emergency gastrointestinal surgery (excluding palliative procedures and surgery for complications of elective operations) were recruited after operating theatre records were examined. Patients' surrogates were asked if patients were unable to give consent. The modified Fried's frailty score (a scale [0 to 5] that includes weakness, weight loss, exhaustion, low physical activity and slowed walking speed) was scored as soon as the patient was in the general ward. Age, gender, ethnicity, Charlson comorbidity score, operation type (laparotomy v. laparoscopic or groin hernia repair without laparotomy), complications, modified Fried's score (frail v. pre-frail or robust) and the modified Frailty Index-11 (MFI-11) were recorded for patients. Logistic regression was used to analyze the association between the variables and outcome of interest, 30-day unplanned emergency department attendance or readmission. A total of 104 patients were recruited from January to December 2017, of whom 22 patients had an unplanned readmission within 30 days. On univariate analysis, Fried's frailty (OR 4.33, 95% CI 1.59–12.08, $p < 0.01$), Charlson comorbidity score (0–1 v. 2+, OR 3.10, 95% CI 1.15–9.49, $p = 0.03$), laparotomies (OR 2.80, 95% CI 1.04–8.49, $p = 0.05$) and complications (OR 2.48, 95% CI 0.94–6.49, $p = 0.06$) were associated with higher readmission rates. On multivariable analysis, all 4 factors were associated with increased risk of readmission, although only Fried's frailty was statistically significant (OR 3.28, 95% CI 1.07–10.23, $p = 0.04$). In contrast, MFI-11 was only marginally associated with readmission on univariate analysis (OR 1.30, 95% CI 0.51–3.49, $p = 0.58$). Although Fried's frailty score is more labour intensive to collect and difficult to calculate from routinely collected health care data, it has a stronger association with 30-day readmissions than MFI-11.

34

Overall and disease-free survival in colorectal cancer patients receiving adjuvant chemotherapy with a biologic agent: a systematic review and meta-analysis. ***D. Carter, C. Li, M. Valencia, L. Ruo, S. Parpia, M. Simunovic, O. Levine, P. Serrano*. From McMaster University, Hamilton, Ont.**

Adjuvant therapy for patients undergoing curative resection for stage III and high-risk stage II colorectal cancer improves overall survival. Biologic agents have shown promise as adjuncts to chemotherapy in the setting of stage IV colon cancer, but the effect in earlier stage colon cancer remains unclear. We conducted a systematic review and meta-analysis on the additive effect of biologic agents to adjuvant chemotherapy on overall survival and disease-free survival in patients with colon cancer (all comers and subpopulations defined by microsatellite instability, BRAF and KRAS status, and stage). We searched Medline, Embase and Central for randomized controlled trials published between January 2002 and February 2017. Six trials including 10 754 patients were included. Overall survival and disease-free survival were significantly worse in the intervention arm, adjuvant chemotherapy with biologic agents (HR 2.55, 95% CI 2.37–2.75) and (HR 2.56, 95% CI 2.40–2.73), respectively, when compared with the control arm, adjuvant chemotherapy alone. High heterogeneity in the study population was explained by a subgroup analysis of the different biologic agents used (bevacizumab v. others); however, results still showed harm in the intervention arm across subgroups. Bevacizumab was associated with improved overall survival in patients with microsatellite instability (HR 0.58, 95% CI 0.36–0.92), but this was the only indication of benefit for a biomarker-defined subpopulation. Analyses by tumour stage failed to demonstrate advantage with use of a biologic agent; however, it did explain heterogeneity between studies. The addition of a biologic agent to adjuvant chemotherapy in the treatment of high-risk stage II and III colon cancer is not associated with survival benefit. Patients with microsatellite unstable tumours may benefit from the addition of bevacizumab to adjuvant chemotherapy.

35

Patterns of complex emergency general surgery in Canada. ***K. Vogt* (Western University, London, Ont.), *L. Allen* (Western University, London, Ont.), *P. Murphy* (Western University, London, Ont.), *R. van Heest* (William Osler Health, Brampton, Ont.), *F. Saleh* (William Osler Health, Etobicoke, Ont.), *S. Widder* (University of Alberta, Edmonton, Alta.), *S. Minor* (Dalhousie University, Halifax, N.S.), *P. Engels* (McMaster University, Hamilton, Ont.), *E. Joos* (University of British Columbia, Vancouver, B.C.), *C. Wang* (University of Alberta, Edmonton, Alta.), *R. Nenshi* (McMaster University, Hamilton, Ont.), *M. Meschino* (McMaster University, Hamilton, Ont.), *C. Laane* (University of British Columbia, Vancouver, B.C.), *N. Parry* (Western University, London, Ont.), *M. Hameed* (University of British Columbia, Vancouver, B.C.), *A. Lacoul* (Dalhousie University, Halifax, N.S.)**

Most of the literature on operative emergency general surgery (EGS) addresses appendiceal and biliary disease; however, EGS surgeons manage conditions beyond the appendix and gallbladder. The current study aimed to describe the operative burden of these conditions throughout Canada. This multicentre retrospective cohort study evaluated patients operated on by EGS services at 6 centres across Canada in 2014. Adult patients (≥ 18 yr) undergoing non-elective operative intervention for non-biliary, non-appendiceal diseases were included. Data collected included demographics, diagnosis, procedure details, complications (graded based on Clavien–Dindo [CD]) and length of stay. Logistic regression was used to identify predictors of morbidity and mortality. A total of 2694 patients were included. The median patient age was 60 years (IQR 47–74), and 52% were male. The most common principal diagnoses were small bowel obstruction (15%), hernia (15%), malignancy (11%) and perianal disease (9%). The most common procedures were bowel resection

(34%), hernia repair (17%) and débridement of skin/soft tissue infection (12%). Half of cases (50%) were booked as emergent (OR within 8 h), with 31% considered imminently life threatening (OR within < 2 h). Forty-six percent of cases were completed overnight (5 pm – 8 am). The overall mortality rate was 8%; however, 149 patients (6%) were managed after transfer from another centre, with mortality among these patients being significantly higher (13% v. 7%, $p = 0.006$). Thirty-four percent of patients had a complication, with independent predictors including increased age ($p < 0.001$), emergent OR ($p = 0.022$) and transfer from another centre ($p = 0.012$). This study identified the current epidemiology of non-biliary, non-appendiceal EGS operative intervention across multiple Canadian centres. Canadian surgeons are performing a large volume of EGS emergently, and the burden of EGS conditions carries significant risk of morbidity and mortality. The results of this study will be used to guide future research efforts and help set benchmarks for quality improvement.

36

Surgical skill and complications after colorectal surgery. ***L. Lee*** **(Institute for Clinical Evaluative Sciences, Toronto, Ont.),** ***C. Chrystoja*** **(Institute for Clinical Evaluative Sciences, Toronto, Ont.),** ***J. Ramjist*** **(Institute for Clinical Evaluative Sciences, Toronto, Ont.),** ***R. Sutradhar*** **(Institute for Clinical Evaluative Sciences, Toronto, Ont.),** ***L. Lix*** **(University of Manitoba, Winnipeg, Man.),** ***M. Simunovic*** **(Hamilton Health Sciences, Hamilton, Ont.),** ***N. Baxter*** **(University of Toronto – Saint Michael's Hospital, Toronto, Ont.),** ***D. Urbach*** **(University Health Network, Toronto, Ont.).**

Surgeon technical skill may affect postoperative outcomes. However, this relationship has not been previously characterized in colorectal surgery. The objective was to determine the effect of technical skill on short-term outcomes in patients undergoing colorectal surgery. Surgeons performing colorectal resections in 2009–2010 at 80 hospitals in Ontario, Canada, were invited to participate. Consenting surgeons were directly observed by a trained assessor and their technical ability was evaluated using the Objective Structured Assessment of Technical Skill (OSATS, summary score 1–5). All patients undergoing open colorectal cancer surgery by these surgeons from 2009 to 2014 and their characteristics and outcomes were obtained from Ontario administrative health data. The main outcome was 30-day surgical complications, defined as anastomotic leak, surgical site infection, wound dehiscence and major hemorrhage. There were 118 participating surgeons who underwent assessment. These surgeons performed 8981 procedures during the study period (mean annual volume 19.0 [SD 15.7]). The mean OSATS summary score was 4.6 (SD 0.2). Surgeons were grouped based on OSATS score quartiles (Q1 3.0–4.0, $n = 37$; Q2 4–4.57, $n = 37$; Q3 4.57–4.86, $n = 17$; Q4 4.86–5.0, $n = 27$). There was no difference in surgical complications by OSATS quartiles (Q1 12.3% v. Q2 11.0% v. Q3 12.2% v. Q4 12.0%, $p = 0.58$). There was no correlation between individual OSATS scores and risk-adjusted 30-day surgical complications ($r^2 = -0.004$, $p = 0.47$). Surgical technical skill did not affect surgical complications after open colorectal resection. These data suggest that patient factors and the structures and processes of care may influence complications more than technical ability.

37

The use of imaging studies and the effect on surgical delays and complications in patients with acute appendicitis: a population study. ***J. Ablin*****,** ***S. Patel*****,** ***S. Nanji*****,** ***S. Merchant*****,** ***K. Lajkosz*****,** ***S. Brogly*****,** ***P. Groome*****. From Queen's University, Kingston, Ont.**

Computed assisted tomography (CT) and ultrasound (US) have had a significant impact on the treatment of appendicitis. The objective of this study was to describe the use of imaging in the diagnosis of appendicitis and the effects on surgical delays, hospital costs and complications. This study is a retrospective population study, using adult patients in a population of 13.6 million undergoing appendectomy between 2009 and 2015. The primary exposure was the use of imaging categorized as None, US, CT or both (US and CT). The primary outcomes were time from triage to surgery, complications rates and hospital costs. Univariate and multivariate analyses were used to estimate associations between the imaging modality and outcomes. A total of 50 369 patients were identified. There was an equal distribution of males and females (49.7% and 50.3%, respectively). The mean age was 39.9 years, with most patients being from an urban setting (88.7%) and being treated at community hospitals (76.3%). Those with any imaging had a longer wait until surgery (+2.3 h, $p < 0.001$). Time to surgery was highest in those requiring both CT and US (+4.5 h compared with no imaging), followed by those requiring CT (+2.1 h). US increased time to surgery marginally (+0.5 h). Hospital costs were also increased in those with both US and CT (+$256 v. no imaging) and those with CT alone (+$234). Complications rates were associated with the use of CT and both CT and US (but not with the use of US alone). Our study has shown that the use of imaging can result in significant delays until surgery, especially in those requiring CT scan. In addition, hospital costs are significantly increased in this group. Clinicians may want to consider US as the first imaging modality to facilitate early surgery and reduced costs.

38

Relationship between preoperative patient-reported outcomes and hospital length of stay: a prospective cohort study of general surgery patients in Canada. ***J. Sutherland*** **(University of British Columbia, Vancouver, B.C.),** ***G. Liu*** **(University of British Columbia, Vancouver, B.C.),** ***T. Crump*** **(University of Calgary, Calgary, Alta.),** ***M. Bair*** **(Indiana University School of Medicine, Indianapolis, Ind.),** ***A. Karimuddin*** **(University of British Columbia, Vancouver, B.C.).**

As an aging population drives more demand for elective inpatient surgery, one approach to reducing length of stay is enhanced evaluation of patients' preoperative health status. The objective of this research is to determine whether patient-reported outcome (PRO) measures collected preoperatively can identify patients at risk for longer lengths of stay. This study was based on a prospectively recruited cohort of patients who were scheduled for elective inpatient general surgery. All participants completed a number of PROs preoperatively, including the EQ-5D for general health status, the Patient Health Questionnaire (PHQ-9) for depression and the pain intensity (P), interference with enjoyment of life (E) and interference with general

activity (G), known as the PEG, for pain. PROs data were linked to hospital discharge summaries. Multivariate regression was performed to estimate risk of longer lengths of stay, adjusting for patient characteristics and clinical characteristics. The primary outcome was length of stay and its associated cost. Data collection ranged from October 2012 to November 2016. Participation among the population of 2307 eligible patients was 50.5%, providing 1165 participants. Preoperative patient-reported outcomes were not concordant with hospital-reported diagnoses of depression or pain. Patients' preoperative depression and pain scores were independently positively associated with longer length of stay after adjusting for patient-level characteristics. Patients whose PHQ-9 score was 10, representing clinically significant depression, were expected to have a 1.53 day longer hospitalization, an estimated incremental hospital cost of $1667. Preoperative self-reported assessment of depression and pain can assist with identifying patients at higher risk of longer lengths of stay. Patient's self-reported preoperative measures of depression and pain should be incorporated into patient pathways and are opportunities for improving management of general surgery patients, and possibly play a role in aligning hospital funding with patients' needs.

39

No association found between wait time for elective cholecystectomy and postsurgical patient-reported outcomes. ***J. Sutherland*** **(University of British Columbia, Vancouver, B.C.),** ***A. Peterson*** **(University of British Columbia, Vancouver, B.C.),** ***A. Karimuddin*** **(University of British Columbia, Vancouver, B.C.),** ***G. Liu*** **(University of British Columbia, Vancouver, B.C.),** ***T. Crump*** **(University of Calgary, Calgary, Alta.).**

Symptomatic cholelithiasis has a strong impact on an individual's quality of life even though non-emergent cases are often required to wait for extended periods for surgery. The objective of this study is to measure the association between wait times for elective cholecystectomy and patients' postoperative quality of life using patient-reported outcomes (PROs). This is a prospectively recruited sample of patients from multiple hospitals in Canada. Participants completed general health-related quality of life, pain, depression and condition-specific PROs preoperatively and 6 months postoperatively. Four multivariable linear regression models were used to estimate the association between wait time and postsurgical PRO scores. There were 136 participants included for analysis. Participants' average wait was over 4 months. Wait time had no statistically significant or clinically meaningful association with postsurgical PRO scores on any questionnaire. However, 9% of the sample visited the emergency department while waiting for surgery. Current guidelines recommend elective cholecystectomy for all symptomatic patients or patients presenting with complicated cholelithiasis. While patients generally improved with surgery, the duration of their wait was unrelated to their self-reported health, depression and pain 6 months after cholecystectomy. A secondary finding of this study was a relatively high rate of emergency department visits while awaiting surgery. Future research should focus on confirming this finding in a larger sample and identifying risk factors for adverse events to ensure that patients are appropriately triaged for surgery.

40

A comparative study of skills using Basic Endoscopic Skills Training (BEST) Box and Fundamentals Of Laparoscopic Surgery (FLS) Training Box. ***J. Koichopolos*** **(Western University, London, Ont.),** ***J. Hawel*** **(Western University, London, Ont.),** ***E. Sblomovitz*** **(University of Toronto, Toronto, Ont.),** ***I. Habaz*** **(University of Toronto, Toronto, Ont.),** ***A. Elnahas*** **(Western University, London, Ont.),** ***N. Alkhamesi*** **(Western University, London, Ont.),** ***C. Schlachta*** **(Western University, London, Ont.).**

Endoscopic simulation training lacks a cost-effective model for the practice and evaluation of endoscopic skills. The Basic Endoscopic Skills Training (BEST) Box was adapted from the pre-existing Fundamentals of Laparoscopic Surgery (FLS) Box and has been validated as a cost-effective flexible endoscopy simulator. The aim of our study is to explore the relationship between endoscopic and laparoscopic skill. Laparoscopic suturing time was compared with traditional (Simbionix GI Mentor Endobubble simulation) and novel (BEST Box) endoscopic simulators. Senior surgical residents participating in an advanced laparoscopic foregut training course were enrolled in the study. Participants were timed while completing the forward peg transfer task in the BEST Box, endoscopic balloon popping as well as laparoscopic suturing (as per FLS guidelines). The BEST Box consists of 6 skills: (1) forward view peg transfer, (2) retroflexion view peg transfer, (3) puncturing, (4) snaring, (5) clipping and (6) cannulation. Only the forward view peg transfer was timed for our study. Each participant was allowed to practise at each station for as long as they felt necessary before being timed/scored. All stations were then completed twice and the fastest time was recorded. There was significant correlation between the participant's skill in simulated laparoscopic suturing and simulated endoscopic skill using the BEST Box. Among the 15 participants who performed both stations, the Pearson coefficient (r) was 0.551 (p = 0.033) and the coefficient of determination (r^2) was 0.304. There was a trend toward correlation between laparoscopic suturing time and balloon popping score, but this did not reach statistical significance (r = –0.458, r^2 = 0.210, p = 0.086). Timed skills in simulated laparoscopic suturing correlate with skills in simulated flexible endoscopy using the BEST Box. This study adds to the growing body of evidence that laparoscopic and endoscopic skills are complementary and has the potential to impact simulation training involving both skill sets.

41

Geographic and socioeconomic predictors of perforated appendicitis: a national Canadian cohort study. ***G. Akhtar-Danesh***, ***A. Doumouras***, ***D. Hong*****. From McMaster University, Hamilton, Ont.**

Appendicitis is the most common surgical emergency in children. Postoperative outcomes depend on disease severity. Perforated appendicitis is associated with longer hospital stays and higher complication rates. Studies from the United States suggest that socioeconomic status (SES) affects perforation rates, but these effects should dissipate in a universal health care system. Rurality has also been shown to increase perforation risk in adults, but spatial patterns have never been delineated. Accordingly, this study aimed to examine whether geography and SES predict

perforated appendicitis in a large, universal health care system. Using administrative databases, Canadian children < 17 years with appendicitis from 2008 to 2015 were identified. Perforation rates were examined across quartiles of SES and based on distance from treating hospital. A spatial analysis was completed to look for neighbourhoods with high perforation rates. Hierarchal multinomial regression was used to compare high perforation clusters with average clusters. Over the study period, 43 055 children with appendicitis were identified. The overall perforation rate was 30.6%. Figure 1 demonstrates the spatial pattern of perforation rates. Children living > 125 km away from the treating hospital were 2.55 times more likely to have perforated appendicitis compared with those < 50 km away (95% CI 1.35–4.47, p = 0.001). Children in rural areas were 2.39 times more likely to have appendiceal perforation compared with their urban counterparts (95% CI 1.31–4.02, p = 0.001). Lower SES neighbourhoods were not more likely to be high perforation clusters. High perforation clusters were more likely to experience complications (OR = 1.24, 95% CI 1.08–1.42, p = 0.001). In this population-based study within a universal health care system, appendiceal perforation was not a function of SES but rather a spatial phenomenon. Distance from the treating hospital and rurality increased the risk of perforation. These findings highlight the disparities in access to timely surgical care in larger countries.

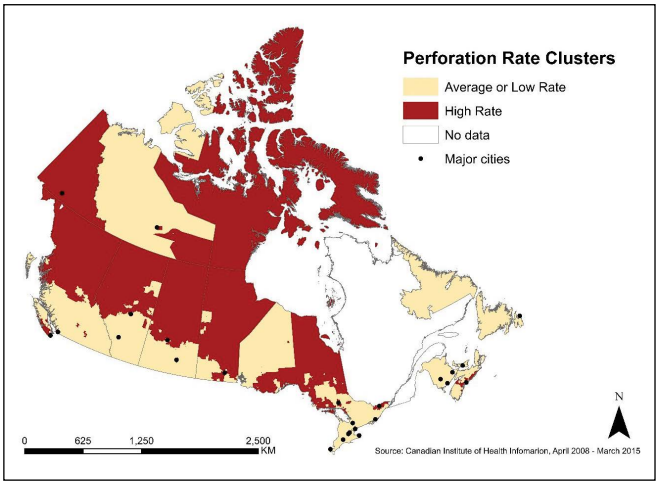


Fig. 1. Neighbourhood pediatric appendicitis perforation rates.

42

Surgical needs and wait times for low socioeconomic status Canadians. *T. Daodu*, *V. Nguyen*, *R. Dearden*, *I. Datta*. From the University of Calgary, Calgary, Alta.

Differences in socioeconomic status (SES) are associated with a disparity in access to and utilization of health services. This study aimed to characterize the challenges faced by individuals living in poverty concerning timely access to surgical specialists. A retrospective review of all referrals from a large urban clinic devoted to treating low SES patients to surgical specialists from Jan. 1, 2010. to Dec. 31, 2014 was conducted. All patients aged 18 years and older referred to general surgery, orthopedic surgery, vascular surgery, neurosurgery, urology, otolaryngology, gynecology, ophthalmology, plastic surgery and gastroenterology were included. Age, gender, housing status, employment status and Charlson Comorbidity Index (CCI) were evaluated. Reasons for referral, average wait time and no-show rates were assessed. Finally, the addition of an on-site gastroenterology clinic was evaluated for its efficacy in reducing wait times and no-show rates. A total of 1154 patients were referred to surgical or interventional specialties by Calgary Urban Project Society (CUPS) physicians and nurse practitioners. Mean patient age was 51 (95% CI 50.16–51.74) and mean CCI was 2.7 (95% CI 2.57–2.82). A total of 751 (65.1%) of patients were male, 519 (45%) of patients were unemployed and 236 (20.5%) had no permanent address. The longest wait times were for neurosurgery (mean 245 d, 95% CI 122.44–368.36) and the shortest wait times were for ophthalmology (mean 56 d, 95% CI 43.91–67.90). There was a 36.5% no-show rate for clinic appointments and 15.4% no-show rate for surgery. Unemployed patients and those with no fixed address were not more likely to miss appointments than other low SES patients. There was a significant decrease in wait time and reduction in no-show rate with the addition of an on-site gastroenterology clinic. Low SES Canadian patients have unique health care needs and are at high risk of missing appointments. This may lead to a delay in diagnosis and treatment and overall poorer health outcomes.

43

Enhancing the human elements of telementoring – a scoping review of the literature. *L. Hampton* (University of Manitoba, Winnipeg, Man.), *A. Kirkpatrick* (University of Calgary, Calgary, Alta.), *J. McKee* (University of Alberta, Edmonton, Alta.), *J. Regehr* (University of Manitoba, Winnipeg, Man.), *P. Brindley* (University of Alberta, Edmonton, Alta.), *D. Martin* (University of Manitoba, Winnipeg, Man.), *A. LaPorta* (Rocky Vista School of Medicine, Parker, Colo.), *J. Park* (University of Manitoba, Winnipeg, Man.), *A. Vergis* (University of Manitoba, Winnipeg, Man.), *L. Gillman* (University of Manitoba, Winnipeg, Man.).

Telementoring has proven to be a viable means of providing advanced medical care in remote or austere environments. A large body of research has focused on developing technology to facilitate telementoring; however, the human element remains largely unexplored. A scoping review was conducted to identify strategies for enhancing communication between health care providers. All English language articles from Medline and Scopus as well as reference lists of relevant articles were searched. Two independent reviewers identified articles concerning telementored interactions between health care providers and categorized them according to theme. A total of 144 articles were identified in the initial search. Of those, 63 articles met inclusion criteria and were included in the review. Forty-one articles focused on improving the quality of 911 dispatcher directed CPR. These studies contained 2 major themes: (1) the ability of the dispatcher to identify an out-of-hospital cardiac arrest (OHCA) and (2) to provide clear instructions to the bystander to administer effective CPR. A standardized approach with scripted questions resulted in a higher sensitivity for detecting OHCA. A short, concise script resulted in improved quality of CPR compared with no mentoring, unscripted mentoring or more complex instructions. Sixteen articles examined telementoring in surgery and trauma resuscitation. Common themes revolved around the development of a common language and establishing an understanding between the mentor and provider

regarding the limitations of the provider and their environment. It was also hypothesized that telementoring may decrease the stress experienced by the provider. Six articles focused on physician–physician consultation. A handover tool highlighting critical information outperformed an unstructured approach in the delivery of vital information. As medicine and technology improve, research into the human factors of telementoring must keep pace. Communication strategies consisting of standard approaches, and short concise validated scripts may improve the safety, efficacy and overall experience for mentors and remote providers.

44

Inventory of residents' perspectives on acute care surgery in Canada. ***K. DeGirolamo, M. Hameed, K. D'Souza*. From the University of British Columbia, Vancouver, B.C.**

Emergency general surgery, which accounts for half of general surgery practice, and which requires rapid, multidisciplinary and often multimodal responses to a broad spectrum of acute surgical illness, offers urgent and unique challenges and opportunities in surgical training. An updated national environmental scan of the educational experiences of residents on acute care surgery (ACS) services is required to advance surgical training, particularly in the context of new movements in competency-based medical education. A cross-sectional online survey was disseminated to general surgical residents across 16 Canadian academic institutions. The survey consisted of multiple-choice and open-text questions. Seventy-four residents (16.3% response rate) participated between August and December 2016. A total of 71.4% of residents report that current service experience and program curricula adequately prepare them to care for emergency general surgery patients; 62.1% report spending more than 50% of their time on service conducting nonoperative duties. Additionally, the majority report lacking opportunities to attend ACS clinics (81.1%) or gain endoscopy experience (75.7%). Learners felt that despite the existence of learning goals and objectives, these were not consistently reviewed (56.2%) at the start of rotations. Lastly, outside of academic half or full days, 42.9% of residents report having no formalized teaching on the ACS service. Furthermore, when probed on improvements that could be made to the service, 30 of 44 respondents suggested formal didactic sessions and bedside teaching opportunities. Other suggestions included integrating clinic experiences, additional allied health professional staffing support, and guidelines on resident expectations. Despite the poor response rate, this survey provides some insight into the educational benefits and potential of ACS reaching services. However, in the future, surgical educators can enhance their ACS curricula by formalizing teaching opportunities in a team environment and expanding learning into clinics.

45

Surgeon and patient adherence to a standardized pain management bundle: a prospective non-inferiority study to reduce opioids in outpatient general surgical procedures. ***L. Hartford, D. Gray, P. Murphy, R. Hilsden, C. Clarke, K. Vogt, R. Wigen, L. Allen, C. Garcia-Ochoa, S. Gray, A. Maciver, N. Parry, J. Van Koughnett, K. Leslie*. From the University of Western Ontario, London, Ont.**

Canada has the second highest rate per capita of opioid prescribing in the world. Surgeons have a crucial role, as the diversion of excessive, unused prescriptions is a major contributor to opioid abuse. We assessed surgeon and patient adherence to a new standardized pain care bundle, designed to reduce opioid use in outpatient general surgical procedures. We implemented a multimodal intra- and postoperative analgesic bundle, promoting co-analgesia regimes and opioid-reduced prescriptions with surgeons; preoperative patient education instructions regarding pain management strategies, minimizing narcotic use and return of unused prescriptions. Opioid prescribing practices were compared in a prospective cohort of 224 patients who underwent laparoscopic cholecystectomy or open hernia repair (inguinal, umbilical) preintervention with 192 patients postintervention (Table 2). Surgeon adherence was assessed by comparing oral morphine equivalents (OME), as well as the number of opioid pills prescribed. Patient adherence was assessed by comparing co-analgesia use and return of medications for disposal. A survey was distributed among surgeons, residents and secretaries at the time of study completion to assess adherence. Descriptive analysis was completed, and groups were compared using χ^2 and Mann–Whitney U tests, as appropriate. Patients found the instructions helpful (174/192; 94%). Surgeons discussed pain control with their patients "usually" or "always" (9/17; 53%) in clinic, and 15/17 (88%) on the day of surgery. For outpatient hernia repair and cholecystectomy, a standardized pain care bundle including education, intra- and postoperative multimodal analgesia, and patient education instructions significantly decreases opioid prescribing, with satisfactory surgeon and patient adherence.

Table 2. Pre-intervention and post-intervention group comparison

Surgeon and patient adherence	Pre-intervention *n* = 224	Post-intervention *n* = 192	*p* value
Prescription given			
OME, median (25th, 75th)	100 (75–116)	50 (50–50)	<0.001
No. of pills, median (25th, 75th)	20 (15–30)	10 (10–00)	<0.001
Anti-inflammatory use, *n* (%)	96 (43%)	134 (70%)	<0.001
Acetaminophen use, *n* (%)	114 (51%)	151 (79%)	<0.001
Medication disposal, *n* (%)	13/173 (7.5%)	18/78 (23%)	<0.001

OME = oral morphine equivalents.

46

Withdrawn

47

Are group practices the way of the future for surgery? A scoping review. ***T. Zwiep, S. Ahn, J. Greenberg, F. Balaa, D. McIsaac, R. Musselman, I. Raiche, L. Williams, H. Moloo*. From the University of Ottawa, Ottawa, Ont.**

Group practices have the potential to positively impact patients and physicians. Physician organization into groups has been

successful in the United States but has not been adopted to the same extent in Canada, especially in surgical specialties. The objective of this study was to review the literature to assess the impact that group practices have on patients and physicians. A scoping review was performed based on the methodology proposed by Arksey and O'Malley and refined by Levac and colleagues and a protocol was developed and published. Medline, Embase, Cochrane Central and the Cochrane Economic Database were searched. Titles and abstracts were screened by 2 members and the abstraction results charted and verified. Qualitative and quantitative analyses were then performed to identify key themes. The initial search strategy returned 2292 articles. After screening, 132 full-text articles were reviewed. Eighty-one articles met the inclusion criteria and were included in the analysis. The majority of these were surveys (63%). The papers were from the United States (57%), Europe (21%), Canada (17%) and others (5%). Family medicine groups were represented most often (77%), followed by surgical specialties (42%) and other specialties (37%). A thematic analysis was performed. Common themes in all disciplines included enhanced quality of life and job satisfaction for physicians when compared with solo practices. Outcomes focused on cost and income were most often associated with papers from the United States. Patient outcomes were not as well studied but did show improvements in access to care and quality of care. Group practices were generally found to improve patient and physician outcomes when compared with solo practices and this trend was present from the 1960s to the present day. This study has identified areas for further study including the barriers to adoption in Canada and the benefits that existing surgical group practices deliver.

48

Withdrawn

49

Timing of CT for adhesive small bowel obstructions. ***M. Nguyen*** **(University of Toronto, Toronto, Ont.),** ***D. Naidu*** **(Sunnybrook Health Sciences Centre, Toronto, Ont.),** ***P. Karanicolas*** **(University of Toronto, Toronto, Ont.),** ***A. Nadler*** **(Sunnybrook Health Sciences Centre, Toronto, Ont.).**

Small bowel obstructions (SBOs) represent one of the most common surgical problems in modern Western medicine where management strategies vary widely between practitioners. The aim of this study was to assess the timing of computed tomography (CT) scan from emergency department (ED) presentation on outcomes for patients with SBOs to guide the development of an evidence-based clinical pathway. A single-institution retrospective chart review to establish pre-pathway implementation performance metrics was performed on patients diagnosed with adhesive SBO between July 1, 2017, and Dec. 31, 2017. Non-adhesive causes of SBO were excluded. Groups were divided based on mean time to CT (early group: 0–6 h v. late group: over 6 h). SBO was confirmed by CT in all patients. Groups were compared using Fisher's exact test. Fifty patients met the inclusion criteria. The mean time to CT from ED presentation was 5 hours, 43 minutes. There were no differences in comorbidities or radiologic grades of SBOs between groups. The average length of stay was 5.6 days for the early group and 6 days for the late group. We found that 94% of the early CT group had an initial plan for conservative management compared with 79% of the late CT group ($p = 0.13$); 61% of the early CT group also had contrast studies as an adjunct to clinical assessment compared with 21% in the late CT group ($p = 0.01$); and 17% of the early CT group had surgery versus 36% of the late CT group ($p = 0.25$). Only 3% of the early CT group required a bowel resection at surgery while 21% of the late CT group did ($p = 0.06$). These preliminary data suggest that early CT may affect management and outcomes in patients with adhesive SBO but further studies are required.

50

Laparoscopic sigmoid colectomy for diverticulitis with transanal extraction. ***R. Raskin*** **(Western University, London, Ont.),** ***V. Khokhotva*** **(Windsor Regional Hospital, Windsor, Ont.).**

The elective surgical management for chronic sigmoid diverticulitis has typically been performed using a laparoscopic approach when feasible. However, the benefits of minimally invasive surgery are diminished when an extraction incision is required. In this video demonstration, we present a case of chronic sigmoid diverticulitis managed with laparoscopic sigmoid colectomy with transanal specimen extraction. Transanal specimen extraction has been associated with a reduction in postoperative pain with decreased analgesia requirements, fewer wound-related complications and shorter hospital stays compared with standard laparoscopic resection. This technique was first described in 1993 and since then has increased in popularity across the world. However, in Canada, this technique has not yet become common. The patient in our case presented with recurrent episodes of acute diverticulitis. CT showed thickening of the left colon. Colonoscopy revealed severe sigmoid diverticulosis with mild left-sided diverticulosis. The patient underwent elective laparoscopic sigmoid colectomy with transanal specimen extraction. She was discharged from hospital 4 days after her operation after resolution of postoperative ileus. The patient did not experience any other short- or long-term complications.

YouTube video link: www.youtube.com/watch?v=g2VIFX1zM80&feature=youtu.be

51

Characterization and compliance of tranexamic acid (TXA) administration to trauma patients in a regional trauma centre. ***R. Poirier*** **(Université de Sherbrooke, Sherbrooke, Que.),** ***C. Plourde*** **(Université de Sherbrooke, Sherbrooke, Que.),** ***A. Paré*** **(Université de Sherbrooke, Sherbrooke, Que.),** ***M. Marchand*** **(Université de Sherbrooke, Centre Universitaire de Santé et de Services Sociaux de l'Estrie, Sherbrooke, Que.),** ***M. Leclair*** **(Université de Sherbrooke, Centre Universitaire de Santé et de Services Sociaux de l'Estrie, Sherbrooke, Que.),** ***J. Deshaies*** **(Université de Sherbrooke, Centre Universitaire de Santé et de Services Sociaux de l'Estrie, Sherbrooke, Que.).**

The CRASH-2 trial has provided robust evidence that the administration of TXA in traumatology can significantly reduce the risk of 30-day mortality (–1.5%, $p = 0.0035$) if the medication is used according to the literature recommendation (<3 h following

trauma). Since the publication of the CRASH-2 trial (2010), very few Canadian data have been published regarding the quality of TXA administration in regional trauma centres. While a very low compliance rate (27%) has been observed, more data are required to develop quality improvement interventions. The primary aim of this study was to assess TXA administration in trauma patients at our centre. A retrospective cohort study was conducted among all trauma patients admitted consecutively who required trauma activation between Jan. 1, 2015, and June 30, 2017, in our centre. To be classified as "optimal," TXA administration had to be initiated < 3 h following the trauma and had to include an initial bolus (1 g / 10 min) and a perfusion (1 g / 8 h). Among 271 trauma patients, 82 (30.3%) presented an indication to receive TXA. Among those patients, 13.4% received the medication according to CRASH-2 recommendations while 20.7% received it in a suboptimal matter. TXA administration (optimal v. suboptimal v. no administration) had no statistically significant impact on 30-day mortality (18.2% v. 17.6% v. 7.4%, $p = 0.260$). Patients who received TXA (adequately or suboptimally) had significantly more confirmed hemorrhage than patients who did not receive it (72.7% v. 38.9%, $p = 0.039$). Sixteen patients (6%) presented an indication to receive TXA in their referring centre but did not receive it and arrived too late in our centre (> 3 h following trauma) to receive it. TXA is underused in our centre. The rate of compliance with CRASH-2 administration guidelines (13%) deserves a consideration by our trauma team. The results support the need for a local intervention to improve the quality of TXA administration.

52

Changes in practice patterns and timeliness of care for women diagnosed with invasive breast cancer in Manitoba. ***P. Hebbard*, *I. Ratnayake*, *K. Decker*, *E. MacIntosh*. From CancerCare Manitoba, Winnipeg, Man.**

Changes in practice patterns can be difficult to measure in clinical practice. Most studies use retrospective administrative data with inherent delays in data collection and analysis. Administrative data may capture timeliness of care but cannot elucidate the reasons behind delays. This is of particular concern in breast cancer where numerous changes in care have been introduced over recent years with little ability to evaluate uptake and outcomes. To address this gap, we measured the quality of breast cancer surgery in 6-month intervals from April 2016 to March 2018 using information captured from a point-of-care synoptic OR reporting system. The synoptic OR system captured over 50 percent of breast cancer cases in the province ($n = 807$). The percentage of invasive breast cancer patients who received neoadjuvant therapy ranged from 12.3% to 17.6%. Rates of re-excision following breast-conserving therapy decreased from 9.3% in 2016 to 3.9% in 2017/2018. No women had reoperation for sentinel node positive disease. These results are consistent with new surgical guidelines. Between 44.5% and 52.5% of patients waited longer than 30 days after initial surgical consult for definitive surgery. Access to OR time accounted for 4.2%–25.2% of delays and between 10% and 24% of all patients chose a later date for personal reasons or the desire to have reconstructive surgery. This study demonstrates that synoptic OR reporting can be an effective tool to contemporaneously monitor trends in surgical quality and capture unique and informative care data for the benefit of both clinicians and policy-makers.

53

Does perioperative nutritional optimization decrease the incidence of postoperative complications in surgical patients with gastrointestinal cancer? A systematic review and meta-analysis. ***Z. Najarali* (McMaster University, Hamilton, Ont.), *M. Valencia* (McMaster University, Hamilton, Ont.), *B. Zhang* (McMaster University, Hamilton, Ont.), *A. Albusaini* (Royal College of Surgeons in Ireland, Dublin, Ireland), *N. Solis* (McMaster University, Hamilton, Ont.), *E. Duceppe* (McMaster University, Hamilton, Ont.), *S. Parpia* (McMaster University), *L. Ruo* (McMaster University, Hamilton, Ont.), *M. Simunovic* (McMaster University, Hamilton, Ont.), *P. Serrano* (McMaster University, Hamilton, Ont.).**

Studies suggest that perioperative carbohydrate loading, increased protein intake and immunonutrition (supplements containing omega-3 and omega-6 fatty acids, glutamine or arginine) contribute to decreases in postoperative complications. The purpose of this meta-analysis is to systematically assess the literature to determine if perioperative nutritional supplements are associated with a lower risk of infectious and non-infectious postoperative complications, and length of hospital stay (LOS) in surgical patients with gastrointestinal cancer. We searched Medline, Embase, the Cochrane Central Register of Controlled Trials and PubMed from 1947 to August 2017 and included randomized controlled trials involving cancer patients undergoing elective curative gastrointestinal surgery. The intervention was perioperative administration of "immuno-nutrition," protein supplementation, carbohydrate loading or a combination. Random effects model was used to pool treatment effects. Heterogeneity was explored via subgroup analysis. The protocol was registered in PROSPERO (CRD42017076266). Of 3097 articles, 58 eligible trials were included ($n = 6372$ patients). Perioperative nutrition was associated with a lower risk of postoperative infections (36 studies, 4416 patients; risk ratio [RR] 0.73, 95% confidence interval [CI] 0.65–0.82). Perioperative nutrition was also associated with a lower risk of postoperative non-infectious complications (39 studies, 5029 patients; RR 0.81, 95% CI 0.72–0.91). Heterogeneity was low for both outcomes ($I^2 = 8\%$ and 25%, respectively). LOS was lower for the intervention group (20 studies, 3680 patients) with a mean difference of –1.47 (95% CI –2.81 to –0.14) and high heterogeneity ($I^2 = 95\%$). Subgroup analysis of surgery type and type of immunonutrition did not explain heterogeneity. Perioperative nutritional optimization decreases the risk of postoperative infectious, non-infectious complications, and LOS in surgical patients with gastrointestinal cancer.

54

Impact of the surgeon on the outcomes of acute appendicitis: a population-based analysis. **P. *Murphy*, *P. Murphy*, *A. McClure*, *M. Dakouo*, *K. Vogt*, *C. Vinden*. From Western University, London, Ont.**

Appendectomy is the most common emergency general surgery procedure performed. The impact of surgeon characteristics on the choice of operation, laparoscopic (LA) or open (OA), and clinical outcomes has not been well studied. This was a population-based retrospective cohort study of all patients ≥ 12 years of age in Ontario undergoing appendectomy from 2006 to 2015 using administrative databases through the Institute for Clinical

Evaluative Sciences (ICES). Surgeons were categorized as laparoscopic surgeons (≥70% of appendectomies were laparoscopic during the study period) and open surgeons (≥ 70% were performed open). Outcomes included readmission, reoperation, emergency department (ED) visit within 30 days, postoperative drainage, length of stay (LOS) and mortality. Regression analysis identified factors determining surgeon choice of operation and compared outcomes based on the surgeon's preferential approach. A total of 98 531 appendectomies were performed in Ontario in the 10-year period. Over the study period the use of laparoscopy increased from 57% in 2006 to 92% in 2015. On univariate analysis, patients undergoing LA had a shorter LOS, fewer reoperations, fewer ED visits and lower mortality than patients undergoing OA (Table 3). After adjusting for patient factors, surgeon age significantly impacted if a patient underwent an OA (OR 2.41 per 10-year increase in age, 95% CI 2.10–2.77). Other factors associated with a patient undergoing an OA included older patient, male gender and perforation. On regression analysis OA was associated with more ED visits (OR 1.13, 95% CI 1.03–1.23) and higher mortality (OR 2.34 ,95% CI 1.41–3.90) but lower drainage (OR 0.63, 95% CI 0.51–0.77). Laparoscopic appendectomy consistently performed equal to or better than open appendectomy for almost all outcomes, including mortality even when controlling for surgeon preference. The benefits of laparoscopy far outweigh the slight risk of postoperative drain insertion and should be adopted as the standard of care. Surgeons providing emergency care should be proficient in laparoscopic appendectomy.

55

Early operative management is a cost-effective strategy in patients with adhesive small bowel obstruction: a population-based, retrospective cost-effectiveness analysis. ***R. Behman, A. Nathens, N. Look Hong, P. Pechlivanoglou, P. Karanicolas*. From the University of Toronto, Toronto, Ont.**

Table 3. Univariate analysis of surgeon characteristics and outcomes

Variable	Laparoscopic appendectomy	Open appendectomy	*p* value
Appendectomies, *n* (%)	78 089 (79%)	20 442 (21%)	
Surgeon age (yr), median (IQR)	43 (38–51)	51 (44–58)	< 0.001
Surgeon male, *n* (%)	61 746 (79.1%)	17 257 (84.4%)	< 0.001
Converted to open, *n* (%)	2 221 (2.8%)	0 (0%)	–
Operative duration (min), median (IQR)	105 (90–120)	90 (75–105)	< 0.001
Length of stay, median (IQR)	2 (2–3)	3 (2–4)	< 0.001
<1 day, *n* (%)	8 344 (10.7%)	839 (4.1%)	< 0.001
Same day or next day, *n* (%)	48 959 (62.7%)	6 659 (32.6%)	< 0.001
Postoperative drain, *n* (%)	1 358 (1.7%)	266 (1.3%)	< 0.001
Reoperation	322 (0.41%)	137 (0.67%)	< 0.001
30-d ED visit, *n* (%)	11 412 (14.6%)	3 288 (16.1%)	< 0.001
30-d readmission, *n* (%)	3 060 (3.9%)	773 (3.8%)	0.40
30-d mortality, *n* (%)	43 (0.055%)	53 (0.26%)	< 0.001

d = day; ED = emergency department

Adhesive small bowel obstruction (aSBO) is a recurrent, potentially chronic surgical illness. While conservative management is often successful, operative intervention for aSBO is associated with a lower risk of recurrence. The long-term costs and benefits to patients of different management strategies for aSBO are not well understood. We sought to compare the long-term cost-effectiveness of a trial of conservative management (TCM, the current standard of care) and early operative management (EOM) for aSBO. We identified patients admitted to hospital with their first episode of aSBO between 2005 and 2013 and created propensity-matched cohorts based on patients' likelihood to undergo EOM, defined as surgery the day of or day following admission. Patients were followed to estimate the number of recurrences and adverse events as well as accumulated costs. Utilities were attributed to aSBO-related events and we estimated the incremental cost-effectiveness ratio (ICER). A total of 25 150 patients were admitted for their first episode of aSBO and 3174 (13%) were managed by EOM. After 5 years of follow-up, the average accumulated costs associated with EOM exceeded those of TCM ($17 752 v. $11 602, $p < 0.0001$). However, patients managed by TCM were 58% more likely to experience a recurrence of aSBO (20.9% v. 13.2%, $p < 0.0001$). The disutility associated with recurrences contributed to a net effectiveness associated with EOM. EOM became more cost-effective with each additional year of follow-up with an ICER of $26 602/QALY after 5 years. Optimal strategies of care for aSBO should consider long-term outcomes and costs, including risks of recurrence and associated adverse events. Within 5 years following the first episode of aSBO, EOM is a cost-effective approach to care compared with TCM. Guidelines regarding the role of early surgical intervention for aSBO should be revisited in view of this evidence.

56

Cancer Care Ontario quality indicators for gastric cancer: total gastrectomy increased lymph node retrieval and increased 30-day mortality at a single institution. ***K. Lung, K. Leslie*. From Western University, London, Ont.**

Cancer Care Ontario recently examined 3 quality indicators for gastric cancer surgery: lymph node retrieval (16 or more), positive proximal or distal margins, and 30- and 90-day mortality. We performed a quality improvement study to determine factors that may affect these quality indicators. All gastrectomies performed at our centre for gastric adenocarcinoma were included. A total of 105 patients were identified between January 2012 and August 2017. Mean age was 68 years, and 30% were female. Ten percent of cases were Siewart III gastresophageal junction cancers. Sixty-five percent of patients did not undergo any neoadjuvant treatment; 35%, 51% and 10% underwent total, subtotal and proximal gastrectomies respectively. Fifty-eight percent had Roux-en-Y reconstruction and 26% had Billroth II reconstruction. Nine percent of the surgeries were on an emergent basis. Ten percent had positive margins. Forty-eight percent had 16 or more lymph nodes retrieved. Thirty-day mortality was 3%, and 90-day mortality was 5%. Median length of stay was 9 days. There was no difference in margin status for patients undergoing total compared with less than total (subtotal or proximal) gastrectomies (13.5% v. 8.8%, $p = 0.51$). There was, however, a greater lymph node retrieval rate with total gastrectomy (75.7% v. 32.4%, $p < 0.001$). Neoadjuvant treatment did not affect margin status (8.1% v. 11.8%, $p = 0.74$) or

lymph node retrieval rates (43.2% v.. 50%, $p = 0.55$). Emergency surgeries were more likely to yield positive margins (44.4% v. 7.3%, $p = 0.01$), but not poorer lymph node retrieval rates (44.4% v. 47.9%, $p > 0.99$). There was no difference in extent of surgery performed for emergency cases ($p > 0.99$). All 3 patients who died in the first 30 days underwent total gastrectomies (8.1% v. 0%, $p = 0.04$). Emergency surgery was not associated with 30-day mortality (11.1% v. 2.1%, $p = 0.24$). Changing practice to perform more total gastrectomies for gastric adenocarcinoma may improve lymph node retrieval rates, but at the risk of greater 30-day mortality.

57

Citywide mass casualty exercise — from the field into the operating room and beyond. ***N. Parry*** **(London Health Sciences Centre, Western University, London, Ont.),** ***K. Vogt*** **(London Health Sciences Centre, Western University, London, Ont.),** ***R. Leeper*** **(London Health Sciences Centre, Western University, London, Ont.),** ***P. Simone*** **(London Health Sciences Centre, London, Ont.),** ***K. Leslie*** **(London Health Sciences Centre, Western University, London, Ont.),** ***E. Schemitsch*** **(London Health Sciences Centre, Western University, London, Ont.),** ***L. Code Orange Committee*** **(London Health Sciences Centre, London, Ont.).**

Mass casualty exercises are essential for disaster management planning. Most are done as tabletop exercises or are limited to the emergency department (ED) without involving inpatient wards or the operating room (OR). We describe a full-scale citywide exercise where mock patients were brought through the entire perioperative care journey during a regular-flow work day. The city staged a citywide mock disaster simulating a tornado touching down at a sporting event. Local college students were moulaged as victims. First responders searched the area and triaged patients to green (ambulatory), yellow (delayed) and red (immediate). All "red" and "yellow" patients presented to the regional trauma centre. Our goal was to evaluate care and flow from the ED to the OR and postoperative care areas. Staff perceptions around emergency preparedness were evaluated with a survey before and after the exercise. Eleven "red" patients presented to the ED where a trauma surgeon and an ED physician were chief triage officers. Each patient was assigned a trauma team leader who consulted other surgical services as necessary. Patients who required operative intervention were physically transported into a fully prepped and staffed OR as soon as resources were available. Eight mock patients with immediate life-threatening injuries required operative intervention. Mean time between booking and patient arrival in the OR was 10 minutes (range –4 to 20). Elective cases were put on hold, but none were cancelled. Communication barriers to clinical services were identified as opportunities for improvement. Staff felt better prepared for a mass casualty event involving the OR after the exercise (24% pre v. 61% post). We demonstrated that the OR and perioperative area can be successfully involved in a mass casualty exercise without adversely affecting clinical care. The exercise highlighted barriers within our current process, which are extremely useful for ongoing disaster management planning.

58

Social determinants of the need for emergency surgery in patients presenting with an inguinal hernia. ***C. Laane*** **(University of British Columbia, Vancouver, B.C.),** ***L. Chen*** **(University of British Columbia, Vancouver, B.C.),** ***L. Rosenkrantz*** **(Simon Fraser University, Burnaby, B.C.),** ***N. Schuurman*** **(Simon Fraser University, Burnaby, B.C.),** ***M. Hameed*** **(University of British Columbia, Vancouver, B.C.),** ***E. Joos*** **(University of British Columbia, Vancouver, B.C.).**

Socioeconomic status (SES) influences the outcomes of surgical pathologies in areas with unequal access to health care. However, in Canada, the health care system is publicly funded. The purpose of this study is to measure the effect of SES on the development of urgent indications for inguinal hernia repair in a universal health care system. This is a propensity-score matched retrospective case-control study. All consecutive adult patients who underwent surgical management of an inguinal hernia between 2012 and 2016 at the affiliated hospitals were included. The SES was measured using the previously validated Vancouver Area Neighbourhood Deprivation Index (VANDIX) score. We identified a total of 2306 patients. Patients were analyzed in 2 groups: elective surgery (controls) and emergency surgery (cases). We included 98 cases and 294 controls matched for age, sex and ASA. The mean age was 65.9 years, 87.5% were male, 91.3% had a unilateral hernia and 11.7% had a recurrent hernia. Conditional logistic regression analysis did not find a significant correlation between lower SES and emergency surgical management ($p = 0.334$). Secondary logistic regression analysis was done to assess the impact of SES on morbidity and length of stay. In the elective group, lower SES correlated with an increased risk of having an extended length of stay (OR 1.737; 95% CI 1.089–2.803). In the emergency group, lower SES had decreased odds for multiple complications (OR 0.219; 95% CI 0.041–0.827). In conclusion, we found no correlation between a low SES and the need for emergency inguinal hernia repair. Although the analysis did not detect disparities in the need for urgent hernia repair in an urban Canadian context, future studies could focus on the effect of SES on surgical outcomes, or the influence of geography on the need for emergency surgery.

59

Hidradenitis suppurativa: wide excision of advanced disease with full thickness skin removal to healthy subcutaneous fat. ***R. George, E. Shavit, A. Pawliwec.*** **From the University of Toronto, Toronto, Ont.**

The surgical literature of 1997–2017 typically advocates excision for hidradenitis suppurativa (HS) extending to the muscular fascia, removing apocrine gland projections into the subcutaneous layer, and reports recurrence rates of 3%–53%. The depth of excision complicates closure and recovery. HS is now understood as a pilo-sebaceous disease. Full thickness skin excision to healthy subcutaneous fat should control HS. We conducted a retrospective review of 192 consecutive HS consultations to a general surgical service, identifying patients treated with wide local excision (WLE). Minor procedures (deroofing, incision/drainage) were excluded. Patient demographics, surgical site, method of closure, complications and recurrence were extracted. Areas excised included axilla, inguinal-crural, inframammary, posterior neck, genital (mons pubis, vulva, scrotal), perianal, and natal cleft. A total of 66 patients underwent 133 WLE. All were excised to healthy subcutaneous fat. One hundred procedures were closed

primarily with rotation or advancement flaps, 33 by secondary intention. Local recurrence occurred in 18% of primary closures and 18% of secondary intention closures. One patient with secondary intention healing returned to the emergency department for bleeding; 34% of patients with primary closure experienced some dehiscence (23% major, 11% minor separation). Two patients with axillary disease had restriction of arm raising, requiring physiotherapy. Median follow-up was 14.3 months (1–55). In all instances preoperative medical therapy was continued in the peri- and post-operative period. Resection to healthy subcutaneous fat during WLE provides comparable control to deeper resections, simplifying care. This reduces the need for complex plastic reconstruction, allowing general surgical care for most HS patients.

60

A strategy for prospective surveillance in emergency general surgery. ***Z. Rana, C. Laane, E. Joos, D. Evans, P. Dawe, R. Brown, M. Hameed*. From the University of British Columbia, Vancouver, B.C.**

Emergency general surgery (EGS) services are an organizing force in Canadian general surgery, with the potential to transform approaches and outcomes for a highly acute patient population. Their success depends on access to and analysis of high-quality process and outcome data. However, the acuity and diversity of the EGS case mix make data collection challenging and expensive, precluding the large-scale adoption of EGS registries. We developed a prospective surveillance strategy for a busy EGS service that could provide a foundation of high-quality data for quality improvement (QI) and resource allocation. EGS patients are identified at the point of care by surgical teams. Key data elements are entered in a secure, Web-based application designed to support data capture for QI and research purposes. This concurrent data entry is used to inform daily handover and team-based decision-making and seamlessly populates a limited EGS registry used to track operative and nonoperative cases. Data for a 7-month pilot period (July 1, 2017 – Jan. 13, 2018) are reported to demonstrate the feasibility of concurrent and complete data capture. A total of 1246 EGS patients were seen by the service, 646 of whom were female (51.8%). Ages ranged from 17 to 103 years (mean age 57.2 yr). Of these, 40.8% underwent a surgical procedure. Our top diagnoses were appendicitis (27.9%), cholecystitis (9.3%), hernia (5.9%) and small bowel obstruction (SBO) (5.9%). Other diagnoses accounted for 14.4%. The rate of nonoperative management was 59.2%: 13.4% for SBO, 9% for appendicitis and 6.1% for cholecystitis. A prospective surveillance strategy integrated into surgical workflow, handover and decision-making was successful in populating a simple, concurrent and complete EGS registry. The registry is useful in quantifying demographics and flow, identifying patients and defining operative and nonoperative case mix, and provides a foundation for QI and research initiatives.

61

Intra-operative injuries during abdominopelvic surgery: an analysis of national medico-legal data. ***G. Lefebvre, K. Devenny, D. Héroux, C. Bowman, R. Mimeault, L. Calder*. From The Canadian Medical Protective Association, Ottawa, Ont.**

Intra-operative injuries during abdominopelvic surgery still occur despite advances in surgical care. Medico-legal data are a rich source of information on medical errors and understanding the contributing factors in surgical injuries may lead to improvements in surgical safety. This study aimed to (1) determine the types and frequencies of injuries that occurred during abdominopelvic surgeries and their medico-legal outcomes; (2) describe clinical management of these injuries; and (3) describe contributing factors (provider, team, system) using an in-house coding system. We conducted a retrospective descriptive analysis of national medico-legal cases (closed between Jan. 1, 2012, and Dec. 31, 2016) that involved an injury during the intraoperative phase of abdominopelvic surgery. We analyzed legal case characteristics and contributing factors at an aggregate level using descriptive statistics. We also conducted a supplementary, qualitative review of relevant College complaint cases (2012–2016) for more insight into nontechnical contributing factors. Our analysis identified 230 closed legal cases and 92 College cases involving abdominopelvic intraoperative injuries in Canada. The most common types of injury in legal cases involved the gastrointestinal tract (26%), vasculature (14%) and ureters (13%). Physicians identified these injuries intraoperatively in 38% of nongynecologic and 14% of gynecologic surgeries; clinical management often involved a return to the operating room for repair (81% of legal cases). Among legal cases, peer experts identified that failure to consider alternate intraoperative surgical techniques (23% nongynecologic, 17% gynecologic) and inadequate surgical safety protocols (19% nongynecologic, 10% gynecologic) contributed to the medico-legal events. College cases highlighted the relevance of effective communication with patients and their families, including disclosure discussions when injuries occur. Understanding patterns of abdominopelvic intraoperative injuries, and why they happened, has important implications for both clinical practice and system improvements. This research presents new opportunities for safer surgical care and supports prioritization of quality improvement efforts.

62

Influence of adjuvant antibiotics on fistula formation following incision and drainage of anorectal abscesses: a systematic review and meta-analysis. ***L. Baker, R. Winter, C. Cahill, D. Fergusson, L. Williams*. From the University of Ottawa, Ottawa, Ont.**

The use of antibiotics following incision and drainage (I&D) of perianal abscesses (PA) is controversial. The objective of this review is to summarize the available evidence on the role of antibiotics following I&D of PA on fistula formation. Embase, Medline and CINAHL were systematically searched from inception to Mar. 9, 2018. Clinicaltrials.gov and the World Health Organization trials registries were also searched for relevant trials. Any studies examining the association between antibiotic administration following I&D of PA and incidence of fistula formation were included. Study eligibility, data extraction and risk of bias were independently assessed by 2 reviewers. Heterogeneity was measured with a Q-test and with I^2 statistics. Data were pooled by using the random-effects model based on the heterogeneity test results and expressed as odds ratios (OR) with 95% confidence intervals (CI). A total of 5 studies (573 patients), 2 randomized controlled trials (RCTs) and 3 observational studies,

were included (Fig. 2). Outcomes assessed included incidence of fistula formation (n = 5) and adverse events (n = 1). Representation to the emergency department and requirement for reoperation were not reported in any of the eligible studies. There was a significant and positive association between antibiotics and reduced fistula formation in 1 study (n = 306) and a negative association in 2 studies (n = 169). Pooled estimate revealed no association between adjuvant antibiotics and fistula formation (OR 0.85; 95% CI 0.27–2.69), with a high degree of heterogeneity between studies (I^2 = 82%). Review of the available literature reveals no association between adjuvant antibiotics and development of perianal fistula following I&D; however, the available data are limited and there is a high degree of heterogeneity between studies, limiting our ability to draw conclusions. Adequately powered, high-quality, RCTs are necessary to establish if adjuvant antibiotics have the potential to reduce the incidence of fistula formation.

63

Does medical school anatomy exposure affect surgical residency applications? An analysis of the Canadian residency match data. ***T. Schroeder*, *K. Kahnamoui*, *S. Elkheir*, *F. Farrokhyar*, *B. Wainman*. From McMaster University, Hamilton, Ont.**

The time dedicated to gross anatomy teaching and cadaveric dissection has been decreasing in North American medical schools. No studies have examined the effects of this trend on surgical residency training. We sought to determine if Canadian schools with more time dedicated to anatomy teaching, in particular cadaveric dissection, produced more first-choice applicants to surgical residency positions. Canadian Resident Matching Service (CaRMS) data from first-year resident match reports were analyzed from 1997 to 2016. An original questionnaire was distributed to each Canadian medical school requesting information on institutional anatomy teaching methods and quantifying the hours devoted to anatomy instruction over the past 20 years. Nonresponders were contacted by phone. Results from a related study were used when no original response was available. Statistical analysis was performed using generalized linear regression analysis for overall effect and Tukey test for pairwise comparison. Data were available for all but 1 school. Over time, relatively fewer medical students applied to surgical programs (p < 0.001); however, the proportion applying to general surgery did not change (p = 0.252). Three schools were more likely to produce first-choice applicants to general surgery (McGill University, p < 0.001; Western University, p < 0.001; and University of Toronto, p = 0.026). One school was less likely to produce first-choice applicants to general surgery (Northern Ontario School of Medicine, p = 0.008). Neither the presence of mandatory dissection nor total hours of gross anatomy instruction had an effect on the percentage of applicants to surgical programs as a whole or general surgery in particular. There is a significant discrepancy between schools producing first-choice applicants to general surgery. There was no correlation with the presence of mandatory cadaver dissection or total hours of gross anatomy instruction. Further investigation is required to determine why this discrepancy exists.

64

Withdrawn

65

Laparoscopic and endoscopic approach to large bowel intussusception in the adult patient: a case report. ***O. Hershorn*, *S. Lim*, *K. Hardy*, *A. Vergis*. From the University of Manitoba, Winnipeg, Man.**

Intussusception is a common emergency among children presenting with abdominal pain or obstruction and is often idiopathic in nature. It is much more rare in adults and is more commonly due to a pathologic lead point, including polyps, Meckel's diverticulum or malignant lesions. We present a case of a 39-year-old woman with features of a partial bowel obstruction from a colorectal intussusception from a large circumferential polyp unresectable by colonoscopy. A combination of endoscopic and laparoscopic techniques were used to reduce the pathologic lead point and resect the portion of diseased bowel as illustrated in the submitted video. Utilization of endoscopic and laparoscopic

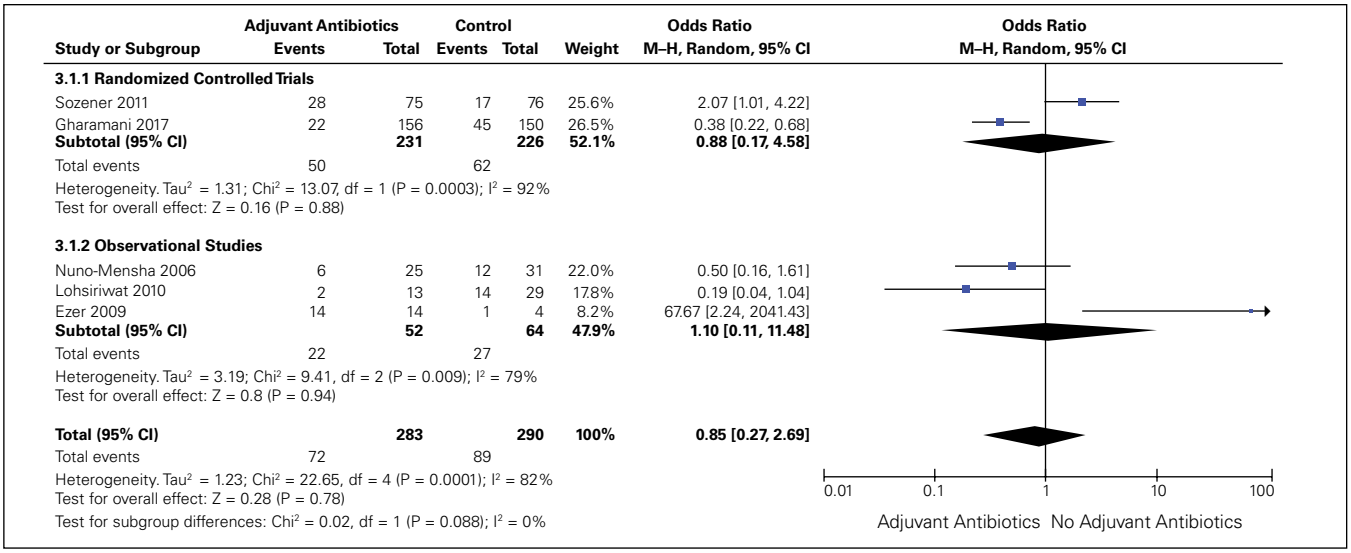


Fig. 2. Major complications for antibiotic versus no antibiotic groups.

techniques represents a novel approach to the management of intussusception in adults and may be superior to previous forms of nonoperative and operative management.
YouTube video link: https://youtu.be/FDv5DDmeKrs

66

What am I training for? An analysis of surgical trainees' educational and employment expectations in Canada. ***A. Arora*** **(University of Toronto, Toronto, Ont.),** ***F. Wright*** **(University of Toronto, Toronto, Ont.),** ***A. Nadler*** **(University of Toronto, Toronto, Ont.),** ***J. Escallon*** **(University of Toronto, Toronto, Ont.),** ***L. Gotlib*** **(Sunnybrook Health Sciences Centre, Toronto, Ont.).**

Unemployment or underemployment after graduation from residency is a known issue in general surgery (GS). The aim of the current study was to explore graduating residents' employment expectations and to recommend ways to increase employability within the current system. An online questionnaire was developed and distributed to graduating GS residents at a national review course in 2018. A descriptive analysis was performed. A total of 48/110 (44%) residents responded, representing 14/17 GS programs from Canada. Sixty-nine percent of respondents felt ready for practice yet only 15% of respondents stated they had secured a full-time job (of whom 43% were from Quebec). Seventy-six percent of respondents were moderately or severely stressed about finding a job. Fifty-four percent of respondents would consider taking a job outside of Canada if they could not secure a position in Canada. Sixty-four percent of participants thought there should be mandatory retirement age or a decrease in the residency spots to increase employment. Ninety-two percent of respondents thought the best ways to find jobs were by doing electives at the hospital and having connections/contacts at that institution. More than 84% thought job sharing could result in mentoring or smooth transition to practice. Most respondents ranked location of practice as the single most important factor in a job. Employment after graduation from GS remains an issue. Based on the responses we suggest a multi-pronged approach to ameliorate this issue, including investment in career planning and counselling at the GS program level, use of the new transition to practice year to create job-finding networks, increased use of shared practice models, and possibly fewer GS residency match spots at the national level. Focused interviews with survey participants are planned to further explore these findings.

67

The educational role of autonomy in medical training: a scoping review. ***M. Allen, N. Gawad, I. Raîche*****. From the University of Ottawa, Ottawa, Ont.**

Medical training is built upon incremental independence; however, limits imposed upon autonomy in recent years have resulted in concern regarding the current quality of medical training. The role of autonomy and its impact on medical education have not been comprehensively reviewed. As such, a scoping review was performed to explore the literature and provide a more thorough understanding of the significance of autonomous practice in medical training. A scoping review was performed given the limited empiric evidence. The Medline electronic database was searched for all study designs on the role of autonomy in medical training. Articles that referenced the medical profession or trainees, and "autonomy," "independence" or "supervision" were included. Inclusion criteria was broad given the paucity of studies focusing on the role of autonomy. A 3-step selection process was implemented to select articles for final analysis. Data were qualitatively synthesized and analyzed. The search yielded 884 articles, of which 307 were included for full-text review. The educational role of autonomy was not mentioned in 167 articles. Of the remaining publications, 140 described participant (80) or author (60) opinions regarding the potential benefits of autonomy as an educational strategy, predominantly in residency training. The most commonly identified themes associated autonomy with increased confidence and the development of clinical decision-making skills. Only 2 studies specifically assessed the role of autonomy: a survey on resident perception of autonomous practice as an educational strategy and a simulation-based study in which autonomous practice led to improved learning outcomes. Currently, the literature on the role of autonomy in medical training primarily represents the subjective opinion of medical educators and trainees. A better understanding of the role of autonomy could lead to the development of educational strategies to compensate for the gap left by the current context of decreased autonomy in medical training.

68

Optimal timing of emergency cholecystectomy for patients with acute cholecystitis: a systematic review and meta-analysis. ***G. Jeyakumar, D. Li, M. Aarts*****. From the University of Toronto, Toronto, Ont.**

Acute cholecystitis (AC) is best managed with cholecystectomy during the emergency hospital admission. The optimal timing of urgent cholecystectomy is unknown and is needed to appropriately prioritize patients waiting on the emergency operative list. A systematic review was completed for articles published between 2000 and January 2018. Studies were included if they evaluated bile leak, mortality or conversion to open surgery based on timing of surgery during hospital admission for AC. Pooled data were used for calculations. Nineteen cohort studies were included. Studies fell into 2 groups: those that evaluated outcomes based on (a) duration of symptoms until cholecystectomy (< 72 h v. > 72 h) (8 studies, 1800 patients), or (b) wait time (d) for cholecystectomy after hospital admission (11 studies, 166 342 patients). There was no significant difference in biliary tract injuries (fixed effects model, RR = 0.47; 95% CI 0.14–1.55) or mortality (single study, RR = 0.58, 95% CI 0.03–11.93) between patients who underwent surgery < 72 hours versus > 72 hours of symptoms. However, significantly fewer conversions were needed in patients undergoing surgery with < 72 hours of symptoms (fixed effect model, RR = 0.69, 95% CI 0.50–0.93). In those studies evaluating wait time from admission to surgery, bile duct complications increased with waiting (< 24 h = 0.65%, day 1 = 0.99%, day 2 = 1.19%, day 3 = 1.26%, day 4 = 1.16%, $\chi^2 = 23.6$, $p < 0.0001$), as did conversion rates (< 24 h = 14.63%, day 1 = 16.94%, day 2 = 21.49%, day 3 = 21.89%, day 4 = 21.21%, $\chi^2 = 58.5$, $p < 0.0001$). Despite this, mortality rates were highest in patients undergoing surgery < 24 h and ≥ day 3 (< 24 h = 0.96%, day 1 = 0.77%, day 2 = 0.78%, day 3 = 0.98%, day 4 = 1.49%, $\chi^2 = 22.2$, $p < 0.0001$). Increased wait time for urgent cholecystectomy in patients with AC is associated with increasing rates of bile duct injury and conversion. Consideration should be given to a 48-hour timeframe for cholecystectomy upon admission for AC.

69

Impact of the acute care surgery model on resident operative experience in emergency general surgery. ***M. Meschino*, *A. Giles*. From McMaster University, Hamilton, Ont.**

Implementation of the acute care surgery (ACS) model of emergency general surgery (EGS) delivery has been shown to improve patient, hospital and surgeon-specific outcomes. To date, however, little has been published on the impact of the ACS model on residency training. Our study compared the EGS operative experience between residents on ACS (ACS-R) and elective (Elective-R) rotations. Resident-reported case logs were prospectively collected over a 9-month period for all EGS cases across 3 teaching hospitals in our academic institution. Descriptive statistics were tabulated and group comparisons made using the χ^2 statistic for categorical data and t test for continuous data. Overall, 1061 cases were reported, with resident participation approaching 70% (88% ACS-R, 66% Elective-R). Appendiceal and biliary disease accounted for 50% of cases. Residents on ACS rotations reported twice as many EGS cases per block as elective residents (12 v. 6, $p < 0.001$). However, the majority of these cases occurred overnight while on call rather than during daytime ACS hours (80% v. 20%, $p < 0.001$), with significant variability noted between sites (91% v. 75% v. 71%, $p < 0.001$). Senior residents were more likely than junior residents to report a role of primary operator in a given case (74% v. 38%, $p < 0.001$). While there was no difference in senior resident role on call versus daytime, junior residents were significantly more likely to be involved as primary operator during daytime cases (50% v. 33%, $p = 0.015$). The competency by design mandate has forced residency programs to reevaluate the way surgical training is being delivered. Despite implementation of the ACS model, residents in our program continue to obtain most of their EGS operative experience after hours while on call. While further research is needed, our study suggests that improved daytime operating room access may be one way to maximize the quantity and quality of the EGS experience at our institution.

70

Is there a gender bias in the advancement to the Society of American Gastrointestinal and Endoscopic Surgeons (SAGES) leadership? ***T. Dumitra*, *R. Alam*, *J. Fiore*, *J. Mata*, *G. Fried*, *M. Vassiliou*, *C. Mueller*, *L. Lee*, *L. Feldman*. From the McGill University Health Centre, Montreal, Que.**

The proportion of women in surgery has risen significantly, yet there are fewer women in leadership positions within academia. Specialty societies play an important role in academic advancement but the progression of women in surgical societies has not been studied. The purpose of this study was to determine if there are gender differences in advancement within SAGES leadership. A retrospective audit of all SAGES committee members (CM) from 1992 to 2016 was performed. The overall membership gender distribution was available from 2010 to 2016. Leadership positions included committee chair/co-chair, board of governors and executive committee. Three phenomena were investigated: pipeline, by determining the change in women CMs compared with overall membership over time; sticky floors, by comparing advancement beyond CM by gender; and glass ceiling, by analyzing the promotion trajectory and time to leadership positions between genders. Statistical analysis comparing trends over time was performed using Kendall's tau. There were 1326 surgeons who served on at least 1 committee during the study period. Women represented 14.7% of CMs, 14.7% of chairs/co-chairs, 15.2% of board members and 15% of executives, with 1 woman president. The proportion of women CMs has significantly increased over time from 3% in 1992 to 23% in 2016 (p-trend < 0.001). A similar proportion of women and men advanced beyond CM (2.4% v. 2.9%, $p = 0.350$), with no difference in time to advancement. From 2010 to 2016, the proportion of women CMs and board members increased at a faster pace than the proportion of overall women members ($p < 0.05$). Female executives surpassed overall women members in 2016 (29% v. 16%). A similar proportion of men and women "skipped ranks" to reach the board/executive (34% v. 20%, $p = 0.268$). The proportion of women in leadership positions within SAGES is higher than in the overall membership. There were no gender differences in the advancement of CMs to leadership positions. While these data are encouraging, SAGES should continue to foster the advancement of women surgeons.

71

Acute appendicitis and biliary disease outcomes in the paradigm of acute care surgery: a systematic review and meta-analysis. ***O. Al Busaidi*, *A. Brobbey*, *T. Stelfox*, *T. Chowdhury*, *J. Kortbeek*, *C. Ball*. From the University of Calgary, Calgary, Alta.**

Before the introduction of acute care surgery as a module of care, surgical emergencies were dealt with by a staff surgeon on a daily basis. Regardless of how busy his or her night was, the surgeon was still expected to stay the next day for his or her own elective duties or clinic. In an attempt to avoid such scenarios and eventually improve the quality of care in surgery departments, the ACS model of care was established in 2005. The main aims were to reduce emergency waiting time and have dedicated surgeons away from elective list distraction. Many retrospective single-centre studies have already discussed the efficacy of ACS in reducing the time to operate and the number of procedures done at night. This systematic review meta-analysis looks into different aspects where ACS affected appendectomy and cholecystectomy outcomes. PRISMA guidelines were followed for this systematic review. Ovid Medline, Embase and Google Scholar were searched. Papers with raw data discussing the pre-ACS and post-ACS eras were selected. Out of 1704 papers, 27 studies were selected to be included in this project, 14 discussing acute appendicitis, 10 discussing biliary disease and 3 discussing both. Using STATA v14, the random effect of the most common complications, length of stay, mortality and cost were pooled. The ACS model had proven itself an effective model in reducing overall complications as well as patient length of stay.

72

Costs of complications in general surgery: Are we adhering to the best practice bundles? ***N. AlShahwan*, *S. Fraser*. From McGill University, Montreal, Que.**

Surgical complications have been reported to be the most adverse events in Canadian hospitals. These surgical complications increase patient morbidity, mortality and cost. The purpose of this study is to identify the costs of treating common complications

after general surgery procedures at a tertiary care centre and determine the rate of adherence to the best practice prevention bundles published by the American College of Surgeons' National Surgical Quality Improvement Program (ACS NSQIP). Patient's charts were reviewed over a 1-year period and the costs of treating patients with complications were compared with the costs of treating similar patients with matching diagnoses and surgical procedures who did not have any complications. These patients were identified using the NSQIP database. The complications of interest are urinary tract infections (UTIs), venous thromboembolisms (VTEs) and deep surgical site infections (SSIs). Our primary outcome is the cost of complications. Secondary outcomes are length of stay, 30-day mortality rates and adherence to prevention recommendations. The cost data were obtained using the hospital's accounting software; the data showed the costs of admission, surgical procedure, medications, laboratory tests, imaging, emergency department visits and clinic visits. The total number of complications identified was 66; the majority were deep SSIs. The cost of treatment was significantly higher for all patients with complications regardless of the procedure. The crude length of stay was 21.54 days in the complication group versus 5.7 days for the no-complication group. The mortality was significantly higher in the complication group (6%) versus (0.9%) in the no-complication group. Reviewing the adherence to the prevention bundles showed that 13% of UTIs were preventable. This is the first Canadian study to examine the added costs of complications to general surgery procedures; there was an increase in mortality, length of stay and costs in treating the patients who had a complication.

73

Gender is associated with promotion among Canadian academic surgeons. ***N. Gawad*** **(University of Ottawa, Ottawa, Ont.),** ***A. Tran*** **(University of Ottawa, Ottawa, Ont.),** ***A. Martel*** **(University of Ottawa, Ottawa, Ont.),** ***N. Baxter*** **(University of Toronto, Toronto, Ont.),** ***M. Allen*** **(University of Ottawa, Ottawa, Ont.),** ***N. Manbas*** **(University of Ottawa),** ***F. Balaa*** **(University of Ottawa, Ottawa, Ont.).**

Female physicians are less likely to be full professors in the United States, but gender disparities in faculty rank have yet to be studied in Canada. The purpose of this study is to determine if differences in region, training, research productivity and years in practice explain gender differences in academic promotion among Canadian surgeons. A cross-sectional database of practising faculty-appointed general surgeons in Canada in 2017 was developed using searches of publicly available physician directories, university and hospital websites and direct communication with departments. Information included gender, region, residency completion year, graduate education, completion of Clinician Investigator Program, fellowship training, number of publications as residents and in practice, and Scopus H-index as a marker of publication impact. A 10% audit was completed to ensure reliable data extraction between investigators. The dependent variable was binary, defined as whether full professorship was attained or not. All variables were analyzed in a multivariable logistic regression. Of the 429 surgeons included, 112 (26%) were women. Sixty-three percent of women were assistant professors (38.8% of men). Conversely, 5.4% of women were full professors (24.6% of men). While women completed residency more recently (15.1 v. 20.1 yr, $p < 0.001$), male and female surgeons did not differ significantly in their number of publications as residents (3.15 v. 2.84, $p = 0.59$) or per year of practice (2.49 v. 1.97, $p = 0.10$), number of fellowships pursued ($p = 0.33$) or graduate education ($p = 0.07$). Gender remained significantly associated with obtaining full professorship (OR 3.71, 95% CI 1.22–11.27, $p = 0.02$) in the multivariable model (Table 4). The model's c-statistic was 0.91. Female surgeons with faculty appointments in Canada are significantly less likely to receive promotion to full professor controlling for years in practice, clinical and graduate training and research productivity. The responsibility lies on universities to address the pervasive inequities in systems of promotion.

74

Laparoscopic sigmoid colectomy with hand-sewn end to end anastomosis. ***D. Mannina, V. Khokhotva*****. From Western University, London, Ont.**

Developed in the Soviet Union in the 1940s, surgical staplers can offset limited surgical skill, thus enabling surgeons to be trained faster. Subsequently, staplers for gastrointestinal anastomosis facilitated the laparoscopic approach to colorectal surgery. Studies failed to show a benefit of stapled versus hand-sewn anastomotic technique. While offering reduced operative time, stapled anastomoses are more expensive. Laparoscopic colorectal surgery is mainstream in wealthy settings but remains out of reach for most of the world, where stapler costs are prohibitive. Moreover, hand-sewn anastomoses require less dissection and mobilization, thus making for less invasive surgery. Where staplers may not be

Table 4. Multivariable analysis for predictors of promotion

Variable	Odds ratio	Significance
Gender		
Female	Reference	
Male	3.708 (1.220–11.267)	$p = 0.02$
Region		
Quebec and Eastern Canada	Reference	
Ontario	0.934 (0.379–2.306)	$p = 0.88$
Western Canada	2.287 (0.950–5.509)	$p = 0.07$
Degree		
None	Reference	
Basic Science	1.013 (0.339– 3.025)	$p = 0.98$
Epidemiology	0.429 (0.084–2.198)	$p = 0.31$
Medical Education	1.801 (0.466– 7.421)	$p = 0.42$
Other	1.429 (0.466–4.383)	$p = 0.53$
Clinician investigator training		
None	Reference	
Yes	0.213 (0.040–1.128)	$p = 0.07$
Total publications		
Per 10 publications	1.616 (1.102– 2.370)	$p = 0.01$
H-Index		
Rating	1.043 (0.960–1.133)	$p = 0.32$
Fellowships		
None	Reference	
Yes	0.483 (0.209–1.115)	$p = 0.09$
Practice years		
Per decade of practice	1.616 (1.102–2.370)	$p = 0.01$

feasible, hand-sewn anastomoses are a viable option. Here we present a technique of laparoscopic hand-sewn anastomosis following resection of a neoplasm located in mid sigmoid colon. The patient is a 54-year-old man, who presented with vague abdominal pain and rectal bleeding. He is otherwise healthy, a non-smoker and has no family history of colon neoplasms. Colonoscopy demonstrated a circumferential near-obstructing mass in mid sigmoid colon. The neoplasm was marked with India Ink tattoo and the patient underwent surgery. The sigmoid, descending colon and upper rectum were mobilized, the vascular pedicle was divided and the mesentery was cleared coming to the points of proximal and distal transection. Subsequently the colon was transected proximally and then distally. Endoloops were used to contain GI contents of the resected specimen, which was then positioned into a large extraction bag. Two-layer sutured anastomosis of the proximal descending colon and rectosigmoid area was constructed using interrupted 3-0 Vicryl sutures on the outer layer and a running 3-0 PDS V-Loc inner layer. The anastomosis took 104 minutes to complete. The patient was discharged on postoperative 3 without complications. We conclude that the technique of laparoscopic hand-sewn anastomosis is feasible and can be used in situations where a stapler cannot.
YouTube video link: www.youtube.com/watch?v=d9LO02ehtdU

75

A national study of in-residency research productivity among Canadian academic surgeons. ***A. Tran, N. Gawad, A. Martel, N. Manhas, M. Allen, F. Balaa.*** **From the University of Ottawa, Ottawa, Ont.**

The demands faced by surgery residents are changing over time as factors such as work-hour restrictions, societal expectations and increased subspecialization present competing forces. Resident research is well established as an important aspect of general surgery training and is related to future research productivity, fellowship training and eventual academic career. The impact of these competing forces on resident research productivity has not been studied on a national level. The purpose of this study is to describe trends of in-residency research productivity among academic general surgeons across Canada. A retrospective cohort analysis was conducted to identify all practising academic general surgeons across 17 institutions in Canada using searches of publicly available physician directories, university and hospital websites and direct communication with departments. A database was created including gender, region, year of residency completion, graduate education, fellowship training and number of publications during residency. The mean number of in-residency publications by decade was compared using analysis of variance testing. Four hundred and thirty-four surgeons were included. Of these, 73% were male, 61.7% completed graduate studies and 45.2% were designated assistant professor. The median number of fellowships completed was 1 (IQR 0–1) and the median number of years since completing residency training was 17 (IQR 10–26.8). The mean number of in-residency publications for surgeons completing residency in or after 2010 is 4.5, 2 of which were first-author publications. There was a significant increase in resident research productivity per decade for number of total ($p < 0.001$) and first-author ($p < 0.001$) publications. There was also a significant increase in completion of graduate education per decade ($p < 0.001$). This study describes the landscape of research productivity among Canadian general surgery residents who pursue academic practice. The changing demands faced by surgery residents are demonstrated through the significant increase in resident research productivity over time.

76

Adhesive small bowel obstruction is associated with high short- and long-term mortality: a population-based analysis of 22 197 patients. ***R. Behman, A. Behman, B. Haas, N. Look Hong, P. Pechlivanoglou, P. Karanicolas.*** **From the University of Toronto, Toronto, Ont.**

Adhesive small bowel obstruction (aSBO) is among the most common reasons for admission to a general surgery service. Despite its prevalence, the short- and long-term survival of this patient population has not been well described. We sought to estimate the short- and long-term survival of patients admitted to hospital with aSBO. We used administrative data to identify patients admitted for their first episode of aSBO between 2005 and 2011. Patients were divided into 2 subgroups: those younger than 65 years at the time of admission (non-geriatric subgroup [NGS]) and those 65 years or older (geriatric subgroup [GS]). We estimated the overall 30-day, 90-day and 1-year mortality. One-year mortality was compared with the general population. We also assessed the timing of deaths in relation to admission as well as the proportion of patients who were discharged before experiencing a short-term mortality. A total of 22 197 patients were admitted for their first episode of aSBO. The mean patient age was 65 years and 52% of patients were female. Overall, the 1-year mortality of the cohort was 13.9% (6.7% in the NGS, 19.4% in the GS). For both subgroups, the 1-year risk of death was significantly greater than that of the age-matched general population (13.9-fold in the NGS, 3.9-fold in GS). While the majority (59%) of deaths occurred within 90 days of admission, the elevated risk of death compared with the general population persisted beyond 90 days. A significant proportion of short-term deaths (36%) occurred after discharge from the aSBO admission. Patients admitted with aSBO have a high risk of short- and long-term mortality, with the majority of deaths occurring within 90 days of admission. Increased monitoring of patients in the early postadmission period may be necessary.

77

Withdrawn

78

The inter-rater reliability of technical skills assessment and retention of rater training. ***N. Gawad, A. Fowler, R. Mimeault, I. Raiche.*** **From the University of Ottawa, Ottawa, Ont.**

The inter-rater reliability of laparoscopic skills assessment is usually determined in the context of motivated raters from a single subspecialty practice group with significant experience using similar tools. The purpose of this study was to determine what extent of rater training is necessary to achieve good inter-rater reliability between attending surgeons with differing subspecialty practices, and if rater training is retained over periods of non-use. Two

attending surgeons assessed a total of 33 laparoscopic cholecystectomy videos using the Global Operative Assessment of Laparoscopic Skills (GOALS) instrument over 5 scoring sessions distributed across 6 months. They participated in different types of training sessions before their first and third scoring sessions, and retention was tested in their second, fourth, and fifth scoring sessions. Inter-rater reliability was calculated with an intra-class correlation (ICC) in a 2-way random-effects model. Inter-rater reliability was highest after each training session (Scoring #1 ICC = 0.76, Scoring #3 ICC = 0.74). Inter-rater reliability was not retained 1.5 months after the brief video-based training session (Scoring #2 ICC = –0.17). It was retained 2.5 months after the in-depth discussion training session (Scoring #4 ICC = 0.70), but not 4.5 months later (Scoring #5 ICC = 0.04). Good inter-rater reliability can be achieved with different types of rater training, but the impact of rater training is lost in periods of non-use. This suggests the need for further study of the inter-rater reliability of technical skills assessment when performed by the wide variety of surgeon raters as is commonly encountered in the environment of postgraduate resident assessment.

79

What are the odds of colorectal polyps or cancer in patients with abnormal fecal occult blood tests? Results from a population-based screening program. ***L. Findlay-Shirras*** **(University of Manitoba, Winnipeg, Man.),** ***K. Decker*** **(CancerCare Manitoba, Winnipeg, Man.),** ***H. Singh*** **(University of Manitoba, Winnipeg, Man.),** ***N. Biswanger*** **(CancerCare Manitoba, Winnipeg, Man.),** ***J. Park*** **(University of Manitoba, Winnipeg, Man.)**

Most provinces in Canada have launched population-wide, fecal-based colorectal cancer (CRC) screening programs. These programs have, however, led to challenges about how to proceed with follow-up testing given the large number of individuals with abnormal results and limited endoscopy capacity in publicly funded systems. This study assessed the positive predictive value (PPV) of fecal-occult blood screening tests (FT) and the sociodemographic and clinical factors associated with adenomas or CRC in individuals with abnormal FT results. We retrospectively reviewed all individuals (ages 50–74 yr) who participated in a provincial population-based screening program (using high-sensitivity guaiac FT) from 2007 to 2014 (n = 118 096 FTs). Sociodemographic and clinical factors assessed included age, gender, geography, Deprivation Index, Resource Utilization Band (as a measure of health status) and screen type (first or subsequent screening). The FT abnormal rate was 3.5% (3876 abnormal tests). Of 2930 completed colonoscopies, 594 adenomas, 601 advanced adenomas and 126 CRCs were detected. The PPV was 40.8% for any adenoma and 4.3% for CRC. The adjusted odds of adenoma for an individual was 1.2 times that of someone 10 years younger (OR 1.20, 95% CI 1.05–1.37) and 1.7 times higher for men than women (OR 1.71, 95% CI 1.40–2.07). The adjusted odds of cancer for an individual was 3.0 times that of an individual who was 10 years younger (OR 3.0, 95% CI 2.03–4.00). The likelihood of pathologic findings in patients with abnormal FT results is variable. Practitioners and screening programs can use these findings to triage patients, especially older patients and men, to optimize the use of endoscopy resources and expedite diagnoses and potential treatments.

80

Cost-effectiveness analysis of laparoscopic vs. open subtotal gastrectomy for gastric adenocarcinoma. ***A. Gosselin-Tardif*** **(McGill University),** ***M. Abou Khalil*** **(McGill University),** ***J. Mata Gutierrez*** **(McGill University),** ***A. Guigui*** **(McGill University),** ***L. Feldman*** **(McGill University),** ***L. Lee*** **(McGill University),** ***C. Mueller*** **(McGill University),** ***L. Ferri*** **(McGill University).**

Laparoscopic subtotal gastrectomy has been associated with good perioperative outcomes and superior quality of life when compared with the traditional open approach to gastric adenocarcinoma resection, albeit at higher direct operative costs. An economic evaluation was conducted to assess the cost-effectiveness of minimally invasive gastrectomy compared with open gastric resection for patients with gastric cancer. A cost-effectiveness analysis between laparoscopic subtotal gastrectomy (LSG) and open subtotal gastrectomy (OSG) in gastric cancer patients was conducted using a decision tree cohort model. The perspective of the publicly funded Canadian healthcare system was adopted, with a 12-month time-horizon. Model inputs were informed by a meta-analysis of relevant literature, with costs represented in 2016 Canadian dollars (CAD) and outcomes measured in quality-adjusted life years (QALYs). A secondary analysis was conducted using inputs extracted solely from European and North American clinical studies. Deterministic and probabilistic sensitivity analyses (DSA and PSA, respectively) were performed. In the base-case model, costs of LSG was estimated to be $934.78 greater than OSG, with an incremental gain of 0.050 QALYs, resulting in an incremental cost-effectiveness ratio (ICER) of $18 846.12 per additional QALY. On DSA, results were most sensitive to changes in postoperative utility, operating theatre and equipment costs, as well as operative and hospitalization duration. PSA showed that the likelihood of LSG being cost-effective at willingness-to-pay (WTP) thresholds of $50 000/QALY and $100 000/QALY was 64% and 68%, respectively. Secondary analysis using European and North American clinical inputs resulted in LSG being dominant (cheaper and more effective) over OSG, largely due to reduced length of stay following LSG. In this decision analysis model, LSG was cost-effective compared with OSG for gastric cancer, especially when the minimally invasive approach leads to significant length of stay reductions as reported in Western studies.

81

Accuracy of published appropriateness indications for predicting use of damage control during emergent laparotomy for trauma. ***D. Roberts*** **(University of Calgary, Calgary, Alta.),** ***T. Stelfox*** **(University of Calgary, Calgary, Alta.),** ***L. Moore*** **(The University of Texas Health Science Center, Houston, Tex.),** ***J. Holcomb*** **(The University of Texas Health Science Center, Houston, Tex.),** ***J. Harvin*** **(The University of Texas Health Science Center, Houston, Tex.).**

Although studies have identified published indications that experts and practising surgeons agree indicate use of damage control (DC) laparotomy, it remains unknown whether these indications predict use of DC in practice. We examined the accuracy of published appropriateness indications for predicting use of DC during emergent trauma laparotomy. We conducted a retrospective

study of the accuracy of a set of published appropriateness indications for predicting use of DC during emergent laparotomy for trauma. We included consecutive adults (≥ 16 yr of age) who underwent emergent laparotomy for trauma between 2011 and 2016 at a high-volume, level 1, American trauma centre. In total, 1192 young (median 33 yr) patients underwent emergent trauma laparotomy. Published preoperative indications independently associated with an increased likelihood of performing DC over definitive laparotomy included (1) a concomitant severe traumatic brain injury (positive-likelihood ratio [LR] = 4.3; 95% confidence interval [95% CI] = 3.0–6.0); (2) Injury Severity Scale score > 25 (positive-LR = 2.4; 95% CI = 2.1–2.8); or (3) systolic blood pressure (SBP) < 90 mm Hg upon arrival to the trauma bay (positive-LR = 6.0; 95% CI = 3.8–9.6). Published intraoperative indications independently associated with an increased likelihood of performing DC laparotomy included (1) an abdominal vascular injury and major associated hollow or blunt abdominal organ injury (positive-LR = 3.9; 95% CI = 2.5–6.3); (2) devascularization or disruption of the pancreas, duodenum or pancreaticoduodenal complex (perfectly predicted use of DCL); and (3) administration of > 10 units of packed red blood cells (positive-LR = 10.5; 95% CI = 7.3–15.0). The likelihood of undergoing DC laparotomy was 11.7 (95% CI = 1.5–90.7) times higher when the SBP of the patient was persistently < 90 mm Hg during operation and 7.0 (95% CI = 2.1–23.7) times higher when the pH was persistently < 7.2 during operation (instead of only at the beginning of operation). This study suggests that previously published appropriateness indications accurately predict use of DC over definitive laparotomy in practice. They also suggest that surgeons more frequently perform DC when physiologic derangements persist during laparotomy.

82

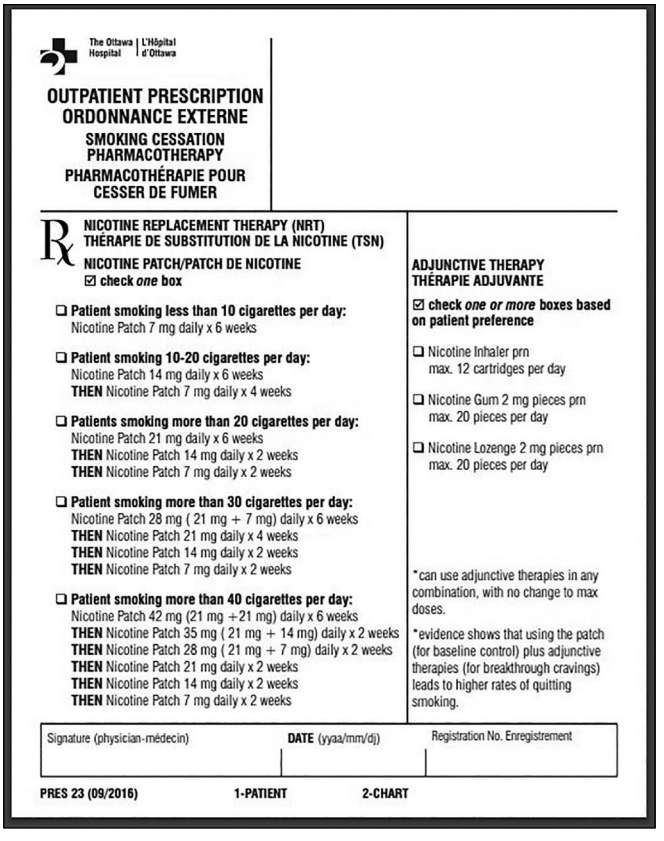
A novel, evidence-based smoking cessation program in an outpatient colorectal surgery clinic: 16-month outcomes. ***J. Sadek*** **(University of Ottawa, Ottawa, Ont.),** ***P. Belanger*** **(University of Ottawa Heart Institute, Ottawa, Ont.),** ***K. Nadeau*** **(University of Ottawa, Ottawa, Ont.),** ***K. Mullen*** **(University of Ottawa Heart Institute, Ottawa, Ont.),** ***D. Aitkens*** **(University of Ottawa Heart Institute, Ottawa, Ont.),** ***K. Foss*** **(The Ottawa Hospital, Ottawa, Ont.),** ***D. MacIsaac*** **(The Ottawa Hospital, Ottawa, Ont.),** ***L. Williams*** **(University of Ottawa, Ottawa, Ont.),** ***R. Musselman*** **(University of Ottawa, Ottawa, Ont.),** ***I. Raiche*** **(University of Ottawa, Ottawa, Ont.),** ***H. Moloo*** **(University of Ottawa, Ottawa, Ont.).**

Smoking cessation programs initiated as late as 4 weeks before surgery reduce perioperative morbidity and mortality, yet outpatient clinic smoking cessation interventions are rarely provided. Our aim was to develop a functional, evidence-based, outpatient smoking cessation program. A multidisciplinary team met regularly over 12 months to develop a program addressing smoking cessation in our colorectal surgery clinic, including a novel protocol, consult form and prescription (Figs. 3 and 4). Two needs assessments identified baseline smoking statistics and current practices. Clinic intervention involved brief counselling, nicotine replacement therapy, quit booklet and referral to a local cessation program through a novel "opt out" technique. Charts were audited and cessation data were collected through the local program. Before implementation, 19% (70/369) surgical patients were smokers. Less than 10% were asked about smoking, and none were offered any intervention. Of 1203 patients seen on 2108 visits over 16 months after implementation, 955 (79.4%) were asked their smoking status on their first visit and 1035 (86.0%) were asked on at least 1 visit. Of 169 smokers identified, 108 (63.9%) consults were sent with the "opt out" technique. Intention-to-treat quit rates at 1, 3 and 6 months were 19.5% (17/87), 18.1% (15/83) and 18.6% (11/59), respectively. Responder quit rates for the same periods were 26.6%, 30.6% and 33.3%. All 10 staff surveyed after implementation felt the program was easy to use, said they would use it again and had positive patient responses. The average required time was 3–6 minutes. Our team has developed a fast, easy-to-use smoking cessation program for outpatient surgical clinics. Successful implementation has led to increased smoking identification, treatment and cessation, with sustained quit rates even at 6-month follow-up. The novel "opt out" technique doubled baseline retention rates. Systematically addressing smoking cessation should be standard of care in outpatient surgical clinics.

83

Sleep deprivation and medication errors in surgery: a prospective observational study. ***S. Zhang, J. Ring, M. Methot, B. Zevin*****. From Queen's University, Kingston, Ont.**

Sleep deprivation in physicians is associated with impaired decision-making, increased medical errors and increased adverse events. General surgery residents are frequently exposed to sleep deprivation; however, a relationship between fatigue and prevalence of


The Ottawa Hospital | L'Hôpital d'Ottawa

OUTPATIENT PRESCRIPTION
ORDONNANCE EXTERNE
SMOKING CESSATION PHARMACOTHERAPY
PHARMACOTHÉRAPIE POUR CESSER DE FUMER

℞ **NICOTINE REPLACEMENT THERAPY (NRT)**
THÉRAPIE DE SUBSTITUTION DE LA NICOTINE (TSN)
NICOTINE PATCH/PATCH DE NICOTINE
☑ **check *one* box**

❑ **Patient smoking less than 10 cigarettes per day:**
Nicotine Patch 7 mg daily x 6 weeks

❑ **Patient smoking 10-20 cigarettes per day:**
Nicotine Patch 14 mg daily x 6 weeks
THEN Nicotine Patch 7 mg daily x 4 weeks

❑ **Patients smoking more than 20 cigarettes per day:**
Nicotine Patch 21 mg daily x 6 weeks
THEN Nicotine Patch 14 mg daily x 2 weeks
THEN Nicotine Patch 7 mg daily x 2 weeks

❑ **Patient smoking more than 30 cigarettes per day:**
Nicotine Patch 28 mg (21 mg + 7 mg) daily x 6 weeks
THEN Nicotine Patch 21 mg daily x 4 weeks
THEN Nicotine Patch 14 mg daily x 2 weeks
THEN Nicotine Patch 7 mg daily x 2 weeks

❑ **Patient smoking more than 40 cigarettes per day:**
Nicotine Patch 42 mg (21 mg +21 mg) daily x 6 weeks
THEN Nicotine Patch 35 mg (21 mg + 14 mg) daily x 2 weeks
THEN Nicotine Patch 28 mg (21 mg + 7 mg) daily x 2 weeks
THEN Nicotine Patch 21 mg daily x 2 weeks
THEN Nicotine Patch 14 mg daily x 2 weeks
THEN Nicotine Patch 7 mg daily x 2 weeks

ADJUNCTIVE THERAPY
THÉRAPIE ADJUVANTE
☑ **check *one or more* boxes based on patient preference**

❑ Nicotine Inhaler prn
max. 12 cartridges per day

❑ Nicotine Gum 2 mg pieces prn
max. 20 pieces per day

❑ Nicotine Lozenge 2 mg pieces prn
max. 20 pieces per day

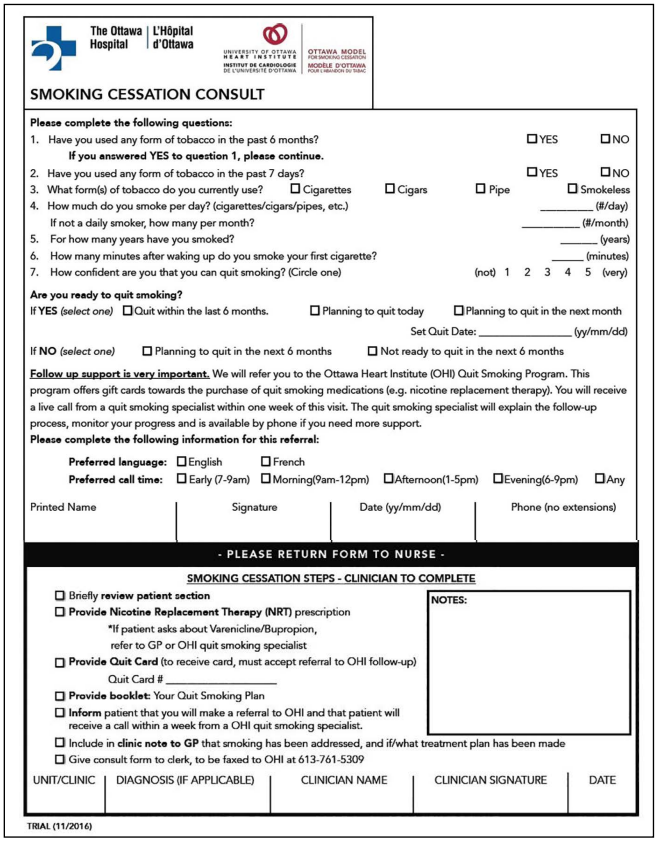
*can use adjunctive therapies in any combination, with no change to max doses.

*evidence shows that using the patch (for baseline control) plus adjunctive therapies (for breakthrough cravings) leads to higher rates of quitting smoking.

Signature (physician-médecin) | **DATE** (yyaa/mm/dj) | Registration No. Enregistrement

PRES 23 (09/2016) **1-PATIENT** **2-CHART**

Fig. 3. Nicotine replacement prescription.



The Ottawa Hospital | L'Hôpital d'Ottawa

SMOKING CESSATION CONSULT

Please complete the following questions:

1. Have you used any form of tobacco in the past 6 months? ☐YES ☐NO
   If you answered YES to question 1, please continue.
2. Have you used any form of tobacco in the past 7 days? ☐YES ☐NO
3. What form(s) of tobacco do you currently use? ☐Cigarettes ☐Cigars ☐Pipe ☐Smokeless
4. How much do you smoke per day? (cigarettes/cigars/pipes, etc.) _____ (#/day)
   If not a daily smoker, how many per month? _____ (#/month)
5. For how many years have you smoked? _____ (years)
6. How many minutes after waking up do you smoke your first cigarette? _____ (minutes)
7. How confident are you that you can quit smoking? (Circle one) (not) 1 2 3 4 5 (very)

Are you ready to quit smoking?

If **YES** *(select one)* ☐Quit within the last 6 months. ☐Planning to quit today ☐Planning to quit in the next month

Set Quit Date: _____ (yy/mm/dd)

If **NO** *(select one)* ☐Planning to quit in the next 6 months ☐Not ready to quit in the next 6 months

Follow up support is very important. We will refer you to the Ottawa Heart Institute (OHI) Quit Smoking Program. This program offers gift cards towards the purchase of quit smoking medications (e.g. nicotine replacement therapy). You will receive a live call from a quit smoking specialist within one week of this visit. The quit smoking specialist will explain the follow-up process, monitor your progress and is available by phone if you need more support.

Please complete the following information for this referral:

Preferred language: ☐English ☐French

Preferred call time: ☐Early (7-9am) ☐Morning(9am-12pm) ☐Afternoon(1-5pm) ☐Evening(6-9pm) ☐Any

Printed Name | Signature | Date (yy/mm/dd) | Phone (no extensions)

- PLEASE RETURN FORM TO NURSE -

SMOKING CESSATION STEPS - CLINICIAN TO COMPLETE

☐ Briefly **review patient section**
☐ **Provide Nicotine Replacement Therapy (NRT)** prescription
*If patient asks about Varenicline/Bupropion, refer to GP or OHI quit smoking specialist
☐ **Provide Quit Card** (to receive card, must accept referral to OHI follow-up)
Quit Card # _____
☐ **Provide booklet:** Your Quit Smoking Plan
☐ **Inform** patient that you will make a referral to OHI and that patient will receive a call within a week from a OHI quit smoking specialist.
☐ Include in **clinic note to GP** that smoking has been addressed, and if/what treatment plan has been made
☐ Give consult form to clerk, to be faxed to OHI at 613-761-5309

NOTES:

UNIT/CLINIC | DIAGNOSIS (IF APPLICABLE) | CLINICIAN NAME | CLINICIAN SIGNATURE | DATE

TRIAL (11/2016)

Fig. 4. Smoking cessation consultation.

medication prescription errors for general surgery residents is yet to be established. Our objective was to determine the prevalence of medication errors for general surgery residents at an academic hospital during post-call (PC) and well-rested (WR) times. We conducted a prospective within-subject observational study comparing medication error rates between PC and WR general surgery residents during patient care rounds (0500–0800). PC residents were defined as having just completed a 24-plus-2 hours call shift, while WR residents did not have a preceding call shift. Pilot data were collected between July and August 2017. Medication errors were identified and classified using a previously defined taxonomy. Error rates were calculated as the total number of errors divided by the total number of medication orders, and stratified between WR and PC residents. PC residents made significantly more errors than WR residents (9.2% v. 3.2%; $p = 0.04$). Errors in decision-making comprised 33% of the total errors, while prescription-writing errors comprised 67% ($p = 0.30$). Among junior residents, 80% of errors related to prescription writing and 20% related to decision-making. Junior residents made 67% of errors while senior residents made 33% of errors ($p = 0.30$). PC and WR error rates were 4.3% and 12.5%, respectively, in July ($p = 0.078$), and 2.0% and 3.3% in August ($p = 0.684$). Our study demonstrated a significant difference in the rates of medication prescription errors between well-rested and post-call residents, with most errors occurring during prescription writing. Residents may be particularly vulnerable to the effects of sleep deprivation at the start of residency. Our pilot data demonstrate a need for preventive strategies to address medication prescription errors and possible resultant patient adverse events.

84

The use of a novel smartphone application for the delivery of bowel preparation instructions: a pilot feasibility trial. ***D. Yu*** **(Queen's University, Johns Hopkins School of Public Health),** ***L. Hookey*** **(Queen's University, Kingston, Ont.),** ***S. Patel*** **(Queen's University, University of Oxford, Memorial Sloan Kettering Cancer Center).**

Poor-quality bowel preparation as a result of dietary and medication nonadherence may result in unnecessary repeat colonoscopies. The objective of this study was assess the feasibility of a novel smart phone application in the delivery of bowel preparation instructions. A novel smartphone application was developed to deliver bowel preparation instructions. Patients undergoing elective colonoscopies with access to a smartphone were eligible. Primary outcomes included endoscopist-reported bowel preparation quality assessed by the Aronchick and Ottawa Bowel Preparation Scales (BPS). Secondary outcomes included cecal intubation and polyp detection rates and patient self-reported medication adherence and application ease of use based on a Likert scale. This is the pilot study results for the COLOPREP trial (NCT03225560). A total of 11 participants were enrolled; all were prescribed Pico-Salax for bowel preparation. The median age was 49 years, and the majority (82%) were male. Indications for colonoscopy included presence of symptoms (64%), screening (27%) and positive fecal occult blood test (9%). Aronchick BPS were as follows: excellent 18%, good 64%, fair 18%. The Ottawa BPS were as follows: 0–4 60%, 5–9 40%. One participant's Ottawa BPS was excluded due to inability to tolerate the entire procedure due to discomfort. Cecal intubation and polyp detection rates were 100% and 30%, respectively (among participants who had complete colonoscopies). Participant-reported adherence to dietary restrictions and medication use was 100%. The mean Likert rating for application usability, instruction understandability and notification helpfulness were 4.9, 4.9 and 4.6, respectively (5 = best, 1 = worst). This pilot study demonstrates the feasibility of a future trial using a smartphone application as an automated reminder program for patients undergoing colonoscopy. We have demonstrated the capability as well as the ease of use of our novel application. Patient recruitment is ongoing, and a future randomized controlled trial is planned.

85

Exclusion criteria and adverse events in perioperative trials using tranexamic acid: a systematic review. ***J. Yates*** **(University of Ottawa, Ottawa, Ont.),** ***I. Perelman*** **(Ottawa Hospital Research Institute, Ottawa, Ont.),** ***E. Saidenberg*** **(The Ottawa Hospital, Ottawa, Ont.),** ***S. Khair*** **(University of Ottawa, Ottawa, Ont.),** ***J. Taylor*** **(University of Ottawa, Ottawa, Ont.),** ***J. Lampron*** **(The Ottawa Hospital, Ottawa, Ont.),** ***A. Tinmouth*** **(Ottawa Hospital Research Institute, Ottawa, Ont.).**

Tranexamic acid (TXA) has been shown to be effective at minimizing blood loss and the need for transfusion during surgery while being safe and inexpensive. Despite this, it remains underused, mainly due to safety concerns. There is also a lack of evidence-based guidelines regarding which patients should not receive TXA due to the risk of harm outweighing potential benefits. We conducted a systematic review and meta-analysis to determine for which patients safety information on TXA is lacking due

to common exclusion from perioperative TXA trials. We searched the databases Medline, Embase, Central and Clinicaltrials.gov from inception until September 2017. Eligible studies were randomized controlled trials (RCTs) administering systemic TXA perioperatively to any elective or emergent surgery patients. Our primary outcome was the exclusion criteria of the RCTs, and as a secondary outcome we assessed risk of adverse events from TXA use. A descriptive synthesis of study characteristics and exclusion criteria was performed. The safety of TXA was assessed through meta-analysis. Two hundred and seventy eligible RCTs were included in this systematic review (Table 5). We found that patient groups commonly excluded from perioperative TXA trials were those with major comorbidities, those with a history of thromboembolic events, those taking medication affecting coagulation, those allergic to TXA and those with coagulopathy (Table 6). Some of these exclusions may not be warranted based on current evidence, but due to being excluded from RCTs, there may be limited efficacy and safety data on TXA in these patient populations.

Table 5. Summary of included studies (*n* = 270)

Study characteristic	*n* (%)
Surgery type	
Orthopedic	114 (42.2)
Elective	100 (37.0)
Emergent	14 (5.2)
Cardiac	70 (25.9)
Spine and neurosurgery	26 (9.6)
Obstetric	16 (5.9)
ENT and maxillofacial	16 (5.9)
Gynecologic	5 (1.9)
Oncologic	5 (1.9)
Plastic	5 (1.9)
Liver transplant	4 (1.5)
Urologic	3 (1.1)
Opthalmologic	2 (0.7)
Thoracic	2 (0.7)
Abdominal surgery	1 (0.4)
Multiple surgery types	1 (0.4)
Patient age	
Adult	259 (95.9)
Pediatric	11 (4.1)
Route of administration for systemic TXA	
IV	257 (95.2)
Oral	13 (4.8)
Comparator groups*	
Placebo	183 (67.8)
No intervention	48 (17.8)
Aprotinin	27 (10.0)
Intra-articular TXA	18 (6.7)
Topical TXA	12 (4.4)
ACA	14 (5.2)
Other	17 (6.3)
Blinding	
Double blind	192 (71.1)
Single blind	22 (8.1)
No blinding	32 (11.9)
Unclear	24 (8.9)

Abbreviations: TXA = tranexamic acid; ENT = ear/nose/throat; IV = intravenous; ACA = aminocaproic acid.

*The sum of numbers will exceed 270 and the sum of percentages will exceed 100%, as some studies had more than 1 comparator group.

Table 6: Exclusion criteria of perioperative TXA trials (*n* = 270)

Exclusion criterion	RCTs with exclusion criteria *n* (%)*†
Comorbidities	**194 (71.9)**
Renal dysfunction	178 (65.9)
Hepatic dysfunction	111 (41.1)
Cardiac dysfunction	91 (33.7)
Ischemic heart disease	30 (11.1)
Coronary artery disease	21 (7.8)
Atrial fibrillation	10 (3.7)
Stent in situ	8 (3.0)
Heart failure	6 (2.2)
Valvular disease	2 (0.7)
Previous history of thromboembolic events	**158 (58.5)**
Deep vein thrombosis	45 (16.7)
Cerebrovascular accident	44 (16.3)
Myocardial infarction	36 (13.3)
Pulmonary embolism	35 (13.0)
Any arterial thrombosis	8 (3.0)
Family history of thromboembolic events	8 (3.0)
Medication affecting coagulation	**144 (53.3)**
Anticoagulants	100 (37.0)
NSAIDS	37 (13.7)
Antiplatelets	33 (12.2)
Contraceptive medications	7 (2.6)
Hormone-containing medications	7 (2.6)
DVT prophylaxis	3 (1.1)
Allergy to TXA	**135 (50.0)**
Coagulopathy	**134 (49.6)**
Family history of coagulopathy	2 (0.7)
Age	**104 (38.5)**
Less than:	
8 mo	4 (1.5)
18 yr	71
40 yr	6 (2.2)
50 yr	3 (1.1)
Greater than:	
5 yr	2 (0.7)
30 yr	4 (1.5)
40 yr	5 (1.9)
55 yr	2 (0.7)
65 yr	12 (4.4)
80 yr	29 (10.7)
Abnormal coagulation profile	**82 (30.4)**
Low platelet count	44 16.3)
Elevated prothrombin time	30 (11.1)
Elevated partial thromboplastin time	20 (7.4)
Elevated INR	19 (7.0)
Anemia	**67 (24.8)**
ASA status	**42 (15.6)**
>1	4 (1.5)
>2	20 (7.4)
>3	18 (6.7)
Hematologic disease	**40 (14.8)**
Pregnancy	**39 (14.4)**
Pregnancy complications	**15 (5.6)**
Refusal of blood product transfusion	**36 (13.3)**

Table 6 (continued)	
Secondary arthritis	**26 (9.6)**
Rheumatologic	23 (8.5)
Osteoarthritis or post-traumatic arthritis	7 (2.6)
Ophthalmologic pathology	**22 (8.1)**
Respiratory disease	**18 (6.7)**
Breastfeeding	**17 (6.3)**
Cerebrovascular disease	**16 (5.9)**
Subarachnoid hemorrhage	**15 (5.6)**
Emergency surgery	**13 (4.8)**
Malignancy (solid tumours or hematologic malignancies)	**13 (4.8)**
BMI	**11 (4.1)**
>35	10 (3.7)
<18	3 (1.1)
Weight	**11 (4.1)**
>100 kg	7 (2.6)
<40 kg	5 (1.9)
Epilepsy	**11 (4.1)**
Intra-operative complications	**11 (4.1)**
Uncontrolled hypertension	7 (2.6)
Surgical bleeding	4 (1.5)
Surgery duration over 2.5 h	1 (0.4)
Hematuria	**10 (3.7)**
Diabetes	**8 (3.0)**
Disseminated intravascular coagulation	**8 (3.0)**
Vascular disease	**7 (2.6)**
Peptic ulcer	**5 (1.9)**
Psychiatric disorder or mental illness	**4 (1.5)**
Alcoholism or drug use	**3 (1.1)**
Biliary pathology	**3 (1.1)**
Immunosuppression	**2 (0.7)**
Kidney transplant	**2 (0.7)**
Gastrointestinal disease	**1 (0.4)**
Low-risk surgery	**1 (0.4)**
Peripheral neuropathy	**1 (0.4)**
Use of antibiotics	**1 (0.4)**

Abbreviations: NSAIDS, non-steroidal anti-inflammatory drugs; INR, International normalized ratio; GnRH, gonadotropin-releasing hormone.

*Totals in bold are the number of studies having 1 or more exclusion criteria for a given exclusion criterion category.

†Percentages are calculated using the 270 studies included in this systematic review as the denominator.

Our meta-analysis showed that perioperative systemic TXA was not associated with an increased risk of adverse events compared with placebo or no intervention (RR 1.05, 95% CI 0.99–1.12) (Table 7). In conclusion, systemic TXA is safe to use perioperatively, and evidence-based guidelines for its use in surgery can be developed for many patient populations.

86

Adenoma detection rates and educational interventions: a systematic review. ***S. Lim, S. Hammond, J. Park, D. Hochman, M. Lê, R. Rabbani, A. Abou-Setta, R. Zarychanski*. From the University of Manitoba, Winnipeg, Man.**

Colonoscopy is an effective but imperfect screening tool for identifying and removing adenomas. Currently, it is unclear how to best improve adenoma detection rates (ADRs). Previous studies examining various methods such as simple feedback, trainee involvement, videorecording and mandating longer withdrawal times have shown minimal to no benefit. There has been some promising, albeit limited, research suggesting colonoscopy quality improvement can be achieved with continuing medical education. In this study, we systematically reviewed the literature of controlled studies to evaluate the effect of an educational intervention on ADRs during screening colonoscopies. A comprehensive search of electronic databases for relevant citations in English was performed. We included randomized controlled trials comparing the effect of an educational intervention on practising endoscopists to no educational intervention. Two reviewers independently screened, identified, assessed internal validity using the Cochrane Risk of Bias tool, and extracted data from trials. The primary outcome was the endoscopists' ADRs. From 842 citations identified, we included 3 randomized controlled trials and 1 companion paper enrolling 119 endoscopists who performed 50 498 colonoscopies. In all trials, an educational intervention significantly improved ADRs following training, although 1 trial demonstrated this improvement was not significant when compared with the change in ADRs seen in their untrained control group. Two trials analyzed longer term follow-up and found that the significant beneficial effect of training on ADRs is maintained for at least 4 months after training. An educational intervention focused on improving colonoscopy quality can substantially improve ADRs leading to increased colonoscopy quality. Adenoma detection and cancer prevention are major parts of surgeon endoscopists' practice, and interventions to improve ADRs should be a mandatory part of their continuing medical education.

87

Assessment of conflicts of interest in robotic surgical studies: validating author's declarations with the Open Payments database. ***S. Patel* (Queen's University, University of Oxford, Memorial Sloan Kettering Cancer Center), *D. Yu* (Queen's University, Johns Hopkins School of Public Health), *B. Elsoh* (Queen's University, University of Toronto), *B. Goldacre* (University of Oxford, Oxford, U.K.), *G. Nash* (Memorial Sloan Kettering Cancer Center, New York, N.Y.).**

Authors are required to declare any conflicts of interest (COI) as industry research funding may bias study results and conclusions. With the Physician Payments Sunshine Act, it is now possible to validate these declaration statements. The objective of this study was to determine the accuracy of self-declared COI statements in robotic studies and identify risk factors for undeclared payments. Robotic surgery studies with at least 1 American published in 2015 were identified through Embase and Medline. Undeclared COI were determined by comparing the author's declared COI with industry-reported payments found in the Open Payments database for 2013 and 2014. Undeclared payments and discrepancies in the COI statement were determined. Risk factors were assessed for an association with undeclared payments at the author and study level. A total of 458 studies comprised of 2253 American authors were included. Urology studies comprised the

Table 7. Summary of meta-analysis results for the secondary outcome of adverse events. Meta-analysis was done separately for each comparator group, given sufficient data (2 or more studies available for analysis)

Analysis	No. of studies*	No. of events / No. patients in systemic TXA group	No. of events / No. patients in comparator group	RR (95% CI)
Systemic TXA v. placebo/no intervention	198	1306 / 13 284	1237 / 12 116	1.05 (0.99–1.12)
Systemic TXA v. topical TXA	12	27/750	25/635	0.81 (0.48–1.34)
Systemic TXA v. intra-articular TXA	17	60/861	60/872	1.01 (0.71–1.45)
Systemic TXA v. ACA	12	567/1187	561/1184	1.03 (0.96–1.10)
Systemic TXA v. aprotinin	24	727/2278	786/2268	0.93 (0.89–0.98)†

Abbreviations: AE = adverse event; RR = relative risk; CI = confidence interval; TXA = tranexamic acid; ACA = aminocaproic acid.
*The sum of studies will exceed the 225 RCTs available for meta-analysis, as some studies had more than 1 comparator group and were used in more than 1 meta-analysis.
†Denotes a statistically significant result ($p < 0.05$).

largest proportion at 32.3%, followed by general surgery at 29.0%, obstetrics and gynecology at 20.1% and other surgical studies at 18.6%. Approximately 240 (52%) studies had 1 author or more receive undeclared payments. Out of these studies, 183 were found to have explicitly declared "no COI," while 57 had no declaration statement present. Moreover, only 21% of studies and 18% of authors with a COI declared so in a COI statement. Studies that had undeclared payments from Intuitive were more likely to recommend robotic surgery compared with those that declared funding (odds ratio 4.29, 95% confidence interval 2.55–7.21). Our study found payments from Intuitive were commonly undeclared in robotic surgery studies. More rigorous mechanisms for accountability in COI reporting need to be put into place by journals to achieve appropriate transparency to the target audience. The findings of published studies with undeclared COI should also be interpreted with caution.

88

Cost-effectiveness of extended thromboprophylaxis in patients undergoing colorectal surgery from a Canadian health care system perspective. ***M. Trepanier*, *N. Alhassan*, *N. Wong-Chong*, *C. Sabapathy*, *P. Chaudhury*, *S. Liberman*, *P. Charlebois*, *B. Stein*, *L. Feldman*, *L. Lee*. From the McGill University Health Centre, Montreal, Que.**

There are increasing data to support extended thromboprophylaxis after colorectal surgery, especially in patients with malignancy and inflammatory bowel disease (IBD). However, the absolute number of thromboembolic events is small, and extended thromboprophylaxis may represent a significant economic burden on the health care system. The objective of this study is to determine the cost-effectiveness of extended thromboprophylaxis in patients undergoing colorectal surgery for malignancy or IBD. A patient microsimulation model (100 000 patients; 1-month cycle length) comparing standard management (inpatient administration only) versus extended thromboprophylaxis (daily low-molecular-weight heparin injections up to 28 days postoperatively) after colorectal surgery was constructed using inputs from the American College of Surgeons' National Surgical Quality Improvement Program (ACS NSQIP) 2012–2016 database and targeted literature searches. Costs, quality-adjusted life years (QALYs) and venous thromboembolism (VTE)-related deaths avoided were calculated over a 1-year time horizon starting with hospital discharge from the perspective of the Canadian health care system. Costs are reported in 2017 Canadian dollars. Probabilistic and deterministic sensitivity analyses were performed. In patients with malignancy, extended prophylaxis was associated with higher costs (+$123; 95% CI 116–130), but increased QALYs (+0.04; 95% CI 0.02–0.06), resulting in an incremental cost-effectiveness ratio of $3075/QALY. In patients with IBD, extended prophylaxis also had higher costs (+$110; 95% CI 98–122) and more QALYs (+0.04; 95% CI 0.02–0.07) with an incremental cost-effectiveness ratio of $2750/QALY. Extended prophylaxis also prevented 17 (95% CI 18–40) and 21 (95% CI 13–32) VTE-related deaths per 100 000 patients for malignancy and IBD, respectively. For both malignancy and IBD, there was a 99.7% probability of cost-effectiveness at a willingness-to-pay threshold of $50 000/QALY. Sensitivity analysis demonstrated that the incidence of postdischarge VTE would have to be greater than 2.1% to result in lower overall costs. Extended thromboprophylaxis was associated with acceptable costs, higher QALYs and fewer VTE-related deaths compared with standard management. Despite the rarity of VTE events, extended thromboprophylaxis is a cost-effective strategy.

89

Use of in situ simulation to identify latent safety hazards during introduction of a massive transfusion protocol. ***N. Bradley*, *C. Dakin*, *N. Holm*, *W. Henderson*, *M. Roche*, *A. Sawka*. From the University of British Columbia, Vancouver B.C.**

In situ simulation can improve care in multiple hospital settings, including the operating room (OR). Following an intraoperative hemorrhage, a new massive transfusion protocol (MTP) was implemented at our outpatient surgery centre. We used a multidisciplinary, in situ simulation to evaluate our new process and identify latent safety hazards during MTP activation at a low-acuity hospital. Our in situ simulation was a 1-day event. The scenario progressed from a routine laparoscopic case to hemodynamic instability with unrecognized hemorrhage. Twelve participants from OR and blood bank (BB) performed their usual roles as the scenario unfolded in their clinical sites. Outcomes included satisfaction, latent safety hazards and time to blood delivery. We evaluated satisfaction with a 5-point Likert scale survey, and latent safety hazards with facilitated debriefing, direct observation and video review. Time to blood delivery had 6 time-stamps: verbal recognition of hemorrhage, MD verbal MTP order, RN computer MTP entry, blood readiness in BB, blood arrival in OR and blood transfused. It was measured with direct observation and video review. Participants rated the day as very good/outstanding. BB staff reported improved understanding of OR

activities during massive transfusion and vice versa. Time to blood delivery was similar to real time, but bottlenecks were identified in 3 processes: MTP activation, OR notification of blood readiness, and blood delivery to OR. Latent safety hazards were noted in staffing (suboptimal resource utilization), situational awareness (over delegation of OR staff) and adherence to protocol (lack of awareness of new MTP). Subsequent change interventions included resource allocation via OR charge nurse following MTP activation, a dedicated blood porter and an MTP poster in each OR. In situ, multidisciplinary simulation successfully identified bottlenecks in processes of care and latent safety hazards after implementing a new MTP. In situ simulation can also help build interdepartmental relationships. Ongoing training and assessment are needed to ensure sustainability.

90

Validating a uniform system for measuring disease severity in acute appendicitis. ***E. Tang, P. Murphy, L. Allen, B. Huang, K. Vogt*. From Western University, London, Ont.**

The American Association for the Surgery of Trauma (AAST) recently proposed a uniform grading scale for common emergency general surgery illnesses, including acute appendicitis. Our study is a prospective trial to validate this grading system with respect to disease severity and outcomes in a Canadian population. A prospective cohort study was conducted at a single Canadian centre. All patients admitted or consulted to the acute care surgery (ACS) team with a diagnosis of acute appendicitis were identified daily over the study period from September 2015 to November 2016. AAST grading was assigned by 2 independent reviewers, and agreement was calculated using a K coefficient. Regression analysis, adjusted for age and comorbidities, was performed to correlate AAST grade to patients' length of stay (LOS), odds of complications and readmission rates. A total of 225 patients were included, of whom 94% underwent a surgical intervention. Concordance rate in grading between the 2 reviewers was 83%, with a calculated K coefficient of 0.782 ($p < 0.05$). Higher AAST grades were associated with longer length of stays, increased readmission rates and increased complication rates (Table 8). In summary, the AAST grading system for acute appendicitis can be used with good agreement to formally quantify disease severity. More work is needed to determine its applicability and the practicality of its use in a clinical setting.

91

Nonoperative management of complicated appendicitis: short-term benefits with potential long-term risks. ***T. Gimon, R. Rochon, M. Lipson, W. Buie, A. MacLean*. From the University of Calgary, Calgary, Alta.**

Urgent appendectomy remains the standard of care for most cases of acute appendicitis. Management of complicated appendicitis with associated abscess, phlegmon or mass can be more challenging. The purpose of this study was to determine the outcome of patients presenting with complicated appendicitis initially managed nonoperatively. All patients presenting to a large tertiary care hospital with acute appendicitis between Jan. 1 and Dec. 31, 2016, were identified. Patients who were treated nonoperatively during their index admission were reviewed. Outcomes were determined using the regional electronic medical record. There were 447 patients diagnosed with acute appendicitis in 2016. Twenty patients had complicated appendicitis managed nonoperatively (abscess [11], phlegmon [9]). The average age at diagnosis was 48.2 years (SD ± 20.2); 60% were male. Percutaneous drains were inserted by interventional radiology in 45% ($n = 9$). The average length of stay was 5.65 days (SD ± 3.80). Average length of antibiotic duration was 15.53 days (SD ± 4.81). Postoperative complications included *Clostridium difficile* colitis (2 patients), non-*C. difficile* diarrhea (5), pneumonia (1), urinary retention/UTI (1), portal venous thrombosis (1) and enterocutaneous fistula at a drain site (1). Ten patients (50%) went on to have surgery. Five patients (25%) were readmitted with acute appendicitis within 18 months. Two of these patients underwent urgent surgery during their subsequent admission and both required conversion to open ileocolic resections. The other 3 readmissions had elective interval appendectomies. Another 5 patients had no further episodes of appendicitis but also went on to have an interval appendectomy; 1 was for cancer. Nonoperative management of acute complicated appendicitis is associated with significant morbidity, frequent readmission and risk of open surgery with extended resection. Further research is required to determine the optimal patient selection and timing for interval appendectomy.

92

Impact of robotic assistance on mental workload and cognitive performance of surgical trainees performing a complex minimally invasive suturing task. ***E. Lau* (Western University; CSTAR [Canadian Surgical Technologies & Advanced Robotics], London Health Sciences Centre, London, Ont.), *N. Alkhamesi* (Western University; CSTAR [Canadian Surgical Technologies & Advanced Robotics], London Health Sciences Centre, London, Ont.), *C. Schlachta* (Western University; CSTAR [Canadian Surgical Technologies & Advanced Robotics], London Health Sciences Centre, London, Ont.).**

Few studies have investigated the potential impact of robotic assistance on cognitive ergonomics during advanced minimally invasive surgery. The purpose of this study was to assess the impact of robotic assistance on mental workload and downstream cognitive

Table 8. Summary of patients' clinical outcomes based on their grading of disease severity for acute appendicitis

	AAST grade				
Variable	I	II	III	IV	V
Number of patients	93	35	61	20	12
Median LOS in days, (IQR)	2 (1–2)	2 (1–2)	2 (2–4)	3 (2.75–8)	4 (2.75–5.5)
Odds of readmission (95% CI)	Control	1.068 (0.11–10.80)	4.668 (1.07–20.42)	8.940 (1.72–46.38)	None
Odds of complication (95% CI)	Control	1.271 (0.47–3.46)	2.640 (1.21–5.75)	8.313 (2.81–24.64)	5.162 (1.44–18.52)

performance in surgical trainees. Robot-naïve trainees from general surgery, urology and gynecology, stratified by specialty and level of training, were randomized to either laparoscopic surgery (LS) or robotic-assisted laparoscopic surgery (RALS) and performed a time-limited, complex laparoscopic suturing task after watching a 5-minute instructional video. The RALS group received an additional 5-minute orientation to the robotic console. Subjective mental workload was measured using the NASA-Task Load Index. Concentration and executive cognitive function were assessed using the Psychomotor Vigilance Task (PVT) and Wisconsin Card Sorting Test (WCST), respectively. A p value of 0.05 was considered significant. Sixteen senior residents (SR; ≥ PGY3) and 14 junior residents (JR; PGY1–2) completed the study. There was no difference in mental workload between LS and RALS. Within JR there was no difference in task-completion time comparing LS with RALS; however, LS was associated with impaired concentration post-task versus pre-task (PVT reaction time 306 v. 324 ms, $p = 0.03$), which was not observed for RALS. In contrast, among SR, RALS took significantly longer than LS (10.3 v. 14.5 min, $p = 0.02$) and was associated with significantly worse performance on WCST ($p < 0.01$). Robotic assistance, in this setting, did not provide a technical performance advantage nor impact subjective mental workload with novice users regardless of level of surgery training. We observed a protective effect on cognitive performance offered by RALS to junior trainees with limited LS experience, yet a detrimental effect on senior trainees with greater LS ability and inadequate prestudy robotic training, suggesting that robotic consoles may be mentally taxing for robotic novices and consideration should be given to formal console training before initial clinical exposure.

93

The role of antibiotics in acute uncomplicated diverticulitis: a systematic review and meta-analysis. ***V. Mocanu, J. Dang, I. Tavakoli, N. Switzer, C. Tian, C. de Gara, D. Birch, S. Karmali.*** **From the University of Alberta, Edmonton, Alta.**

Antibiotic use in acute uncomplicated diverticulitis (AUD) remains debated despite recent studies suggesting no difference in outcomes for patients treated without antibiotics. A systematic review and meta-analysis were performed to determine the role of antibiotics in managing AUD. A literature search was conducted using Medline, Embase, Scopus, the Cochrane Library and the Web of Science databases from 1946 to June 2017. Eight studies with 2469 patients were included for review (Fig. 5). Of those, 63.8% underwent management without antibiotics. Major complications included recurrence, treatment failure, abscess, bleeding, fistula, perforation, stenosis and need for elective or emergent surgery. The overall complication rate was 18.7%, with the most common complication being recurrence of diverticulitis. Overall complication rates were not statistically significant between groups (OR 0.72; CI 0.45–1.16; $p = 0.18$) (Fig. 6), but antibiotic use was associated with a longer length of stay in hospital. Subgroup analysis revealed no difference in readmission rates, treatment failure rates, progression to complicated diverticulitis or increased need for elective or emergent surgery between study groups. Antibiotic use in patients with AUD increases length of hospital stay but is not associated with a reduction in overall or individual complication rates.

94

Predictive factors associated with unplanned readmission following colorectal surgery. ***P. Young, C. Chiu, A. Meneghetti), G. Warnock, M. Meloche, O. Panton.*** **From the University of British Columbia, Vancouver, B.C.**

Identifying the risk factors to surgical morbidity and mortality is a critical aspect to quality improvement. Unplanned readmissions are a significant contributor to patient morbidity and overall health care costs. The goal of this study was to identify predictive factors associated with unplanned hospital readmission within 30 days following colorectal surgery. Using the institutional National Surgical Quality Improvement Program (NSQIP) database, a retrospective review of 703 patients undergoing elective and emergency colorectal surgery between January 2014 and December 2017 was performed. Data on patient demographics, operative factors and perioperative characteristics were collected from the NSQIP database. Hospital readmission within 30 days was the primary outcome of interest. Univariate and multivariate analyses were performed. The overall 30-day readmission rate was 8.70%. Demographic factors including age, diabetes, hypertension and congestive heart failure were not predictive of readmission. Only history of chronic obstructive pulmonary disease was predictive of readmission ($p = 0.006$). Preoperative bloodwork and operative factors were not predictive. Length of stay of primary admission was not significantly different between groups (9.7 d with readmission vs 11.1 d with no readmission, $p = 0.58$). The incidence of postoperative events in the

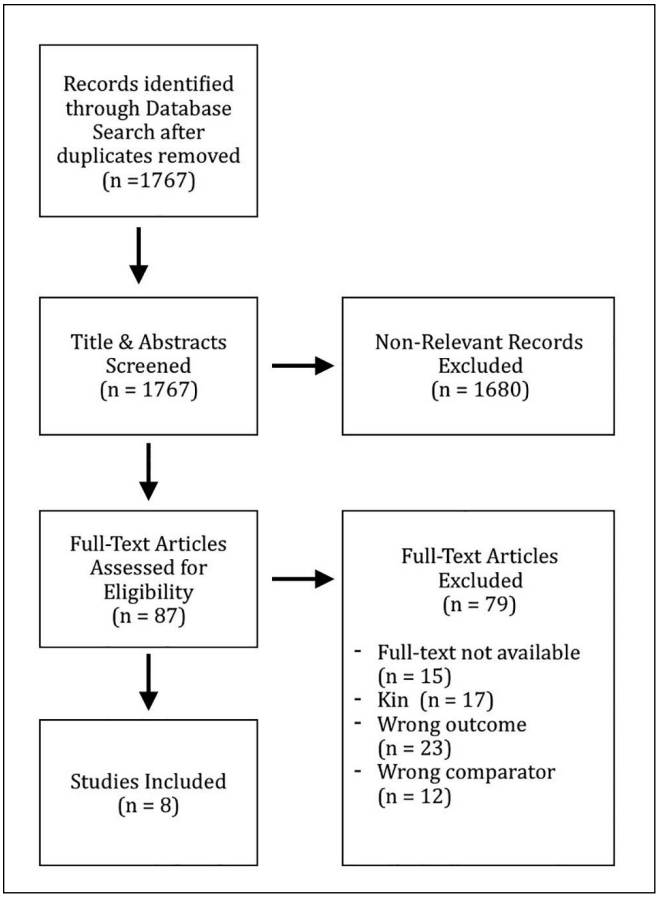


Fig. 5. PRISMA diagram of studies.

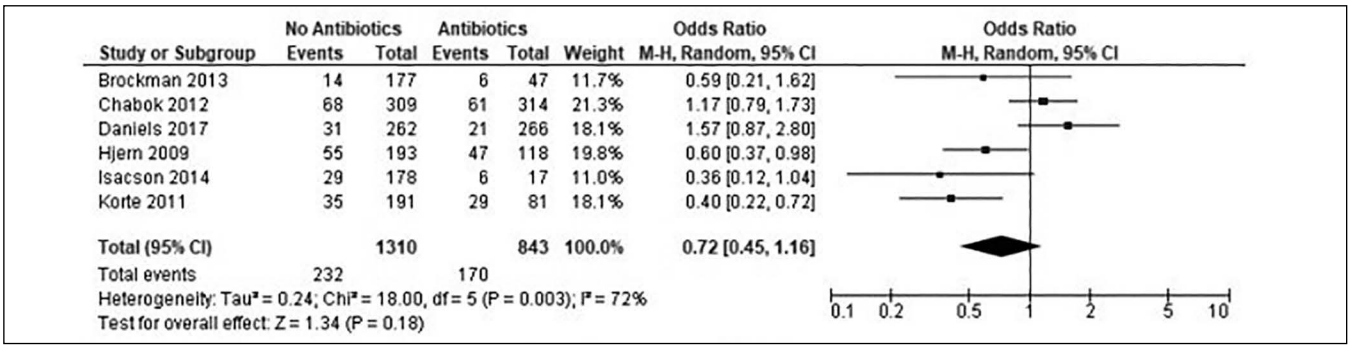


Fig. 6. Major complications for antibiotic versus no antibiotic groups.

readmission group was higher, with specific events including postoperative organ space infection ($p < 0.001$), urinary tract infection ($p = 0.004$) and myocardial infarction ($p = 0.016$) having the greatest predictive value for readmission. Identification of patients at high risk of readmission may lead to new strategies in mitigation of risk factors and to target outpatient interventions to reduce the risk of readmission.

95

Duodenal strictures: rates of malignancy and difficult diagnoses. ***A. Istl, A. Gan, P. Colquhoun.*** **From Western University, London, Ont.**

Peptic ulcer disease was the predominant cause of duodenal strictures before the widespread use of proton-pump inhibitors. Now, with appropriate therapy for benign disease, malignancy is a growing cause of strictures. Many clinicians suggest that duodenal strictures should be treated as malignant until proven otherwise. However, evidence to direct this management is sparse and diagnostic methods are unreliable. Our study characterizes malignancy rates in patients presenting with duodenal strictures and explores factors enabling accurate diagnoses. We conducted an epidemiologic retrospective cohort study of all patients undergoing intervention for duodenal strictures at London Health Sciences Centre (LHSC) from 2006 to 2016. Patients who underwent endoscopic duodenal stent placement, balloon dilatation, pancreaticoduodenectomy or gastrojejunostomy bypass were identified. Demographic, procedural and outcome data were collected. Univariate and multivariate analyses of factors predictive of malignancy and difficult or missed diagnoses were conducted. A total of 122 patients presented to LHSC with a duodenal stricture. The most common presenting symptoms were nausea and vomiting (74%), abdominal pain (56.1%) and weight loss (35.8%). Median duration of symptoms was 3 weeks (IQR 1–8) before presentation, and 79.2% of strictures were malignant in origin. Presenting symptoms, duration of symptoms and common tumour markers did not predict for malignancy on multivariate analysis. However, CA19-9 was only evaluated in 39.2% of patients. Where follow-up information was available, the death rate was 64% in patients with a malignant stricture and 36% in those with benign disease. This suggests delays in investigations and procedures may contribute to undue mortality. Malignancy rates in patients presenting with duodenal strictures substantially exceed rates established before the employment of effective therapy for peptic ulcer disease. Further studies should explore factors that would enable early identification of malignancy. Duodenal strictures should be treated as malignant until proven otherwise.

96

Assessing compliance with practice management guidelines for penetrating abdominal trauma at a level I trauma centre. ***R. Habashi.*** **From McMaster University, Hamilton, Ont.**

Penetrating abdominal trauma (PAT) typically results from a gunshot or stabbing. The approach to treating patients with PAT depends on the mechanism and location of injury, the hemodynamic and neurologic status of the patient and other injuries. The goal is to identify injuries requiring surgical repair, and avoid unnecessary laparotomy. However, the clinical management of PAT in the hemodynamically stable trauma patient has evolved over the past few decades, from mandatory exploratory laparotomy to selective nonoperative management (SNOM). Here we present a retrospective chart review, assessing the compliance with practice management (EAST) guidelines for penetrating abdominal trauma at a Canadian level I trauma centre. A total of 127 penetrating trauma activations were included from Jan. 1, 2011, to Dec. 31, 2015. Adherence to selective nonoperative management (SNOM) per EAST guidelines, rates of therapeutic versus unnecessary laparotomies and rates of postoperative complications were evaluated and compared with published literature. Consistent with the literature, our preliminary results revealed a predominance of stab wounds (80.3%) as primary mechanism, the high utility of CT (68.5%) in SNOM, and an appropriate rate of emergency trauma laparotomies (32.3%). We are pending analysis of adherence to guidelines, number of unnecessary laparotomies and postoperative complication rates. We hope that our study will highlight gaps and formulate educational initiatives. As a subanalysis, we will also investigate the utility of frequent CT in SNOM, striving to reserve resources and improve care.

97

Advancement in the quality of operative documentation: a systematic review and meta-analysis of synoptic versus narrative operative reporting. ***S. Stogryn, A. Abou-Setta, J. Metcalfe, K. Hardy, K. Clouston, A. Vergis.*** **From the University of Manitoba, Winnipeg, Man.**

The operative report is a vital document for the surgical patient and central to quality assessment processes for surgical care. Despite this, data suggest that traditional narrative operative reports are often of poor quality. Synoptic reporting has emerged as a means to improve this document and has shown promise across multiple investigations. A comprehensive systematic review of the literature was performed including

comparative studies evaluating synoptic versus narrative operative reports. The primary outcome of interest was completion of predetermined critical elements for an operative report. Secondary outcomes considered were reliability, efficiency, quality and cost measures. A meta-analysis was performed where sufficient data were available. A quality analysis was performed on all included source articles using the Newcastle–Ottawa scale (NOS). Of the 1471 citations identified in the literature search, 16 studies met the final inclusion criteria. The mean NOS was 7.09 out of 9 (± SD 1.73). Meta-analysis demonstrated that synoptic reporting was significantly more complete than narrative reporting (SMD 1.70, 95% CI 1.13–2.26; I^2 98%; 14 studies; 2874 reports) suggesting that this format outperforms narrative reporting in terms of completeness. The time to complete the operative report was significantly shorter with synoptic reporting (mean difference –0.86, 95% CI –1.17 to –0.55; 6 studies; 891 reports). All other secondary outcomes evaluated favoured the synoptic reporting format. This systematic review and meta-analysis suggests that synoptic reporting platforms outperform traditional narrative reporting in terms of completeness of critical items and time required to complete it. This reporting format should be incorporated into surgical practice.

98

Medical student perspectives on the impact of resident-as-teacher training: a realist review. ***N. Zondervan, K. McLaughlin.*** **From the University of Calgary, Calgary, Alta.**

Residents are important educators of medical students, but they frequently teach without training or confidence in their teaching ability. Resident as teacher training is now mandated across North America. Residents self-report that these interventions improve their teaching ability, but little is known about the effect of these workshops on the medical students these residents ultimately teach. What impact does resident-as-teacher training have on the knowledge, attitudes and skills of medical students? This realist review identifies original studies published in English within the Medline, Embase, Scopus, ERIC and Education Research Complete databases. Our population of interest was medical students and the intervention was exposure to residents who have completed resident as teacher training. Selected studies must have medical student specific outcomes and we included all study designs. Abstracts meeting the search criteria underwent a paired 2-person review to identify articles for inclusion. Data extraction focused on the mechanisms and contextual factors of resident as teacher training that led to any observed changes in the knowledge, attitudes and skills of medical students. A total of 414 abstracts were identified, with 30 original articles meeting the criteria for full-text review. After full-text review 17 studies met the criteria for data extraction. Of these studies only 1 reported a change in medical student knowledge or skills. These studies suggest that interventions with greater than 50 participants for residents with previously low student ratings of teaching effectiveness are more likely to show a positive effect on student ratings. There were no studies identified that elicited a change in medical students' knowledge or skills. Resident as teacher training can be effective in improving student perceptions of resident teaching effectiveness provided it targets an identified learning need. Resident as teacher training has not yet been shown to affect learner-centred outcomes.

CANADIAN SOCIETY OF COLORECTAL SURGEONS (CSCRS)

01

A population-based analysis of the drivers of short-term costs following colorectal surgery. ***J. Springer, A. Doumouras, J. Lee, N. Amin, M. Caddedu, C. Eskicioglu, D. Hong.*** **From McMaster University, Hamilton, Ont.**

Colorectal resections are commonly performed for benign and malignant disease. The morbidity and mortality following resection is responsible for significant health care utilization and therefore identifying areas to create efficiencies is essential for decreasing health care costs in a resource-limited system. The purpose of this study was to characterize predictors of excess short-term costs associated with all colon and rectal resections performed in Canada. This was a population-based retrospective analysis of all colorectal resections with anastomoses performed between April 2008 and March 2015 in Canada. Total inpatient costs for all colorectal resections were calculated. Adjustments were made for demographics, comorbidities, complications, operative technique hospital and surgeon. Costs were modelled using a linear regression using MCMC estimation. Overall, we analyzed 108 304 patients. Multivariable regression showed the adjusted average cost of a 50-year-old man undergoing open colon resection for benign disease with no comorbidities or complications was $9270 (95% CI $7146 – $11 624; $p < 0.001$). With adjustment for complications, laparoscopic colon resections carried a cost savings of $1390 (95% CI $1682–$1099; $p < 0.001$) when compared with open resections. Conversely, when incorporating complication costs for each modality, laparoscopic colon resection saved $5111 (95% CI $5533–$4690; $p < 0.001$) when compared with open resection. Complications were the main driver for increased costs as anastomotic leaks added $9129 (95% CI $8583–$9670; $p < 0.001$). In addition, medical complications such as renal failure requiring dialysis ($16 939, 95% CI $15 547 – $18 314; $p < 0.001$) and ICU admission ($2840/day, 95% CI $2814–$2866; $p < 0.001$) carried significant cost. Complications requiring reoperation cost $16 313 (95% CI $15 739 – $16 885; $p < 0.001$).

02

Implementation of a standardized protocol for the closure and care of perineal wounds leads to a decrease in the incidence of perineal wound complications. ***C. Cahill*** **(University of Ottawa, Ottawa, Ont.),** ***A. Fowler*** **(Memorial University, St. John's, Nfld.),** ***A. Warraich*** **(The Ottawa Hospital, Ottawa, Ont.),** ***H. Moloo*** **(University of Ottawa, Ottawa, Ont.),** ***R. Musselman*** **(University of Ottawa, Ottawa, Ont.),** ***I. Raiche*** **(University of Ottawa, Ottawa, Ont.),** ***L. Williams*** **(University of Ottawa, Ottawa, Ont.)**

Impaired perineal wound healing is a major source of morbidity after abdominoperineal resection (APR). Rates of perineal wound complications after primary closure have been reported to be as high as 37.6% and no standardized approach to the closure and care of these incisions has been published to our knowledge. Our aim was to develop a standardized approach to the intra- and post-operative management of these wounds and to assess its impact on perineal surgical site infection. An interprofessional

team developed and implemented a standardized perineal wound protocol. Literature was explored to extrapolate best practices for these incisions. The resultant protocol included standards for pre- and intra-operative interventions, dressings, activity, elimination and postdischarge care instructions. After an initial pilot, the protocol was implemented in October 2016. Perineal wound occurrences (including perineal surgical site infection and/or wound disruption) were compared before and after implementation using National Surgical Quality Improvement Program (NSQIP) data. A total of 28 patients underwent APR with primary closure before the implementation of the standardized protocol compared with 13 patients after implementation. The 2 groups were similar with respect to age, sex, indication for surgery, history of radiation and extent of dissection. The incidence of perineal wound occurrences in the pre-implementation study period was 9/28 (32.1%) compared with 1/13 (7.7%) following introduction of the protocol ($p < 0.05$). A standardized approach to the care of the perineal incision was successfully developed and implemented at our institution and demonstrated a significant decrease in the incidence of perineal wound occurrences in patients undergoing APR with primary closure of the perineal incision.

03

Are there identifiable points of delay in the treatment of patients with colorectal cancer? An assessment of efficiency of care from initial referral for colonoscopy to surgical resection. ***D. Keren*, *N. Kloos*, *S. Gregg*, *A. MacLean*, *R. Mohamed*, *E. Dixon*, *R. Rochan*, *C. Ball.*** **From the University of Calgary, Calgary, Alta.**

Delays in the diagnosis and treatment of colorectal adenocarcinoma (CRC) remain distressing to patients and clinicians alike. The typical patient pathway involves referral from a family practitioner (FP) to a colonoscopist for diagnostic confirmation, followed by a surgeon for consideration of resection. The primary aim of this study was to evaluate this process for potential delays and direct subsequent improvements. A truly population-based, province-wide administrative database was employed to identify all patients with resected CRC over a 12-month period. Patient demographics, colonoscopy date, colonoscopist details and surgery date were extracted from the electronic medical record. The date of the referral from the FP to the colonoscopist was obtained by individual phone calls to each FP office. Standard statistical methodology was employed ($p < 0.05$ = significant). Of 224 patients who had a CRC resected across southern Alberta, 170 (76%) received their preceding colonoscopy by a gastroenterologist (GI). Patient group characteristics were similar irrespective of who scoped them (GI or surgeon). Patients waited significantly longer between their colonoscopy and surgical resection when their scope was performed by a GI within metropolitan Calgary (43 v. 27 d; $p = 0.02$). The total time from FP referral to colonoscopy to surgical resection was also shorter with a surgeon-performed colonoscopy within Calgary (105 v. 114 d; $p = 0.03$). GI was responsible for 86% and 23% of colonoscopies within metropolitan Calgary and outside of Calgary (i.e., community settings), respectively. Patients outside of Calgary displayed no significant differences in patient flow for any interval regardless of which service scoped them ($p > 0.05$). Patient flow through the health care system is similar whether a GI or surgeon performed their colonoscopy, except for an evident delay between colonoscopy completion and surgical resection within metropolitan Calgary. Targeted improvements for transitions in care should target communication strategies between GI and surgeons in patients with CRC.

04

Treatment strategies and survival trends for anorectal melanoma: Is it time for a change? ***J. Taylor*** **(Johns Hopkins University School of Medicine, Baltimore, Md.),** ***M. Stem*** **(Johns Hopkins University School of Medicine, Baltimore, Md.),** ***D. Yu*** **(Queen's University, Johns Hopkins School of Public School),** ***S. Chen*** **(Johns Hopkins University School of Medicine, Baltimore, Md.),** ***S. Fang*** **(Johns Hopkins University School of Medicine, Baltimore, Md.),** ***S. Gearhart*** **(Johns Hopkins University School of Medicine, Baltimore, Md.),** ***B. Safar*** **(Johns Hopkins University School of Medicine, Baltimore, Md.),** ***J. Efron*** **(Johns Hopkins University School of Medicine, Baltimore, Md.).**

Anorectal melanoma has a poor overall survival (OS). Effective immunotherapy for cutaneous melanoma questions its efficacy for anorectal melanoma. This study aimed to identify trends in prevalence, treatment management and OS for anorectal melanoma. Patients ≥ 18 years diagnosed with stage I–IV anorectal melanoma were queried from the National Cancer Database (2004–2015). Factors associated with immunotherapy use were identified using multivariable logistic regression analysis. Primary outcome was 2- and 5-year OS, which was analyzed using Kaplan–Meier survival curves, log-rank test and Cox proportional hazards model. Subgroup analysis by treatment was performed. A total of 1331 patients were identified, with a significant increase in prevalence over the last decade (6.99% in 2004 v. 10.53% in 2015, $p < 0.001$). Anorectal melanoma patients were older, white, on Medicare and from the southern states. The most common treatment was surgery alone (48.77%), followed by surgery with radiation (11.75%), surgery with immunotherapy (8.68%) and surgery with chemotherapy (8.68%). Immunotherapy was administered to 16.93% of patients, with increased use over recent years (7.24% in 2004 v. 21.27% in 2015, $p < 0.001$). Adjusted multivariable analysis showed that younger age and greater tumour size were significantly associated with immunotherapy use. Two- and 5-year OS rates were 43.57% and 20.50%, respectively. Patients who received immunotherapy had significantly higher 2-year OS. Other therapies did not show a significant difference in OS. Adjusted Cox analysis showed no difference in 2- and 5-year OS based on therapy type. Rates of anorectal melanoma diagnosis have increased in recent years. Surgery remains the most common management option, either alone or in combination with other modalities. The use of immunotherapy has increased substantially in the last 2 years and may confer some survival benefit that has yet to be revealed. These data may suggest a more aggressive treatment paradigm is warranted for anorectal melanoma.

05

Rectal cancer in younger patients: rare, aggressive and deadly. ***D. Yu*** **(Queen's University, Johns Hopkins School of Public Health),** ***M. Stem*** **(Johns Hopkins University School of Medicine, Baltimore, Md.),** ***J. Taylor*** **(Johns**

Hopkins University School of Medicine, Baltimore, Md.), *S. Chen* (Johns Hopkins University School of Medicine, Baltimore, Md.), *S. Fang* (Johns Hopkins University School of Medicine, Baltimore, Md.), *S. Gearhart* (Johns Hopkins University School of Medicine, Baltimore, Md.), *B. Safar* (Johns Hopkins University School of Medicine, Baltimore, Md.), *J. Efron* (Johns Hopkins University School of Medicine, Baltimore, Md.).

Rectal cancer incidence rates among young adults have been rising; the cause is unclear. This study aimed to examine age-specific differences in rectal adenocarcinoma with respect to patient and tumour characteristics, treatment trends and overall survival (OS). Stage I–IV rectal adenocarcinoma patients were queried from the National Cancer Database (2004–2015) and stratified into 4 age categories (20–29, 30–39, 40–49 and ≥ 50 yr). Primary outcome was OS, analyzed using Kaplan–Meier survival curves, log-rank test and Cox proportional hazards model. Subgroup analyses stratified by stage and treatment type were also performed. In total, 273 377 patients were included (20–29: 0.62%; 30–39: 3.00%; 40–49: 11.33%; ≥ 50: 85.05%), with an increasing number of diagnoses from 2004 to 2015 across all age groups except 20–29. Younger patients (<50) were more likely to present with stage IV disease (26.77%, 23.54%, 21.28%, 17.46%, respectively, $p < 0.001$), have tumours ≥ 35 cm (32.49%, 31.64%, 29.66%, 26.84%, respectively, $p < 0.001$), poorly differentiated histology (19.69%, 15.16%, 13.22%, 11.71%, respectively, $p < 0.001$), and higher rates of margin positivity (8.84%, 7.81%, 6.72%, 6.46%, respectively, $p < 0.001$). Younger patients tended to receive multimodal treatment, while older patients (≥ 50) tended to receive surgery alone ($p < 0.001$). Among younger patients, 5- and 10-year OS were worst in the 20–29 group in unadjusted (5-yr OS: 59.62%, 67.46%, 68.70%, 56.23%, respectively; 10-year OS: 48.37%, 56.90%, 56.66%, 38.17%, respectively; both $p < 0.001$) and adjusted analysis (≥ 50-ref; 20–29: HR 0.90, 95% CI 0.83–98; 30–39: HR 0.79, 95% CI 0.76–0.82; 40–49: HR 0.78, 95% CI 0.77–0.80; all $p < 0.001$). Subgroup analysis revealed comparable OS between the 20–29 and ≥ 50 groups. This study reveals differences in patient and tumour characteristics, treatment modalities and outcomes between younger and older than 50 years rectal cancer patients. Twenty-year-olds have more aggressive biology, are diagnosed at later stages, exhibit the worst OS among younger patients and have comparable OS to those ≥ 50.

06

The effect of simethicone on postoperative ileus in patients undergoing colorectal surgery (SPOT), a randomized controlled trial. ***A. Domouras* (McMaster University, Hamilton, Ont.), *J. Springer* (McMaster University, Hamilton, Ont.), *S. Elkheir* (Riverside Health Care, Fort Frances, Ont.), *C. Eskicioglu* (McMaster University, Hamilton, Ont.), *S. Kelly* (McMaster University, Hamilton, Ont.), *I. Yang* (McMaster University, Hamilton, Ont.), *S. Forbes* (McMaster University, Hamilton, Ont.).**

Postoperative ileus is a poorly understood multifactorial outcome following colorectal surgery that presents a significant clinical challenge and contributes to increased morbidity, length of stay and health care costs. To date, there are few interventions that shorten the duration of postoperative ileus. This study is the first to evaluate the efficacy of simethicone in treating postoperative ileus symptoms in patients undergoing colorectal surgery. We conducted a multicentre, double-blinded, placebo-controlled randomized trial. This trial was conducted at 2 academic tertiary care centres in Ontario, Canada. A total of 118 patients undergoing colorectal surgery were included in this study. Patients were randomized to receive either a 5-day course of oral simethicone ($n = 58$) or a placebo ($n = 60$). The primary outcome was time to first passage of flatus. Secondary outcomes included time to first bowel movement, postoperative length of stay and postoperative pain. Statistical analyses were performed on an intention-to-treat basis and statistical significance was set at $p = 0.05$. The median time to first passage of flatus in the simethicone arm was 25.2 hours and it was 26.7 hours in controls ($p = 0.98$). There were no statistically significant differences in the median time to first bowel movement (simethicone = 41.1 h v. control = 42.9 h, $p = 0.91$) or median length of hospital stay (simethicone = 4.5 d v. control = 4.0 d, $p = 0.63$). This study failed to show a difference in return of gastrointestinal motility in patients receiving simethicone following colorectal surgery. Postoperative ileus remains a significant clinical and economic burden to the health care system and further research is needed to identify a reliable and effective method of treatment.

07

Are rectal cancer patients with pretreatment N2-positive disease suitable for "watch and wait" protocols? An ACS-NSQIP analysis. ***N. Wong-Chong, M. Abou Khalil, R. Garfinkle, S. Bhatnagar, G. Ghitulescu, C. Vasilevsky, N. Morin, M. Boutros*. From McGill University, Montreal, Que.**

Following neoadjuvant chemoradiotherapy (NACRT), up to 20% of patients achieve pathological complete response (pCR), which is associated with excellent long-term outcomes. As such, nonoperative management or "watch and wait" protocols are gaining interest worldwide. The aim of this study was to use large multicentre validated data to identify predictors of pCR following NACRT. After ethics board approval, all elective cases of cT2–4, N0–2 rectal cancer treated with NACRT followed by proctectomy in 2016 were identified from the American College of Surgeons' National Surgical Quality Improvement Program Proctectomy-Specific database. Patients with metastases or missing clinical/pathologic stage were excluded. Demographics, comorbidities, operative details and tumour characteristics were collected. Carcinoembryonic antigen level and tumour size were not captured in this database. pCR was defined as ypT0N0. Predictors of pCR were assessed by multivariate logistic regression. Of 597 patients who underwent proctectomy for cT2–4, N0–2 rectal cancer, 369 received NACRT. Fifty-three (14.4%) achieved pCR. There was no difference in mean age, sex or other patient characteristics when comparing pCR to non-pCR (Table 9). The groups were similar with regards to tumour location (upper 1/3, 8.2% v. 9.4%; middle 1/3, 46.9 v. 34.3%; lower 1/3, 44.9% v. 56.2%; $p = 0.23$), pretreatment T-stage (cT2, 11.3% v. 8.9%; cT3, 75.5% v. 77.5%; cT4, 13.2% v. 13.6%; $p = 0.85$) and pretreatment N-stage (cN0, 43.4% v. 38.9%; cN1, 50.9% v. 42.4%; cN2, 5.7% v. 18.7%;

Table 9. Patient characteristics

Factor		No pCR (n = 316)	pCR (n = 53)	p value
Age (yr), mean (SD)		59.8 (13.2)	58.6 (13.7)	0.54
Sex, n (%)	Male	195 (61.7%)	31 (58.5%)	0.66
Race, n (%)	White	248 (85.5%)	36 (80.0%)	0.60
	Black	21 (7.2%)	5 (11.1%)	
	Other	21 (7.2%)	4 (8.9%)	
ASA, n (%)	1	6 (1.9%)	1 (1.9%)	0.99
	2	119 (37.7%)	21 (39.6%)	
	3	186 (58.9%)	30 (56.6%)	
	4	5 (1.6%)	1 (1.9%)	
BMI (kg/m^2), mean (SD)		28.0 (6.4)	28.4 (6.4)	0.68
Diabetes, n (%)		49 (15.5%)	6 (11.3%)	0.43
Hypertension, n (%)		121 (38.3%)	20 (37.7%)	0.94
Smoker, n (%)		64 (20.3%)	11 (20.8%)	0.93
Dyspnea, n (%)	Moderate or severe	8 (2.5%)	1 (1.9%)	0.78
Bleeding disorder, n (%)		8 (2.5%)	1 (1.9%)	0.78
Preoperative steroid use, n (%)		9 (2.8%)	3 (5.7%)	0.29
Wound classification, n (%)	Clean or clean-contaminated	269 (85.1%)	44 (83.0%)	0.83
	Contaminated	39 (12.3%)	8 (15.1%)	
	Dirty	8 (2.5%)	1 (1.9%)	
Preoperative WBC (x10^9/L), mean (SD)		5.5 (1.8)	5.3 (1.7)	0.48
Preoperative hematocrit (%), mean (SD)		38.6 (4.1)	39.3 (4.0)	0.68
>10% weight loss in 6 months before surgery, n (%)		27 (8.5%)	2 (3.8%)	0.23
Preoperative dialysis, n (%)	No	315 (99.7%)	53 (100.0%)	0.68

p = 0.06). On multivariate regression, after controlling for gender, BMI, pretreatment T-stage and tumour location, cN2 disease remained a negative predictor of pCR (OR 0.18, 95% CI 0.04–0.82, p = 0.02). However, cN1 disease was not predictive of pCR. Clinical N2 disease is a negative predictor of pCR. As such, inclusion of patients with pretreatment N2 disease in "watch and wait" protocols should be revisited. More data are needed to validate other predictors of pCR.

08

Assessing the readability, quality and accuracy of online health information for patients with low anterior resection syndrome. ***R. Garfinkle*** **(McGill University, Montreal, Que.),** ***N. Wong-Chong*** **(McGill University, Montreal, Que.),** ***A. Petrucci*** **(McGill University, Montreal, Que.),** ***P. Sylla*** **(Mount Sinai Hospital and School of Medicine, New York, NY),** ***S. Wexner*** **(Cleveland Clinic Florida, Weston, Fla.),** ***S. Bhatnagar*** **(McGill University, Montreal, Que.),** ***N. Morin*** **(McGill University, Montreal, Que.),** ***M. Boutros*** **(McGill University, Montreal, Que.).**

The management of low anterior resection syndrome (LARS) requires a high degree of patient engagement and troubleshooting. This process is facilitated by education and awareness. The objective of this study is to identify the highest rated websites on LARS currently available to patients along with their strengths and deficiencies. An online search of Google, Yahoo and Bing using the search terms "low anterior/anterior resection syndrome" and "bowel function after rectal cancer surgery" was performed in Montreal, Canada, and Toronto, Canada, in July and August 2017, respectively. Readability was assessed using 8 standardized tests. The Suitability Assessment of Materials (SAM) instrument was used to assess comprehension, appropriateness and learning stimulation. Website quality was measured using the DISCERN instrument. An expert panel consisting of 3 colorectal surgeons from different countries assessed each website for accuracy and created a LARS-specific checklist to assess content. Of 117 unique websites, 25 met inclusion criteria. Website affiliation was 6 (24.0%) academic, 4 (16.0%) governmental, 11 (44.0%) non-profit and 4 (16.0%) private. Only 9 (36.0%) websites were updated in the past 2 years. Median readability level was 10.4 (9.2–11.7) and 11 (44.0%) websites were highly suitable. Using the DISCERN instrument, 7 (28.0%) websites had clear aims, 2 (8.0%) divulged the sources used and 4 (16.0%) had overall high quality. Only 8 (32.0%) websites defined LARS and 10 (40.0%) listed all 5 major symptoms associated with the LARS score. The number of websites varied in their discussion of diet modifications (80.0%), self-help strategies (72.0%), medication (68.0%), pelvic floor rehabilitation (60.0%) and neuromodulation (8.0%). Median accuracy of websites was 93.8% (88.2%–96.7%). The current body of online information for patients with LARS is suboptimal. Websites are highly variable, important content is often lacking and the material is written at too complex a reading level for patients.

09

Does time to closure of loop ileostomy increase the risk of postoperative ileus? A large, single-institution review. ***R. Garfinkle, G. Sigler, N. Morin, G. Ghitulescu, S. Bhatnagar, J. Faria, P. Gordon, C. Vasilevsky, M. Boutros.*** **From McGill University, Montreal, Que.**

It has been hypothesized that the structural and functional changes that develop in the defunctioned segment of bowel may contribute to the development of postoperative ileus (POI) after loop ileostomy closure (LIC). As such, longer intersurgery interval between ileostomy creation and LIC may increase POI. All patients who underwent LIC at a single institution between 2007 and 2017 were identified. The primary end point, primary POI, was defined as either (a) being kept nil-per-os on or after postoperative day 3 for

symptoms of nausea/vomiting, distension, and/or obstipation or (b) having a nasogastric tube (NGT) inserted, without postoperative obstruction or sepsis. Secondary end points included length of hospital stay (LOS) and non-POI related morbidity. Patients were then divided into 2 groups based on timing from the index operation to LIC (< 6 months v. > 6 months). Two hundred and fifty-nine patients underwent LIC: 92 within 6 months of ileostomy creation, and 167 after 6 months. Patients with > 6 months intersurgery interval were more likely to have a diagnosis of colorectal cancer (89.8% v. 77.2%, p = 0.010), to have had an open index colorectal resection (88.6% v. 76.1%, p = 0.040) and to have suffered an anastomotic leak after the index resection (15.0% v. 4.3%, p = 0.012). POI was observed in 18.9% of patients, while overall 30-day postoperative and non-POI related morbidity were 39.5% and 23.6%, respectively. POI was more frequently observed in patients with > 6 months intersurgery interval (22.8% v. 12.0%, p = 0.046). POI resulted in a greater median LOS (9 [8–16.5] v. 5 [4–6] d, p < 0.001). On multivariable regression, intersurgery interval > 6 months remained a significant predictor of POI (OR 2.57, 95% CI 1.21–5.91). Intersurgery interval > 6 months is an independent predictor of primary POI after LIC. Such patients may benefit from preoperative bowel stimulation, a novel intervention being evaluated to decrease POI after LIC.

10

A comparison of pathologic outcomes of open, laparoscopic, and robotic resections for rectal cancer using the ACS NSQIP proctectomy-targeted database: a propensity score analysis. ***R. Garfinkle, M. Abou Khalil, S. Bhatnagar, N. Wong-Chong, L. Azoulay, N. Morin,, C. Vasilevsky, M. Boutros.*** **From McGill University, Montreal, Que.**

There is ongoing debate regarding the benefit of using minimally invasive techniques for rectal cancer surgery. The objective of this study was to compare pathologic outcomes of patients who underwent rectal cancer resection by open surgery, laparoscopy and robotic surgery using the American College of Surgeons' National Surgical Quality Improvement Program (ACS NSQIP) proctectomy-targeted database. All patients from the 2016 ACS NSQIP proctectomy-targeted database who underwent elective proctectomy for rectal cancer were identified. Patients were divided into 3 groups based on initial operative approach: open surgery, laparoscopy and robotic surgery. Pathologic and 30-day clinical outcomes were then compared between groups. A propensity score analysis was performed to control for confounders and adjusted odds ratios for pathologic outcomes were reported. A total of 578 patients were included: 211 (36.5%) in the open group, 213 (36.9%) in the laparoscopic group and 154 (26.6%) in the robotic group. The proportion of male patients (60.2% v. 59.6% v. 68.8%, p = 0.15), median body mass index (28.7 v. 27.3 v. 28.0 kg/m^2, p = 0.067) and the proportion of low rectal tumours (53.1% v. 54.5% v. 53.2%, p = 0.26) was similar between groups. Conversion to open was more common among laparoscopic cases compared with robotic cases (15.0% v. 6.5%, p = 0.011). Positive circumferential resection margin (CRM) was observed in 4.7%, 3.8% and 5.2% (p = 0.79) of open, laparoscopic and robotic resections. Propensity score adjusted odds ratios for positive CRM (open surgery as a reference group) were 0.70 (0.26–1.85, p = 0.47) for laparoscopy and 1.03 (0.39–2.70, p = 0.96) for robotic surgery. There were no differences in postoperative morbidity between the groups, and the use of minimally invasive surgery resulted in a shorter median length of stay (6.0 v. 5.0 v. 4.0 d, p < 0.001). The use of minimally invasive surgical techniques for rectal cancer surgery does not appear to confer worse pathologic outcomes.

11

Different risk factors for in-hospital and postdischarge venous thromboembolic events after colorectal surgery. ***N. Alhassan, N. Wong-Chong, M. Trepanier, P. Chaudhury, A. Liberman, P. Charlebois, B. Stein, L. Lee.*** **From McGill University, Montreal, Que.**

The objective of this is study is to identify the different risk factors for inpatient and postdischarge venous thromboembolism (VTE) and the patients at highest risk for postdischarge VTE occurrence. This strategy may be a more efficient use of resources and may avoid potential adverse events and inconvenience to patients. The American College of Surgeons' National Surgical Quality Improvement Project (ACS NSQIP) 2012 to 2016 database was queried for all patients undergoing colorectal resection. Primary outcome was postoperative VTE occurrence within 30 days. Patients were divided into 3 groups: no VTE, VTE during hospital stay and VTE postdischarge. A multinomial logistic regression was performed to identify in-hospital and postdischarge predictors of VTE, adjusting for potential confounders. Out of 260 258 patients, 5381 (2.1%) developed VTE. A total of 3442 (1.3%) occurred during the initial hospital stay and 1929 (0.8%) occurred after discharge. Postoperative mortality was higher in patients with a VTE than those without (8.0% v. 2.9%, p < 0.001). Risk factors for in-hospital and postdischarge VTE were different, as patients with an in-hospital VTE were more likely to be older, male, have higher ASA, have preoperative steroid use, have poor functional status, have a bleeding disorder or have undergone an emergency operation or proctectomy (Table 10). In the postdischarge setting, only age, higher ASA, steroid use, poor functional status, emergency operation and postoperative complications remained significant. Patients with inflammatory bowel disease demonstrated higher risk of VTE than patients with malignancy for both in-patient and

Table 10. Results of the multinomial logistic regression analysis to identify independent risk factors associated with higher probability of VTE occurrence (further adjusted for smoking and other NSQIP-defined comorbidities)

Variable	VTE in-hospital OR (95% CI)	VTE after discharge OR (95% CI)
Age	1.01 (1.00–1.012)	1.01 (1.01–1.01)
BMI ≥ 35		1.20 (1.04–1.38)
Male gender	1.14 (1.07–1.23)	
ASA ≥ 3	1.92 (1.74–2.12)	1.13 (1.02–1.25)
Steroid use	1.43 (1.29 –1.58)	1.34 (1.15–1.56)
Bleeding disorder	1.15 (1.02–1.28)	
Emergency operation	1.69 (1.55–1.86)	1.24 (1.08–1.43)
Poor functional status	1.32 (1.16–1.51)	2.23 (1.19–4.18)
Prolonged operative duration (> 220 min)	1.36 (1.25–1.48)	
Postoperative complications	4.28 (3.92–4.65)	12.42 (11.00–14.01)
Proctectomy	1.30 (1.18–1.44)	
Indication for surgery (v. malignancy) IBD	1.56 (1.36–1.82)	1.23 (1.02–1.48)

postdischarge occurrences. The incidence of VTE in patients undergoing colorectal resection is low, and only half of these occur after discharge and therefore are potentially avoidable with extended thromboprophylaxis. Patients at high risk for postdischarge VTE have different characteristics than those who develop VTE in-hospital. Identifying this specific subset of patients at highest risk for postdischarge VTE may allow for the selective use of prolonged thromboprophylaxis.

12

Comparison between conventional colectomy and complete mesocolic excision for colon cancer — a systematic review and pooled analysis. ***N. Alhassan, M. Yang, N. Wong-Chong, A. Liberman, P. Charlebois, B. Stein, G. Fried, L. Lee*. From McGill University, Montreal, Que.**

Complete mesocolic excision (CME) is advocated based on oncologic superiority, but not commonly performed in North America. Many data are case series with few comparative studies. Our aim was to perform a systematic review comparing outcomes between CME and non-CME colectomy. A systematic review was performed according to PRISMA guidelines of Medline, Embase, HealthStar, Web of Science and Cochrane Library. Studies were included if they compared conventional resection (non-CME) with CME for colon cancer. Quality was assessed using Methodological Index For Non-Randomized Studies (MINORS). The main outcome measures were short-term morbidity and oncologic outcomes. Weighted pooled means and proportions with 95% CI were calculated using a random-effects model when appropriate. Out of 825 unique citations, 23 studies underwent full-text reviews and 14 met inclusion criteria. Mean MINORS score was 13.3 (range 11–15). The mean sample size in the CME group was 1166 (range 45–3756) and it was 945 (range 40–3425) in the non-CME group. Four papers reported plane of dissection, with CME plane achieved in 87.4% (79.7–95.2). Mean OR time in the CME group was 167 minutes (163–171) and it was 138 minutes (135–142) in the conventional group. Perioperative morbidity was reported in 6 studies, with pooled overall complications of 22.5% (95% CI 18.4–26.6) for CME and 19.6 (95% CI 13.6–25.5) for non-CME. Anastomotic leak occurred in 6.0% (95% CI 2.2–9.7) of CME resections versus 6.0% (95% CI 4.1–7.9) in non-CME. CME had more lymph nodes, longer distance to high tie and longer specimens in all studies. Nine studies compared long-term oncologic outcomes and only 3 reported statistically significant higher disease-free or overall survival in favour of CME. Local recurrence was lower after CME in 2 of 4 studies. The quality of evidence is limited and does not consistently support the superiority of CME. Better data are needed before CME can be recommended as the standard of care for colon cancer resections.

13

Nonoperative management compared with radical resection of locally advanced rectal cancer following complete clinical response: a Markov decision analysis. ***S. Khorasani* (University of Toronto, Toronto, Ont.), *A. de Buck van Overstraeten* (Mount Sinai Hospital, Toronto, Ont.), *E. Kennedy* (Mount Sinai Hospital, Toronto, Ont.), *N. Look Hong* (Sunnybrook Health Sciences Centre, Toronto, Ont.).**

Nonoperative management (NOM) for rectal cancer was introduced for patients with clinical complete response (cCR) after chemoradiation therapy (CRT) to avoid short- and long-term surgical morbidity related to radical resection, while aiming to preserve oncologic outcomes. NOM involves a strict surveillance program with surgery reserved only for patients who develop a local regrowth. The objective of this study was to compare the expected quality-adjusted life years (QALYs) of NOM to radical resection in the setting of locally advanced rectal cancer. Using a decision analytic simulation and Markov process, radical resection (including low anterior resection and abdominoperineal resection) was compared with NOM over a 10-year time horizon. The base-case was a medically fit 65-year-old male with a distal rectal tumour who had achieved cCR after CRT. Clinically important probabilities and utilities including those for presence of stoma, postoperative morbidity, local and distant recurrence and salvage surgery were incorporated into the model. Outcomes were expressed in both life-years (LYs) and QALYs. Sensitivity analyses were performed to assess the impact of variation in the probabilities of the clinical variables in the model. While radical resection was marginally better than NOM in terms of LYs (6.96 v. 6.92), NOM resulted in slight improvement in terms of QALYs (5.79 v. 5.62) when patient utilities were considered. The model was sensitive to the probabilities of local regrowth, distant recurrence and salvage surgery for regrowth in NOM in addition to the utilities associated with NOM and low anterior resection. The findings of this decision analysis can be interpreted as a "toss-up," meaning either NOM or radical resection is a reasonable treatment strategy given the clinically insignificant differences between the 2 strategies in terms of LYs and QALYs. These results further highlight the importance of incorporating patient preferences in the decision-making process.

14

A mobile device application (app) to improve adherence to an enhanced recovery program for colorectal surgery: a randomized controlled trial. ***J. Mata, J. Fiore, N. Pecorelli, D. Mouldoveanu, A. Gosselin-Tardiff, L. Lee, S. Liberman, B. Stein, P. Charlebois, L. Feldman*. From McGill University, Montreal, Que.**

Mobile applications (apps) may improve delivery of health education material and have the potential to foster behaviour change and improve patient adherence to enhanced recovery pathways (ERPs). We conducted a randomized controlled trial to estimate the extent to which a novel mobile device app impacts adherence with postoperative ERP elements in comparison with standard written education alone. This was a superiority, parallel-group, assessor-blind, sham-controlled randomized trial. Participants received standard written preoperative education and access to an iPad postoperatively and were randomly assigned with a 1:1 ratio into one of 2 groups: (1) iPad included a novel mobile device app for postoperative education and self-assessment of recovery, or (2) iPad without the app. The primary outcome measure was mean % adherence to a bundle of 5 postoperative ERP elements that require patient participation (early mobilization, gastrointestinal motility stimulation with chewing gum, consumption of oral liquids, breathing exercises and consumption of nutritional drinks). A total of 100 patients were randomly assigned to intervention (n = 50) or control (n = 50). Demographics

were similar except average age was higher in the intervention group (63 v. 57 yr). The app was used by 94% of the patients on postoperative day (POD) 0 and 82% on POD 1. Mean overall adherence to the bundle on the 2 first postoperative days was 61% (95% CI 56–66) with no difference between the intervention and control groups (59% v. 62%; $p = 0.5$). After adjustment for factors that affect recovery, the impact remained non significant (Coefficient 2.4 [95% CI –5 to 10]; $p = 0.53$). In this randomized trial, a mobile app did not improve adherence to a well-established enhanced recovery pathway in colorectal surgery patients, when compared with standard patient education. Future research should evaluate the impact of apps that integrate novel behavioural change techniques, particularly in contexts where adherence is low.

15

Short-term outcomes of perioperative blood transfusions in colorectal cancer surgery: a propensity-adjusted analysis. ***J. Chau*, *S. Bhatnagar*, *M. Abou Khalil*, *N. Morin*, *C. Vasilevsky*, *G. Ghitulescu*, *J. Faria*, *M. Boutros*. From McGill University, Montreal, Que.**

Perioperative blood transfusions in cancer surgery have been implicated with poor long-term oncologic outcomes. However, the impact of perioperative blood transfusions on short-term outcomes is not well studied. The aim of this study was to assess the impact of perioperative blood transfusions on short-term outcomes following elective colorectal cancer surgery. After institutional review board approval, patients who underwent elective colorectal resections for cancer from 2005 to 2016 were identified from the American College of Surgeons' National Surgical Quality Improvement Project (ACS NSQIP) database. Patient demographics, comorbidities and operative variables were collected. The intervention was defined as the need for perioperative blood transfusions (≤ 72 hours from surgery). The primary outcome was 30-day mortality and secondary outcomes were readmission rates, total length of stay in hospital and hospitalization > 30 days. An estimated propensity score was implemented to match patient cohorts between the 2 intervention groups for patient characteristics and operative variables. Multivariate propensity-weighted linear and logistic regression models, controlling for NSQIP-defined major morbidity (including reoperation, deep incisional surgical site infection [SSI], organ space SSI, sepsis or septic shock, wound dehiscence, cardiac arrest, myocardial infection, pneumonia, acute renal failure and deep vein thrombosis/pulmonary embolism), were performed. Of the 73 249 patients who underwent colorectal cancer surgery, 9.7% had received a perioperative blood transfusion. On univariate analysis, transfusions were associated with an increase in mortality (2.8% v. 0.7%, $p < 0.001$), major morbidity (28.9% v. 12.2%, $p < 0.001$), readmission rate (14.6% v. 10.0%, $p < 0.001$), total length of stay (10.6 v. 6.44 d, $p < 0.001$) and hospitalization > 30 days (2.1% v. 0.5%, $p < 0.001$). Using multivariate propensity score adjusted models, perioperative blood transfusions were an independent predictor of mortality (OR 1.45, 95% CI 1.12–1.88), total length of stay (IRR 1.24, 95% CI 1.21–1.28), and hospital stay > 30 days (OR 1.83, 95% CI 1.41–2.38). There was no significant difference in the readmissions (OR 0.89, 95% CI 0.79–1.00). Perioperative blood transfusions during elective colorectal cancer surgery are associated with significantly worse short-term outcomes.

16

Pelvic exenteration with iliac vessel resection for lateral pelvic wall involvement in rectal surgery. ***F. Rouleau Fournier*, *P. Bouchard*. From Centre Hospitalier Universitaire de Québec – Université Laval, Québec, Que.**

Pelvic exenteration with en bloc iliac vessel resection has been described as a curative-intent approach for locally advanced rectal cancer or pelvic recurrence. This procedure is challenging and the goal is to achieve clear margins. This video demonstrates the main steps of the procedure in a patient presenting a left posterolateral perianastomotic recurrence of a pT3N0 sigmoid cancer. The video starts after standard laparotomy exposure and left colon mobilization. We proceed with a step-by-step approach to a standard left lateral pelvic exenteration. During the surgery, left internal iliac vessels are divided to achieve negative surgical resection margins. Left ovariectomy is also required because of cancer involvement. At the end of the procedure, we achieve a complete open left lateral pelvic exenteration with negative surgical margins. This video demonstrates the steps toward a curative intent for patients with locally advanced rectal cancer or pelvic recurrence. Patients with these characteristics should be discussed in tumour board panels and referred to a high-volume centre because the procedure is feasible and improves oncologic outcomes.
YouTube video link: www.youtube.com/watch?v=hSzUaZptLmw&t

17

Impact of preoperative bowel preparation on the risk of *Clostridium difficile* after colorectal surgery: a propensity weighted analysis. ***M. Abou Khalil* (McGill University, Montreal, Que.), *S. Bhatnagar* (McGill University, Montreal, Que.), *J. Abou Khalil* (University of Ottawa, Ottawa, Ont.), *C. Vasilevsky* (McGill University, Montreal, Que.), *N. Morin* (McGill University, Montreal, Que.), *G. Ghitulescu* (McGill University, Montreal, Que.), *J. Faria* (McGill University, Montreal, Que.), *M. Boutros* (McGill University, Montreal, Que.)**

The impact of bowel preparation (BP) on the risk of *Clostridium difficile* infection (CDI) after colorectal surgery (CRS) is not known. The primary aim of this study was to evaluate the effect of BP on CDI following CRS. The secondary aim was to assess the impact of CDI on length of stay and readmission in this cohort. Patients who underwent CRS were selected from the American College of Surgeons' National Surgical Quality Improvement Project (ACS NSQIP) database (colectomy-specific-files, 2015–16). Patients with a preoperative diagnosis of CDI or missing data were excluded. Of 30 514 included patients, 39%, 5%, 18% and 38% had combined oral/mechanical, oral, mechanical or no BP, respectively. Overall incidence of postoperative CDI was 1.6%. Median length of stay was 8 (5, 14) versus 5 (3, 7) days for patients who had CDI compared with those who did not ($p < 0.01$). Readmission rates were greater for patients who had postoperative CDI (30% v. 9%, $p < 0.01$). On inverse probability-weighted regression, combined oral and mechanical BP decreased the probability of postoperative CDI by 33% compared with no BP ($p = 0.03$). This decreased risk was not observed for the other BP groups. On propensity-weighted linear regression, CDI resulted in an increase of 9.7 (95% CI 4.5–20.7) days in length of stay. On propensity-weighted logistic regression, the odds of readmission

were 3.39 (95% CI 2.8–4.1) times greater for patients with postoperative CDI. The probability of postoperative CDI was significantly decreased for patients with combined oral and mechanical BP. Although rare, postoperative CDI significantly increased length of stay and risk of readmission.

18

Does obesity class impact outcomes of total proctocolectomies with ileal-pouch anastomosis? An ACS NSQIP analysis. ***M. Abou Khalil*** **(McGill University, Montreal, Que.),** ***N. Morin*** **(McGill University, Montreal, Que.),** ***C. Vasilevsky*** **(McGill University, Montreal, Que.),** ***G. Ghitulescu*** **(McGill University, Montreal, Que.),** ***J. Motter*** **(Johns Hopkins Bloomberg School of Public Health, Baltimore, Md.),** ***M. Boutros*** **(McGill University, Montreal, Que.).**

Obesity has been associated with increased morbidity following total proctocolectomies with ileal-pouch anal anastomosis (TPC-IPAA). However, the incremental added risk of increasing obesity class is not known. The aim of this study was to evaluate the additional morbidity of increasing obesity class for TPC-IPAA. After ethics board approval, the American College of Surgeons' National Surgical Quality Improvement Project (ACS NSQIP) database (2005–2015) was accessed to identify patients who underwent elective TPC-IPAA. Body mass index (BMI, kg/m^2) was classified as normal (18.5–24.9), overweight (25.0–29.9), obesity class I (30–34.9), obesity class II (35–39.9) and obesity class III (≥ 40). Primary outcomes were overall surgical site infection (SSI) and organ-space infection (OSI). Secondary outcomes were 30-day major morbidity and length of hospital stay (LOS). Of 4581 patients who underwent TPC-IPAA, 57.4%, 17.6% and 9.8% were for ulcerative colitis, malignant colonic neoplasms and benign colonic neoplasms. Median (IQR) age was 44 (31, 56) years and 56.3% were male. Half (51.21%) of patients underwent a laparoscopic TPC-IPAA. Rates of overall SSI, OSI and major morbidity were 15.5%, 8.5% and 27.3%. Median LOS was 7 (5, 10) days. Over one-third of patients (38.5%) had a normal BMI, 4.1% were underweight, 32.9% were overweight, 16.0% were class I obese and 8.4% were class II/III obese. On multivariate regression analysis, higher obesity class was associated with significantly increased odds of SSI and OSI (Table 11). Similarly, increased risk of 30-day major morbidity and a 1-day increase in LOS were observed accross all obesity categories. Increasing obesity class was associated with a significant incremental risk of SSI and OSI following TPC-IPAA. Knowledge of this increased risk stratified by obesity class may help guide preoperative planning, especially pertaining to counselling patients for staged procedures to allow for appropriate preoperative weight loss before IPAA reconstruction.

19

Impact of tumour deposits on oncologic outcomes in stage III colon cancer. ***N. Wong-Chong*** **(McGill University, Montreal, Que.),** ***J. Mottl*** **(Florida Hospital, Orlando, Fla.),** ***G. Hwang*** **(Florida Hospital, Orlando, Fla.),** ***J. Kelly*** **(Florida Hospital, Orlando, Fla.),** ***G. Nassif*** **(Florida Hospital, Orlando, Fla.),** ***M. Albert*** **(Florida Hospital, Orlando, Fla.),** ***L. Lee*** **(McGill University, Montreal, Que.),** ***J. Monson*** **(Florida Hospital, Orlando, Fla.).**

The prognosis of tumour deposits (TD) in stage III colon adenocarcinoma is poorly described. The objective of this study was to determine the impact of TD on oncologic outcomes in patients with stage III colon cancer. The 2004–2014 National Cancer Database was queried for patients with resected stage III colon adenocarcinoma on final pathology and divided into 3 groups: LN+TD–, LN+TD+, and LN–TD+. The main outcome was 5-year overall survival (OS). Multilevel regression models were performed to determine the effect of TD on OS and to identify predictors for receiving adjuvant systemic therapy. Of 74 577 patients included, there were 55 800 LN+TD–, 13 740 LN+TD+ and 5037 LN–TD+. The groups had similar patient and facility characteristics, but LN+TD+ had more advanced tumours. LN–TD+ were less likely to receive adjuvant systemic therapy (52% v. 74% LN+TD– and 75% LN+TD+, $p < 0.001$) and had a longer delay to initiation of adjuvant treatment (> 8 weeks; 43% v. 33% LN+TD– and 33% LN+TD+, $p < 0.001$). LN+TD+ had the lowest 5-year OS (46.0% v. 63.4% LN+TD– v. 61.9% LN–TD+, $p < 0.001$) (Fig. 7). On multivariate survival analysis, LN–TD+ had similar 5-year OS compared with LN+TD– with ≤ 3 positive LNs (HR 0.93, 95% CI 0.87–1.01). LN+TD+ had worse prognosis regardless of number of involved LNs (≤ 3 +LNs: HR 1.39, 95% CI 1.30–1.48 and ≥ 4 +LNs: HR 1.30, 95% CI 1.23–1.37). Of those not receiving adjuvant treatment, LN–TD+ were younger and had more adverse tumour features than LN+ disease. LN–TD+ was independently associated with less delivery of adjuvant systemic therapy (OR 0.81, 95% CI 0.80–0.82). The prognosis of patients with N1c disease is similar to that of patients with nodal involvement

Table 11. Multivariate regression for SSI and OSI (*indicates statistical significance)

		SSI, OR (95% CI)	OSI, OR (95%CI)
BMI	Underweight	1.19 (0.78–1.83)	1.49 (0.91–2.47)
	Normal (reference)		
	Overweight	1.21 (0.99–1.48)	1.03 (0.79–1.33)
	Obesity I	1.61 (1.27–2.03)*	1.53 (1.14–2.05)*
	Obesity II/III	2.27 (1.72–3.00)*	1.59 (1.10–2.30)*
Diabetes		0.79 (0.57–1.08)	0.67 (0.42–1.06)
Smoking		1.05 (0.83–1.34)	1.12 (0.83–1.51)
Laparoscopy		0.71 (0.60–0.83)*	0.94 (0.76–1.16)
Operative time (min)		1.001 (1.001–1.002)*	1.001 (1.001–1.002)*
Immunosuppression		1.25 (1.05–1.49)*	1.38 (1.10–1.71)*
Wound classification	Clean-contaminated (reference)		
	Contaminated	1.24 (0.99–1.56)*	1.34 (1.00–1.79)*
	Dirty	2.13 (1.35–3.37)*	2.56 (1.51–4.34)*

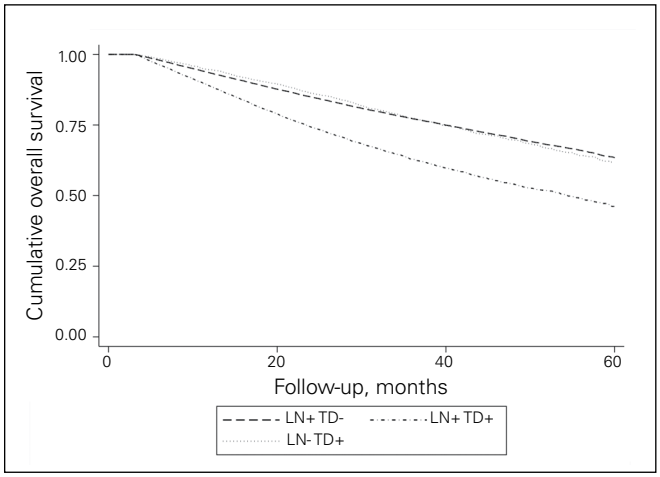


Fig. 7. Kaplan–Meier graph comparing 5-year overall survival of the 3 study groups. Five-year overall survival was 46.0% in LN+TD+, 63.4% in LN+TD– and 61.9% in LN–TD+, $p < 0.001$).

without TD, yet these patients were less likely to receive adjuvant systemic therapy. Improvement in the delivery of appropriate care in these patients may increase survival and should be a target of future quality initiatives.

20

Minimally invasive surgery for stage III colon adenocarcinoma is associated with less delay to initiation of adjuvant systemic therapy and improved survival. ***N. Wong-Chong*** **(McGill University, Montreal, Que.),** ***L. Lee*** **(McGill University, Montreal, Que.),** ***J. Kelly*** **(Florida Hospital, Orlando, Fla.),** ***G. Nassif*** **(Florida Hospital, Orlando, Fla.),** ***M. Albert*** **(Florida Hospital, Orlando, Fla.),** ***J. Monson*** **(Florida Hospital, Orlando, Fla.).**

Minimally invasive surgery (MIS) may improve surgical recovery and reduce time to adjuvant systemic therapy after colon cancer resection. The objective of this study was to determine the effect of MIS on the initiation of adjuvant systemic therapy and survival in patients with stage III colon cancer. The 2010–2014 National Cancer Database was queried for patients with resected stage III colon adenocarcinoma and divided into MIS, which included laparoscopic and robotic approaches, and open surgery. Propensity-score matching was used to balance open and MIS groups. The main outcome measures were delayed initiation of adjuvant systemic therapy (defined as > 8 weeks after surgery) and 5-year overall survival (OS). Multiple Cox regression was performed to identify independent predictors for 5-year OS, including an interaction between delayed systemic therapy and MIS, and adjusted for clustering at the hospital level. There were 86 572 patients that were included in this study. Overall, 45% (38 713 / 86 572) underwent MIS colectomy, of which 93% underwent laparoscopic and 7% robotic surgery. After matching, 33 183 open patients were balanced to 33 183 MIS patients. Patient, tumour and facility characteristics were similar in the matched cohort. There were fewer delays to systemic therapy in the MIS compared with the open group (31% v. 35%, $p < 0.001$) and fewer patients that did not receive any systemic therapy (30% v. 35%, $p < 0.001$). Delayed initiation of systemic therapy > 8 weeks was associated with worse 5-year OS (HR 1.31, 95% CI 1.23–1.39). MIS was independently associated with improved survival (HR 0.82, 95% CI 0.77–0.87). This relationship remained even if 90-day mortality was excluded. MIS approaches are associated with less delay to the initiation of adjuvant systemic therapy and improved survival in patients with stage III colon adenocarcinoma. Surgeons should favour MIS approaches for the treatment of stage III colon adenocarcinoma whenever possible.

21

Delay between neoadjuvant chemoradiation and surgery on rectal cancer outcomes. ***J. McLeod*** **(University of British Columbia, Vancouver, B.C.),** ***J. Cha*** **(University of British Columbia, Vancouver, B.C.),** ***M. Raval*** **(University of British Columbia, Vancouver, B.C.),** ***T. Phang*** **(University of British Columbia, Vancouver, B.C.),** ***C. Brown*** **(University of British Columbia, Vancouver, B.C.),** ***A. Karimuddin*** **(University of British Columbia, Vancouver, B.C.),** ***A. Karimuddin*** **(University of British Columbia, Vancouver, B.C.).**

Neoadjuvant chemoradiation therapy (CRT) followed by total mesorectal excision (TME) at 6 to 8 weeks is recommended for locally invasive rectal cancer. There is debate in the literature regarding this interval on pathological clinical response (pCR), surgical outcomes and survival. The aim of this study is to determine if longer delays impact short- and long-term rectal cancer outcomes. A prospectively maintained database was queried to identify patients undergoing CRT followed by surgery with curative intent. The 2 cohorts were patients having surgery < 8 weeks after completion of CRT or > 8 weeks. Primary outcome was a composite of negative distal margin, clear circumferential radial margin and TME quality. Secondary outcomes included pCR, disease-free survival, perioperative complications and anastomotic leaks. Demographic data were analyzed using 2-tailed t tests and univariate χ^2 analysis. Clinical outcomes were assessed with multivariate logistic regression (adjusted for age, gender, BMI, ASA, cT/N stage, distance from anal verge and operative procedure). The composite outcome was analyzed using Fisher's exact test and disease-free survival by proportional hazard model and Kaplan–Meyer regression. A total of 271 patients were treated with curative resection following CRT between 2006 and 2016; 49% were in the long-interval group (n = 133). There was no significant difference between shorter and longer delays for patient demographics, tumour and nodal staging, distance from anal verge ($p > 0.10$) and restorative procedures. pCR was comparable. There was no significant difference between groups for the composite outcome measure or total complications. The rate of anastomotic leaks was significantly increased for the shorter delay group (5% v. 15%, p = 0.01). Disease-free survival was comparable. In our cohort, shorter delays between CRT and surgery are associated with increased anastomotic leaks for locally invasive rectal cancer. This study adds insight into our understanding of the timing between CRT and surgery in rectal cancer.

22

Post-TES syndrome: a constellation of symptoms resulting from localized pelvic inflammatory changes following transanal endoscopic surgery (TES). ***R. Robertson*** **(University of British Columbia, Vancouver, B.C.),** ***F. Letarte*** **(University of British Columbia, Vancouver, B.C.),** ***A. Karimuddin*** **(University of**

British Columbia, Vancouver, B.C.), *M. Raval* (University of British Columbia, Vancouver, B.C.), *T. Phang* (University of British Columbia, Vancouver, B.C.), *C. Brown* (University of British Columbia, Vancouver, B.C.).

Transanal endoscopic surgery (TES) is a safe and effective therapy for the local excision of rectal lesions. We present the first description of "post-TES syndrome," a cluster of postoperative symptoms related to a local pelvic inflammatory process recognized in a subset of patients following TES. A prospectively collected database of all patients undergoing TES has been collected and maintained at St. Paul's Hospital (SPH) in Vancouver. The experiences of patients presenting with a combination of postoperative pain, fever and imaging findings consistent with post-TES syndrome are described. The syndrome is defined and similar reports of infectious complications in the literature are reviewed. Of 753 patients undergoing TES at SPH from 2006 to 2017, 55 patients presented with postoperative pain or fever. Twenty-five patients were determined to have post-TES syndrome based on our definition and chart review. Sixteen patients presented within the first 2 postoperative days, with all patients presenting within a week. All patients who underwent cross-sectional imaging (n = 11) had a combination of inflammatory change with stranding and/or free fluid and small amounts of intraperitoneal, retroperitoneal or mesorectal air, without signs of free perforation or abscess at the surgical site. Most patients' (92%) symptoms resolved within a week with conservative treatment, 80% of which were treated with antibiotics. Nearly all patients (96%) did not progress to further infectious complications. There were no long-term complications. This is the first report in the literature describing a constellation of symptoms occurring in a subset of patients after TES from a localized inflammatory response. Nearly all patients recover with conservative management without a need for more invasive intervention. Patients presenting with signs and symptoms consistent with post-TES syndrome benefit from a trial of conservative management with expected good clinical outcomes.

23

Hartmann stump complications: Are they rarer than we think? *A. Antoun*, *G. Sigler*, *R. Garfinkle*, *N. Morin*, *C. Vasilevsky*, *V. Pelsser*, *G. Ghitulescu*, *M. Boutros*. From McGill University, Montreal, Que.

Hartmann's procedure (HP) is performed when a colorectal anastomosis is deemed unsafe or not feasible. A stump leak is a feared complication of HP; however, the incidence and outcomes of this complication are not known, and this study aimed to examine them. After institutional review board approval, a retrospective cohort study of patients who underwent HP between 2006–2016 at our institution was performed. The primary outcome was stump complications, a composite outcome of stump leak and peri-stump collection. The secondary outcomes were length of stay, intensive care unit (ICU) admission, reinterventions, mortality and Hartmann reversal rate. Stump leak was defined as evidence of dehiscence of the rectal stump staple line with adjacent pelvic collection on CT, and extravasation of rectal contrast if received. Peri-stump collection was defined as a collection adjacent to the rectal stump, with no definite contrast leak. Of 244 patients with a Hartmann's procedure, 10 (4.1%) patients had a rectal stump complication (6 stump leaks and 4 peri-stump collections). Patient demographics, disease characteristics and operative variables were similar for patients with and without stump complications (Table 12). Of 10 patients with stump complications, 8 required reintervention. Patients with stump complications had significantly longer length of hospital stay (30.5 [19–57] v. 17.0 [10–40] d, p = 0.046), without any differences in ICU admission rates (30% v. 34.3%, p = 0.91), mortality (10% v. 9%, p = 0.91) or Hartmann's reversal (20% v. 27.4%, p = 0.72). To date, this is the largest cohort study to specifically report on the incidence and outcomes of stump complications following HP. The incidence of rectal stump complications was very low. As such, we could not identify any significant predictors. Rectal stump complications increase patients' morbidity with an expected need for reintervention and significantly increased length of stay.

24

A comparison of 2 validated instruments to measure anorectal function in patients with rectal tumours. *E. Hyun*, *K. Clouston-Chambers*, *D. Hochman*, *R. Helewa*, *J. Park* (University of Manitoba, Winnipeg, Man.

Patients frequently report anorectal dysfunction after rectal cancer surgery, which can impact their quality of life (QoL). Two questionnaires (Memorial Sloan Kettering Cancer Center Bowel Function Instrument [BFI] and Low Anterior Resection Syndrome [LARS] score) have been separately validated as measures of bowel function, but it is unclear how these instruments relate to each other and whether there may be an advantage to applying one or both in clinical practice and future research protocols. We assessed the relationship between BFI and LARS and how these relate to validated QoL measures. As part of a larger study examining bowel function after rectal surgery over time, patients undergoing transanal endoscopic microsurgery (TEMS) or restorative proctectomy for rectal neoplasms, as well as those undergoing colonoscopies (controls), prospectively completed BFI, LARS and EORTC Core (C)-30 and Colorectal (CR)-29 QoL questionnaires. We included only baseline (preintervention) data in the present analysis. Pearson product-moment correlation coefficients were separately applied to test correlations. A total of 91 patients completed assessments: 48 with rectal tumours with planned surgery (33 TEMS and 15 restorative proctectomy) and 43 in a group undergoing colonoscopies for a variety of indications, including screening. There were no baseline differences between any of the intended treatment groups or controls on either BFI or LARS. Pearson coefficient r = 0.65 for BFI and LARS scores and r = 0.44–0.61 for BFI urgency frequency, and dietary subscales and LARS score. On regression, the urgency subscale accounted for most of the variation in LARS among the BFI subscale items (standardized β = –0.46). Correlations with CR-29 QoL measures were r = 0.58 for BFI and r = 0.41 for LARS. The moderate correlation of BFI and LARS suggests that they measure related but not identical constructs. The BFI offers some advantages by including more discrete categories of dysfunction to target for intervention, as well as correlating more strongly with QoL.

25

A randomized-control trial of multi-platform audiovisual teaching modules in colorectal surgery. *S. Candy*, *Z. Mir*, *N. Hanna*, *B. Zevin*, *S. Patel*. From Queen's University, Kingston, Ont.

Table 12. Patient characteristics, operative characteristics and outcomes for patients with and without complications after Hartmann's procedure

Variable	No stump complication (*n* = 234)	Stump complication (*n* = 10)	*p* value
Patient characteristics			
Age, yr, median (Q1–Q3)	67.0 (58.0–79.0)	61.5 (48.3–81.3)	0.59
Male (%)	116 (49.6)	3 (30.0)	0.22
Diagnosis (%)			0.32
Diverticular disease	46 (19.7)	2 (20.0)	—
Malignancy	57 (24.4)	3 (30.0)	—
Non-colorectal malignancy	11 (4.7)	1 (10.0)	—
IBD	35 (15.0)	2 (20.0)	—
Bowel ischemia	6 (2.6)	1 (10.0)	—
Volvulus	10 (4.3)	1 (10.0)	—
Iatrogenic injury	9 (3.9)	0	—
Other	60 (25.6)	0	—
ASA 3 or 4 (%)	153 (65.4)	7 (70.0)	0.55
Smoker (%)	60 (25.6)	0	0.17
Diabetes (%)	53 (22.7)	2 (20.0)	0.9
Corticosteroid use (%)	47 (20.1)	3 (30.0)	0.74
Anti-hypertensive use (%)	97 (41.5)	3 (30.0)	0.46
Albumin, median (Q1–Q3)	28.0 (22.0–35.0)	26.5 (23.0–33.5)	0.94
Receiving chemo or previous chemo (%)	45 (19.2)	2 (20.0)	0.95
Receiving radiation or previous radiation (%)	26 (11.1)	2 (20.0)	0.43
Operative characteristics			
Emergency surgery (%)	180 (76.9)	9 (90.0)	0.29
Surgical approach (%)			0.36
Open	211 (90.2)	10 (100.0)	—
Laparoscopic	13 (5.6)	0	—
Lap converted to open	10 (4.3)	0	—
Part of colon used for stump (%)			0.69
Rectum	156 (66.7)	8 (80.0)	—
Rectosigmoid	26 (11.1)	0	—
Sigmoid	36 (15.4)	2 (20.0)	—
Descending colon	4 (1.7)	0	—
Transverse colon	2 (0.9)	0	—
Ascending colon	3 (1.3)	0	—
Diseased segment used for stump (%)	124 (53.0)	8 (80.0)	0.21
Drain placed (%)	51 (21.8)	3 (30.0)	0.55
Rectal tube (%)	77 (32.9)	5 (50.0)	0.28
OR length, hr, median (Q1–Q3)	4.0 (3.0-6.0)	4.3 (3.0–5.1)	0.77
Intra-operative blood product administration (%)	86 (36.9)	6 (60.0)	0.32
EBL, mL, median (Q1–Q3)	300.0 (100.0–500.0)	350.0 (125.0–500.0)	0.65
Outcomes			
Re-intervention (%)	21 (9.0)	8 (80.0)	<0.01
Percutaneous drainage	18 (7.7)	7 (70.0)	<0.01
Re-operation	3 (1.3)	2 (20.0)	<0.01
ICU admission (%)	81 (34.6)	3 (30.0)	0.91
Length of stay, days, median (Q1–Q3)	17.0 (9.8–40.3)	30.5 (19.0–57.3)	0.046
30-d mortality (%)	21 (9.0)	1 (10.0)	0.91
Hartmann reversal (%)	64 (27.4)	2 (20.0)	0.72

Innovative methods for curricular content delivery are constantly being developed; modalities such as podcasts, flipped classroom lectures and online learning modules are the mainstay for medical student learning. These tools are relatively new to surgical education, however, and their utility in this context is only just beginning to be evaluated. Benign anorectal diseases are often under-represented in medical school curricula but are problems commonly encountered by practising physicians. Our goal was to develop multi-platform teaching modules for topics in benign anorectal diseases for use by medical students and to evaluate their usefulness. Research ethics approval was obtained and a survey was created that combined knowledge-based questions with a qualitative assessment of the utility of the videos. Forty-nine second-year medical students were recruited and randomized to 1 of 2 experimental

groups: lecture alone, or lecture and online audiovisual teaching modules (AV). All participants attended a 50-minute lecture on anorectal diseases and then completed a pre-test survey to determine baseline knowledge. Participants in the AV group were then provided with access to the modules; subsequently, all students completed a post-test. The average pre-test score for the 49 participants (18 men, 31 women) was 54% with a standard deviation of 12.6%. The post-test score for the AV group was 69% ± 8% compared with the lecture review alone group with 54% ± 11%. The AV group showed a significant improvement on knowledge-based questions when compared with the lecture-alone group ($p < 0.001$). In addition, 61% of students in the AV group rated the tool as extremely useful. This study demonstrates that audiovisual teaching modules can be highly effective teaching tools in colorectal surgery. As such the development and dissemination of similar modules across other general surgery specialties can prove to be useful and should be pursued for undergraduate and post-graduate medical education.

26

A comparison of nodal harvest following colectomy for obstructed and non-obstructed colon cancer: a matched ACS-NSQIP analysis. ***A. Azin*, *D. Hirpara*, *F. Quereshy*, *T. Jackson*, *A. Okrainec*, *C. O'Brien*, *S. Chadi*. From the University of Toronto, Toronto, Ont.**

There is a paucity of literature assessing the adequacy of lymph node harvest following colectomy for obstructed colorectal cancer (CRC). This study aimed to compare lymph node harvest following colectomy between obstructed CRC and non-obstructed elective CRC patients. Patients undergoing colectomy for CRC were identified between 2014 and 2016 using the National Surgical Quality Improvement Program colectomy data set. A one-to-one coarsened exact-matching was conducted between patients with obstructed and non-obstructed cancer. The primary outcome was adequacy of lymph node harvest. Secondary outcomes included hospital length of stay (LOS), morbidity, readmission, reoperation and mortality. Multivariate analysis was performed to determine the adjusted effect of obstructed tumours on adequacy of lymph node harvest. A total of 20 511 patients were identified. CEM resulted in 1881 patients in each cohort. Compared with elective colectomy, patients with obstructed tumours had greater LOS (9 d v. 6 d, $p < 0.001$), unplanned reoperations (5.4% v. 3.3%, $p = 0.001$), unplanned readmissions (11.0% v. 8.2%, $p = 0.004$), morbidity (32.8% v. 21.2%, $p < 0.001$) and mortality (2.7% v. 0.8%, $p < 0.001$). Patients with obstructed tumours requiring emergency surgery were more likely to have inadequate lymph node harvest on univariate (15.1% v. 10.4%, $p < 0.001$) and multivariate analysis (OR 0.55, 95% CI 0.81–1.63, $p < 0.001$). Patients with obstructed tumours not requiring emergency surgery did not have poor lymph node harvest (OR 0.96, $p = 0.769$). Increased age, neoadjuvant chemotherapy, rectal tumours compared with right-sided tumours, and a non-MIS approach were independently associated with poor lymph node harvest ($p < 0.05$). Emergency colectomy for obstructing CRC is associated with poor nodal harvest. However, patients with obstructing tumours not requiring emergency surgery do not have increased risk of poor-nodal harvest. Surgical diversion or endoscopic stenting may be a potential alternative to optimize nodal counts in select patients.

27

Transanal endoscopic microsurgery (TEM) for rectal GI stromal tumours. ***S. Punnen* (University of British Columbia, Vancouver, B.C.), *M. Raval* (St. Paul's Hospital, Vancouver, B.C.), *A. Karimuddin* (St. Paul's Hospital, Vancouver, B.C.), *T. Phang* (St. Paul's Hospital, Vancouver, B.C.), *C. Brown* (St. Paul's Hospital, Vancouver, B.C.).**

Transanal endoscopic microsurgery (TEM) is effective in the treatment of adenomas and select early rectal cancers. While rare, small gastrointestinal stromal tumours (GIST) can occur in the rectal wall. Our objective in this study is to evaluate the use of TEM in the treatment of early rectal GIST tumours. At St. Paul's Hospital, data for all TEM procedures are prospectively collected and maintained. We identified all patients with pathology-confirmed rectal GIST before TEM from Apr. 1, 2007, to March 1, 2018. Demographic, pathologic, operative and follow-up data were analyzed and presented with descriptive statistics where appropriate. Seven cases of noninvasive rectal GIST were treated with TEM at our centre with a median follow-up time of 31 months (range 0–71). The average age at the time of surgery was 58.1 ± 12.2 years and the average BMI was 26.1 ± 3.7. Median distance of tumours from the anal verge was 4 cm (range 2.5–6) and median tumour size was 3 cm (range 2–5.7). No neoadjuvant treatments were provided. Operative time for cases was 63.9 ± 26.9 minutes on average. Five of the 7 cases were completed as a day surgery. Intraoperative complications were minimal, with 1 patient having postoperative pain and another having postoperative bleeding. Negative margins were achieved in 4/7 patients. Those with positive margins were treated with repeat TEM (2 cases) or chemotherapy using imatinib (1 case). During the follow-up period, there was 1 case of local recurrence successfully treated by TEM. Overall, TEM is a safe method for locally excising GISTs. Although only 1 patient had confirmed recurrence, 3/7 patients still had positive margins after surgery and required repeat surgery or chemotherapy for complete remission. As rectal GISTs are rare, a multicentre registry may better elucidate outcomes with this novel treatment strategy.

28

Retrospective case series of full-thickness local excision of rectal neuroendocrine tumours by transanal endoscopic microsurgery. ***H. Yoon*, *C. Brown*, *A. Karimuddin*, *M. Raval*, *T. Phang*, *W. Xiong*, *H. Stuart*. From the University of British Columbia, Vancouver, B.C.**

Conventional transanal excision is the recommended management of small rectal neuroendocrine tumours (NET). However, transanal endoscopic microsurgery (TEM) has replaced this modality in most regions because of superior visualization and data demonstrating better results in patients with rectal adenomas and early rectal cancers. Our centre is a high-volume TEM centre (> 800 procedures) and a provincial referral centre for local excision. Our objective was to conduct a retrospective review of our TEM for NETs experience. A retrospective case series was performed to evaluate the characteristics and outcomes of rectal NETs managed by full-thickness TEM excision. Demographic, clinical, radiographic, endoscopic and pathologic data from April 2007 to November 2017 were reviewed. Thirty-six patients underwent TEM excision and were followed for a median 9.2 months (range

0–85.7 mo). Mean patient age was 58.2 ± 8.7 years. Median tumour height was 6 cm from the anal verge (range 2–12 cm). Forty-two percent (15/36) of tumours were primarily treated by TEM. Forty-seven percent (17/36) of patients had previous endoscopic polypectomy (16/17) or conventional transanal excision (1/17) with positive margins. Four patients (11%) were referred for recurrence after a mean 3.1 ± 2.7 years after initial endoscopic removal. Mean operative time was 36.9 ± 17.9 minutes with no intraoperative complications. All but 2 patients were discharged the same day. Negative resection margins were achieved in all. Tumour grade was available for 35 patients (grade 1 in 11, grade 2 in 3, and no residual tumour in 21 patients). Two patients (6%) had recurrent disease at 3.2 and 4.5 years after TEM and underwent radical resection. Notably, no residual tumour was present in their TEM specimens. One patient subsequently developed liver metastases.

29

Preoperative versus postoperative neoadjuvant therapy for locally advanced rectal cancer: an assessment of long-term (> 2 years) functional outcomes. ***J. Andrews*** **(Queen's University, Kingston, Ont.),** ***R. Selvam*** **(Queen's University, Kingston, Ont.),** ***S. Wong*** **(Queen's University, Kingston, Ont.),** ***W. Hopman*** **(Kingston Health Sciences Centre, Kingston, Ont.),** ***P. MacDonald*** **(Queen's University, Kingston, Ont.),** ***S. Patel*** **(Queen's University, Kingston, Ont.).**

Neoadjuvant therapy has decreased local recurrence in those with locally advanced rectal cancer. Typically, this is given preoperatively to reduce toxicity and local recurrence, as per the German Rectal Cancer Study Group trial. Unfortunately, some patients are understaged preoperatively and may require postoperative neoadjuvant therapy. The objective of this study was to compare the long-term (> 2 yr) functional outcomes in patients with preoperative versus postoperative neoadjuvant therapy. Patients with locally advanced (stage II and III) rectal cancer treated at a single institution between 2005 and 2012 were eligible for inclusion. Only those with resection and anastomosis, free of an ostomy and follow-up > 2 years were included. Validated questionnaires, including the St. Marks Incontinence Questionnaire, the EORTC QLQ-C30 and the EORTC QLQ-CR29 were used to asses global function, bowel function and other applicable domains. Statistical analysis was undertaken to compare these scores between groups. During the study period, 72 patients fit inclusion, of which 45 returned the questionnaires (63% response rate). Twenty-five participants had neoadjuvant therapy before surgery, and 20 had neoadjuvant therapy after surgery. The groups were similar in age, gender, stage of disease and complications. The majority of the patients received long-course chemoradiation (37/45, 82%). Minimum follow-up was 2 years. There was no difference in the mean St. Mark's Incontinence score in the preoperative versus postoperative groups (9.5 v. 9.4, $p = 0.94$). Similarly, we found no difference in the global health status ($p = 0.25$), fecal incontinence ($p = 0.91$), stool frequency ($p = 0.99$), impotence ($p = 0.93$) or urinary incontinence ($p = 0.32$) scores between the groups. We have reported long-term (> 2 yr) results comparing patients with preoperative to postoperative neoadjuvant therapy. We did not appreciate differences between these groups in functional outcomes.

30

Sedative-related cardiorespiratory events in colonoscopy: a systematic review and network meta-analysis. ***F. Dossa*** **(University of Toronto, Toronto, Ont.),** ***B. Medeiros*** **(Western University, London, Ont.),** ***C. Keng*** **(University of Toronto, Toronto, Ont.),** ***S. Acuna*** **(University of Toronto, Toronto, Ont.),** ***J. Hamid*** **(McMaster University, Hamilton, Ont.),** ***N. Baxter*** **(University of Toronto, Toronto, Ont.).**

Numerous sedative combinations are used for anxiolysis and analgesia during colonoscopy. Previous meta-analyses have attempted to evaluate the safety of sedatives; however, reviews have been limited to pairwise comparisons of propofol against a dissimilar group of all non-propofol agents. We compared the frequency of adverse cardiorespiratory events among the sedative combinations commonly used in colonoscopy. We systematically searched Medline, Embase and the Cochrane library (up to Mar. 28, 2017) to identify randomized controlled trials comparing at least 2 sedative combinations commonly used in colonoscopy. Sedatives eligible for inclusion were short-acting opioids, long-acting opioids, benzodiazepines, propofol, short-acting opioids with benzodiazepines, long-acting opioids with benzodiazepines, and short-acting opioids with propofol. The primary outcome was the frequency of cardiorespiratory events, defined as intra-procedural episodes of hypotension or hypoxemia. We conducted a random-effects Bayesian network meta-analysis using Markov Chain Monte Carlo simulation methods to generate risk ratios and 95% credible intervals for each sedative comparison. We identified 20 studies (2277 patients) directly comparing cardiorespiratory events between sedatives of interest. Cardiorespiratory events were rare across all sedative combinations. Long-acting opioids used with benzodiazepines were associated with a greater risk of cardiorespiratory events than short-acting opioids used alone (RR 3.73; 95% credible intervals [CrI]: 1.14–15.15) (Table 13). We did not find any other significant differences in the risk of cardiorespiratory events between the

Table 13. Results of network meta-analysis. Effect estimates presented as risk ratios (RR) with 95% credible intervals (CrI). Reference sedatives listed in rows, comparators listed in columns. PFL = propofol; SAI = short-acting opioid (fentanyl, remifentanil, alfentanil); LAO = long-acting opioid (meperidine); BZ = benzodiazepine (midazolam, diszepam).

	BZ	LAO+BZ	PFL	SAO	SAO+BZ	SAO+PFL
BZ	BZ					
LAO+BZ	0.71 (0.25–2.58)	LAO+BZ				
PFL	0.95 (0.26–4.66)	1.34 (0.52–3.74)	PFL			
SAO	2.64 (0.62–17.89)	3.73 (1.14–15.14)	2.77 (0.75–12.17)	SAO		
SAO+BZ	1.03 (0.32–4.90)	1.47 (0.58–4.23)	1.09 (0.38–3.38)	0.39 (0.10–1.35)	SAO+BZ	
SAO+PFL	1.02 (0.25–5.67)	1.44 (0.49–4.69)	1.07 (0.32–3.73)	0.39 (0.08–1.55)	0.99 (0.29–3.16)	SAO+PFL

sedative combinations evaluated. Ranking probabilities demonstrated short-acting opioids used alone to have the highest probability of being the safest sedative and long-acting opioids used with benzodiazepines to have the highest probability of being the least safe sedative combination. The frequency of adverse cardiorespiratory events among the sedatives commonly used in colonoscopy is low. Propofol and non-propofol sedative combinations demonstrate similar cardiorespiratory risk profiles, suggesting equivalent safety when used in this setting.

31

Surgical site infection in elective colon and rectal resections: effect of oral antibiotics. ***A. Ghuman*** **(University of British Columbia, Vancouver, B.C.),** ***N. Kasteel*** **(University of Calgary, Calgary, Alta.),** ***C. Brown*** **(University of British Columbia, Vancouver, B.C.),** ***A. Karimuddin*** **(University of British Columbia, Vancouver, B.C.),** ***M. Raval*** **(University of British Columbia, Vancouver, B.C.),** ***T. Phang*** **(University of British Columbia, Vancouver, B.C.).**

Surgical site infection (SSI) is a significant complication of colorectal surgery. Here, we assess the effect of the addition of oral antibiotics (OA) with mechanical bowel preparation (MBP) on SSI rates. We used a retrospective design: consecutive, elective colon and rectal resections at a single academic centre, before (n = 307) and after (n = 189) addition of OA, September 2014 to 2016. All patients had MBP, oral carbohydrate loading, warming blankets, IV antibiotics, subcutaneous heparin, hair clipping and chlorhexidine skin prep. SSIs were assessed using CDC criteria and compared before and after addition of OA using χ^2 analysis. Subgroup analysis was performed on colon and rectal resections independently. Adjusted odds ratio (OR, 95% confidence interval) are reported for potential SSI risk factors. SSI rates before versus after intervention were as follows: overall 19.9% versus 9.5% ($p < 0.05$); superficial 9.8% versus 3.7% ($p < 0.05$); organ space 10.1% versus 5.8% ($p = 0.06$) (Table 14). Subgroup analysis on colon resections SSI rates before versus after intervention: overall 17.9% versus 4.6% ($p < 0.05$); superficial 12.0% versus 3.8% ($p < 0.05$); organ space 6.0% versus 0.9% ($p < 0.05$). SSI rates for rectal resections before versus after intervention: overall 22.8% versus 16.3% ($p = 0.26$); superficial 6.5% versus 3.8% ($p = 0.36$), organ space 16.3% versus 12.5% ($p = 0.41$). Univariate analysis performed on colon resections yielded significant effects for age (0.97, 0.95–2.00), open versus minimally invasive surgery (MIS) (6.35, 2.57–15.67), MIS converted to open versus MIS (4.57, 1.78–11.75), BMI (1.07, 1.02–1.13), wound protector (WP) (0.37, 0.18–0.75), OA (0.22, 0.08–0.58) and surgery date (0.94, 0.89–0.98), but not for sex, lesion location, surgery duration, stoma, wound class, ASA, smoking, diabetes, steroid use, negative pressure wound dressings (NPWD) or surgeon (Table 15). On multivariate analysis, open versus MIS ($p = 0.01$), MIS converted to open ($p = 0.005$) and OA ($p = 0.02$) remained as significant SSI factors. Significant SSI reduction was found after adding OA to MBP. Subgroup analysis revealed significant reduction in superficial and organ space SSIs for colon resections, but not for rectal resections. Operative technique also had a significant effect. The small postintervention number limits assessment of WP and NPWD. Further investigation is needed to understand isolated effects of OA.

Table 14. SSI results

	MBP alone (n = 307)	MBP + oral Abx (n = 189)	*p* value
Colon and rectal resections			
Overall, *n* (%)	61 (19.87)	18 (9.52)	0.002
Superficial, *n* (%)	30 (9.77)	7 (3.70)	0.008
Deep, *n* (%)	0 (0.00)	0 (0.00)	–
Organ space, *n* (%)	31 (10.10)	11 (5.82)	0.06
	MBP alone (n = 184)	MBP + oral Abx (n = 109)	*p* value
Colon resections			
Overall, *n* (%)	33 (17.93)	5 (4.59)	0.0004
Superficial, *n* (%)	22 (11.96)	4 (3.76)	0.01
Organ space, *n* (%)	11 (5.98)	1 (0.92)	0.01
	MBP alone (n = 123)	MBP + oral Abx (n = 80)	*p* value
Rectal resections			
Overall, *n* (%)	28 (22.76)	13 (16.25)	0.26
Superficial, *n* (%)	8 (6.50)	3 (3.75)	0.36
Organ space, *n* (%)	20 (16.26)	10 (12.50)	0.41

Table 15. Regression results

Potential risk factor	Unadjusted OR (95% CI)	*p* value	Adjusted OR (95% CI)	*p* value
Age	0.97 (0.95–1.00)	0.03	0.98 (0.95–1.01)	0.11
Sex	1.38 (0.69–2.74)	0.37	–	–
Lesion location				
Left v. right	0.80 (0.39–1.64)	0.54	–	–
Total v. right	1.49 (0.45–4.89)	0.51	–	–
Operative technique				
Open v. MIS	6.35 (2.57–15.67)	< 0.0001	5.32 (1.48–19.04)	0.01
MIS open → v. MIS	4.57 (1.78–11.75)	0.002	5.95 (1.70–20.87)	0.005
Surgery duration	1.00 (1.00–1.01]	0.57	–	–
BMI	1.07 (1.02–1.13)	0.01	1.06 (1.00–1.13)	0.07
Stoma	2.79 (0.52–14.92)	0.23	–	–
Wound class				
II v. I		0.99	–	–
II v. III	1.32 (0.28–6.21)	0.34	–	–
II v. IV	2.44 (0.74–8.00)	0.14	–	–
ASA score	1.57 (0.91–2.69)	0.11	–	–
Smoking	0.69 (0.23–2.08)	0.51	–	–
Diabetes	1.36 (0.52–3.52)	0.53	–	–
Steroid use	1.36 (0.29–6.41)	0.70	–	–
NPWD	0.72 (0.21–2.49)	0.60	–	–
Wound protector	0.37 (0.18–0.75)	0.007	1.18 (0.42–3.34)	0.76
MBP + PO Abx	0.22 (0.08–0.58)	0.002	0.15 (0.03, 0.77)	0.02
Surgeon	0.78 (0.57–1.08)	0.14	–	–
Date of surgery	0.94 90.89–0.98)	0.009	1.01 (0.92–1.10)	0.88

"–" denotes variables not included in the final regression model ($p > 0.05$ on univariate screen).

32

Trends in the characteristics of proximal and distal colon cancers: a population-based study. ***F. Dossa, N. Baxter*. From the University of Toronto, Toronto, Ont.**

Increasing focus is being placed on population-based colon cancer screening; however, available screening methods have differential impact on the ability to detect proximal versus distal cancers. This study sought to determine how the features of resected proximal and distal cancers have changed over a 25-year period. We used the Surveillance, Epidemiology, and End Results database to analyze trends in the characteristics of surgically resected colon adenocarcinoma diagnosed from 1988 to 2013. We classified cecal, right and transverse tumours as proximal cancers and splenic flexure, left, sigmoid and rectosigmoid tumours as distal cancers. We evaluated changes in tumour size and T, N and summary stages. Temporal trends were analyzed using the Cochran–Armitage test. From 1988 to 2013, there were increasing proportions of proximal cancers diagnosed (Table 16). Both proximal and distal cancers demonstrated decreasing age at diagnosis over time; however, this decline was more precipitous for distal cases. Although both proximal and distal cancer groups demonstrated decreases in T3 tumours over time, concomitant increases in T1/T2 tumours were only found in the proximal group; both groups demonstrated increased proportions of T4 tumours and N2 disease over the study period. Greater numbers of lymph nodes were retrieved over time but decreases in the ratio of positive lymph nodes to total lymph nodes retrieved were found. Overall, we found decreases in stage II and stage IV disease in both groups and an increase in stage I disease within the proximal group; both groups demonstrated increases in the proportion of stage III cancers. The features of surgically resected colon cancers have changed over the last 25 years. There are promising trends in the increasing proportions of early disease for proximal cancers; however, this trend in less apparent for distal cancers, which are occurring in increasingly younger patients.

33

Alberta Rectal Cancer Initiative: implementation of a provincial rectal cancer clinical pathway results in sustainable quality improvement. ***D. Buie* (University of Calgary, Calgary, Alta.), *T. McMullen* (University of Alberta, Edmonton, Alta.), *A. Elwi* (Cancer Strategic Clinical Network, Edmonton, Alta.), *T. MacLean* (University of Calgary, Calgary, Alta.), *H. Wang* (University of Alberta, Edmonton, Alta.), *F. Coutinho* (Alberta Health Services, Calgary, Alta.), *Q. Le* (Alberta Health Services), *L. Shack* (Alberta Health Services, Calgary, Alta.).**

Rectal cancer requires multidisciplinary care from surgeons, radiologists, pathologists and medical and radiation oncologists. Variable practice and reporting in all disciplines contribute to variable outcomes. The aim of this study was to create and implement a provincial evidence-based care pathway to standardize rectal cancer care and improve outcomes. An evidence-based care pathway identified best practice for accurate preoperative staging, appropriate use of neoadjuvant/adjuvant therapy, improved surgical quality, complete pathologic assessment and reporting. Baseline data collection occurred over 1 year before the study (2013).

Table 16. Study results

	Proximal			Distal		
	1988	2000	2013	1988	2000	2013
Proportion of all tumours, *n* (%)	47.0	55.0	59.2*	53.0	45.0	40.1*
Age (mean, SD)	72.1 (11.7)	72.1 (12.5)	70.9 (12.9)*	69.2 (11.5)	68.2 (12.9)	64.6 (13.7)*
Sex, % male	44.5	43.8	46.1	53.8	54.1	54.7
T stage (%)						
T1	9.1	10.4	13.1*	17.8	18.5	16.7
T2	11.8	16.9	15.7*	13.5	16.3	14.4
T3	60.7	59.7	52.1*	54.1	55.2	50.9†
T4	18.4	13.0	19.0‡	14.6	10.0	18.0*
Tumor size, median (IQR), mm	50 (35–60)	45 (33–60)	45 (30–61)*	40 (30–55)	40 (30–55)	40 (28–55)
N stage (%)						
N0	60.8	59.0	61.2	64.5	59.5	58.9*
N1	24.7	23.7	21.4*	24.3	26.3	25.2
N2	14.5	17.3	17.3*	11.2	14.1	15.9*
Number of lymph nodes examined (mean, SD)	12.2 (8.8)	13.9 (9.8)	21.4 (10.6)*	9.5 (7.9)	10.9 (8.8)	18.4 (10.1)*
Number of positive lymph nodes (mean, SD)	1.6 (3.2)	1.8 (3.5)	1.8 (3.7)‡	1.3 (2.9)	1.5 (3.2)	1.7 (3.7)*
TNM stage (%)						
I	16.9	21.3	24.6*	25.4	26.2	25.4
II	38.8	34.9	32.9*	35.5	31.1	28.1*
III	28.1	29.0	30.4*	24.2	29.1	33.0*
IV	16.1	14.8	12.0*	14.9	13.6	13.5§

IQR = interquartile range; SD = standard deviation.
Significant trends denoted by superscripts in 2013 column: *$p < 0.0001$; †$p < 0.001$; ‡$p < 0.01$; §$p < 0.05$.

Opinion leaders were engaged to identify and quantitate best practice including discipline-specific goals, quality measures and performance indicators. Data sources included the provincial cancer registry, oncology databases and chart review. A coordinated multipronged approach was used for knowledge transfer including focused discipline-specific education (CME), opinion leaders, educational outreach, and targeted audit/feedback through discipline-specific personalized report cards containing individual (confidential) and provincial aggregate results. From 2013 to 2016, the use of preoperative staging MRI increased from 53% to 76% with 77% of reports in standardized synoptic format. Reporting of mandatory elements in synoptic pathology reports increased from 75% to 90% and 91% of radical resection specimens were assessed using the Quirke method. Surgical quality improved with an increase in grade 3 (complete) TME resections from 66% to 72% and a decrease in CRM positivity from 7% to 5%. Neoadjuvant therapy in appropriate stage II/III patients increased from 66%to 79%. Using a multifaceted knowledge transfer strategy, implementation of a provincial evidence-based rectal cancer pathway resulted in improved uptake of best practice in all facets of multidisciplinary care. This sustainable approach includes education, engagement, audit and feedback reporting and is easily adaptable to other jurisdictions and tumour groups.

Canadian Association of Thoracic Surgeons (CATS)

01

Laparoscopic Heller myotomy with or without Dor fundoplication for the treatment of achalasia. Do surgical outcomes differ? *H. Roy, R. Kennedy*. From the University of Saskatchewan, Saskatoon, Sask.

Laparoscopic Heller myotomy (LHM) is the standard of therapy for achalasia. Currently, the necessity of an anti-reflux procedure to supplement the myotomy is disputed. This study compares quality of life outcomes (gastroesophageal reflux disease [GERD], dysphagia, patient satisfaction, etc.) between patients receiving LHM with and without Dor fundoplication. Every adult patient who underwent LHM in our health region between 2006 and 2017 was included in the study (n = 85). Using the Gastresophageal Reflux Disease Health-Related Quality of Life Scale (GERD-HRQLS) and other qualitative measures, we interviewed each patient and analyzed their responses by group (± Dor fundoplication) with the χ^2 and Student t tests. Fifty-eight patients completed the survey (68%). Thirty-two received LHM + Dor fundoplication, and 26 received LHM alone. Mean follow-up time was 56 ± 36 months (LHM + Dor) and 62 ± 37 months (LHM alone). Mean operative time was 110.9 ± 13.6 minutes (LHM) versus 127.2 ± 24.4 minutes (LHM + Dor) (p = 0.008). There was no significant difference between the 2 groups with respect to perioperative complications, postoperative heartburn, dysphagia, regurgitation or proton pump inhibitor (PPI) use. Patients receiving Dor fundoplication were more likely to have postoperative gas bloat (22% v. 4%; p = 0.047). Overall satisfaction was 100% with both groups. The only statistically significant differences between LHM ± Dor fundoplication were an increase in OR time and gas bloat syndrome in those receiving fundoplication. LHM alone leads to a slightly increased prevalence of GERD and proton pump inhibitor use, while LHM + Dor slightly increases the prevalence of postoperative dysphagia. However, neither are statistically or clinically significant outcomes. Patient satisfaction is excellent for both procedures. Therefore, the decision of whether or not to perform a Dor fundoplication with LHM should be based on a combination of surgeon and patient preference, with consideration given to specific patient factors.

02

Esophageal replacement following gastric devascularization is safe but may not decrease anastomotic complications of a cervical anastomosis. *N. Hanna* (Queen's University, Kingston, Ont.), *B. Zevin* (Queen's University, Kingston, Ont.), *J. Bunn* (Kingston Health Sciences Centre, Kingson, Ont.), *Z. Mir* (Queen's University, Kingston, Ont.), *W. Chung* (Queen's University, Kingston, Ont.).

Laparoscopic gastric devascularization (LGD) is an innovative method to improve gastric conduit perfusion and reduce the incidence of anastomotic leak and stricture following esophagectomy. This study reports our early experience with LGD performed up to 3 weeks before a McKeown esophagectomy with a cervical esophagogastric anastomosis. A retrospective review of patients who underwent LGD before esophagectomy between February and December 2017 at a large academic medical centre was undertaken. LGD included staging laparoscopy followed by division of the short gastric vessels, left gastric artery, coronary vein, left gastroepiploic vein and posterior gastric attachments. Patient demographics, comorbidities, clinical stage, use of neoadjuvant therapy, perioperative events, length of hospital stay and complications were collected and analyzed. Eleven patients underwent LGD before a McKeown esophagectomy. LGD was performed a median of 15 (9–21) days before esophagectomy. There were no complications or readmissions following LGD. There were no mortalities or reoperations within 30 days of the esophagectomy. Two patients (18%) experienced an anastomotic leak, both managed conservatively. One patient (9%) developed an anastomotic stricture requiring outpatient endoscopic dilatation. Three patients (27%) developed a pneumonia. Three patients (27%) developed surgical site infections along the neck incision. One patient (9%) had a chylothorax while another (9%) had a recurrent laryngeal nerve injury necessitating further management by Otolaryngology. LGD with delayed esophageal resection and reconstruction can safely be performed up to 3 weeks before a McKeown esophagectomy with minimal morbidity and mortality. Although other centres that utilize this technique report lower rates of anastomotic leak than with a single-stage approach, LGD did not reduce the anastomotic leak rate when compared with what is conventionally reported for a McKeown esophagectomy.

03

Surgical morbidity of full-thickness chest wall resection for breast cancer: a coarsened exact matching study. *M. Elmi, E. Wakeam, A. Azin, R. Presutti, S. Keshavjee, T. Cil, D. McCready*. From the University of Toronto, Toronto, Ont.

Chest wall resection is an infrequently used modality for potentially curative or palliative treatment of primary or recurrent breast cancer invading the chest wall. We examined the postoperative morbidity in patients undergoing full-thickness chest wall

resection (FTCWR) surgery using a large multinational surgical outcomes database. A cohort analysis was conducted using the American College of Surgeons' National Surgical Quality Improvement Program (ACS NSQIP) database; 2007–2016. Patients undergoing FTCWR for breast cancer were examined. Outcomes of interest included 30-day postoperative morbidity, respiratory complications and hospital length of stay (LOS). Our secondary aim was to compare, via the coarsened exact matching (CEM) technique, the postoperative morbidity of FTCWR with that of patients undergoing mastectomy only. Two groups were created, and data were preprocessed by CEM, balancing for the following variables: age, sex, BMI, diabetes, smoking, dyspnea, ventilator, COPD, ascites, CHF, hypertension, renal failure, dialysis, disseminated cancer, wound infection, steroid use, weight loss, bleeding disorder, preoperative transfusion, ASA class and concurrent breast reconstruction. A total of 137 patients with a mean age of 60.3 ± 14.2 years were included. The overall postoperative morbidity was 11.7%. Respiratory morbidity was low; 2 patients (1.5%) required either an unplanned reintubation or prolonged intubation. Median hospital LOS was 2 ± 3.1 days. In the CEM analysis, 122 women were included in each of the 2 balanced groups. After matching for the aforementioned variables, the overall morbidity for the FTCWR group (11.5%) was slightly higher than for the mastectomy group (8.2%), but this did not reach statistical significance ($p = 0.52$). FTCWR for the local treatment of breast cancer can be performed with relatively low morbidity and respiratory complications. This is the largest series looking at postoperative complications for FTCWR in the treatment of locally advanced breast cancer. Future studies are needed to determine the long-term oncological results of FTCWR in this unique population of patients.

04

Enhanced recovery after lung cancer surgery in Canada: a survey of current practices. *V. Cheung* (University of Calgary, Calgary, Alta.), *C. Schieman* (University of Calgary, Calgary, Alta.), *J. Bailey* (University of Calgary, Calgary, Alta.), *G. Nelson* (University of Calgary, Calgary, Alta.), *T. Batchelor* (University Hospitals Bristol, Bristol, UK), *S. Grondin* (University of Calgary, Calgary, Alta.), *A. Graham* (University of Calgary, Calgary, Alta.), *N. Safieddine* (University of Toronto, Toronto, Ont.), *S. Johnson* (University of Alberta, Edmonton, Alta.), *W. Hanna* (McMaster University, Hamilton, Ont.).

Enhanced Recovery After Surgery (ERAS) protocols represent a major paradigm shift in perioperative care delivery. Implementation of ERAS protocols has been shown to reduce postoperative complications and length of stay and improve patient satisfaction. The study objective was to investigate current practices in lung resection surgery across Canada and test readiness for ERAS implementation in thoracic surgery. A survey was developed through iterative feedback from a panel of experts and was designed to capture issues specific to lung resection surgery and focus on components of ERAS related to organization and preoperative, intraoperative and postoperative care delivery. The 51-item survey was distributed to members of the Canadian Association of Thoracic Surgeons (CATS) between September and October 2017. The survey was completed by 48 of 86 practising Canadian CATS members in 9 provinces across Canada (56%). Just 25% currently used an ERAS protocol for lung resection patients. Preoperative nutrition practices were variable, with only 21% of respondents using preoperative carbohydrate loading. All respondents performed a surgical safety checklist before surgery and administered prophylactic antibiotics within 60 minutes of incision. A routine urinary catheter was used by 65% of surgeons. Most surgeons (89%) reported using minimally invasive techniques in > 80% of early-stage lung cancer resections. Ninety-six percent used routine deep vein thrombosis prophylaxis, with 76% using in-hospital unfractionated or low-molecular-weight heparin. Only 14% of surgeons used routine atrial fibrillation prophylaxis. Chest tube number, suction use and timing of removal were highly varied. Most surgeons (85%) discharged patients home the same day as chest tube removal. Nearly all respondents (98%) felt that ERAS protocols would improve care in lung cancer surgery and should be an area of CATS focus. These results endorse the mandate of the CATS committee on best practices and can act as a basis for the design and implementation of ERAS pathways in Canada.

05

Enhanced recovery after esophagectomy in Canada: a survey of current practices. *V. Cheung* (University of Calgary, Calgary, Alta.), *C. Schieman* (University of Calgary, Calgary, Alta.), *J. Bailey* (University of Calgary, Calgary, Alta), *G. Nelson* (University of Calgary, Calgary, Alta.), *D. Low* (Virginia Mason Medical Center, Seattle, Wash.), *N. Safieddine* (University of Toronto, Toronto, Ont.), *S. Grondin* (University of Calgary, Calgary, Alta.), *A. Seely* (University of Ottawa, Ottawa, Ont.), *E. Bedard* (University of Alberta, Edmonton, Alta.), *C. Finley* (McMaster University, Hamilton, Ont.).

Enhanced Recovery After Surgery (ERAS) protocols represent a major paradigm shift in perioperative care delivery. Implementation of ERAS protocols has been shown to reduce postoperative complications and length of stay, and improve patient satisfaction. The potential benefits of ERAS have not been thoroughly explored in thoracic surgery, a specialty with wide-ranging average lengths of stay and mortality rates due to variations in perioperative care. The study objective was to investigate current practices in esophageal cancer surgery across Canada and test readiness for ERAS implementation in thoracic surgery. A survey was developed through iterative feedback from a panel of experts and was designed to capture issues specific to esophageal cancer surgery with a focus on ERAS components related to organization and preoperative, intraoperative and postoperative care delivery. The 47-item survey was distributed to members of the Canadian Association of Thoracic Surgeons (CATS) between September and October 2017. The survey was completed by 41 of 86 practising Canadian CATS members in 9 provinces across Canada (48%). Just 12% reported that their thoracic surgery division currently used an ERAS protocol for esophagectomy. All respondents performed a surgical safety checklist before surgery and administered prophylactic antibiotics within 60 minutes of incision. Only 17% of surgeons routinely performed staging laparoscopy before esophagectomy. Forty-nine percent routinely used minimally invasive techniques. The majority (61%) initiated oral intake after a negative-swallow study. Most surgeons (85%) encouraged mobilization the day of surgery, with 15% mobilizing patients on postoperative day 1. Forty-eight percent of respondents collected real-time outcomes data. Nearly all respondents (98%) felt that ERAS protocols would improve patient care in esophageal surgery and should be an area of CATS focus. These results endorse the mandate of the CATS

committee on best practices and can act as a basis for the design and implementation of ERAS pathways in Canada.

06

Comparison of outcomes with operative and nonoperative treatment of thoracic empyema: a population-based study. ***R. Nayak*** **(Queen's University, Kingston, Ont.),** ***S. Brogly*** **(Queen's University, Kingston, Ont.),** ***K. Lajkosz*** **(Institute for Clinical Evaluative Sciences at Queen's University, Kingston, Ont.),** ***D. Lougheed*** **(Queen's University, Kingston, Ont.),** ***D. Petsikas*** **(Queen's University, Kingston, Ont.).**

The objective of this study was to compare mortality and readmission risk associated with operative and nonoperative treatment of thoracic empyema. Administrative universal health care data were used to conduct a population-based cohort study. Patients ≥ 18 years of age with a hospital discharge diagnosis of thoracic empyema from Jan. 1, 1996, to Dec. 31, 2015, were included. Patients who had no documented intervention, who were diagnosed with hemothorax within 3 months or who underwent thoracic surgery within 60 days were excluded. Treatment approach was classified as non-operative (i.e., chest tube with or without fibrinolytics) or operative (video-assisted thoracoscopic surgery [VATS] or open decortication). Modified Poisson regression was used to estimate risk ratios (RR) for mortality and readmission with adjustment for potential confounders (RRadj) using open decortication as the reference standard. Analysis was stratified to 5-year time periods. A total of 9052 hospitalized patients were included in the study cohort. Overall, patients treated non-operatively had higher mortality risk as an inpatient (RRadj 1.44, 1.02–1.99), at 30 days (RRadj 2.52, 1.27–5.23), at 6 months (RRadj 1.57, 1.23–2.05) and at 1 year (RRadj 1.46, 1.17–2.00). This risk remained persistent after stratifying by time. Non-operative management was also associated with higher empyema-specific 90-day readmission (RRadj 2.07, 0.76–7.73). This risk was greatest in the 1996–2000 period and decreased with each 5-year interval. After adjusting for a variety of confounders, non-operative management was associated with a higher risk of readmission and mortality than surgical decortication. Advances in medical care and technology do not appear to have altered this risk significantly.

07

Impact of positive parenchymal margins following non-small cell lung cancer resection. ***A. Kinio*** **(University of Ottawa, Ottawa, Ont.),** ***V. Ferreira Resende*** **(Ottawa Hospital Research Institute, Ottawa, Ont.),** ***C. Anstee*** **(Ottawa Hospital Research Institute, Ottawa, Ont.),** ***A. Seely*** **(The Ottawa Hospital, Ottawa, Ont.),** ***D. Maziak*** **(The Ottawa Hospital, Ottawa, Ont.),** ***S. Gilbert*** **(The Ottawa Hospital, Ottawa, Ont.),** ***F. Shamji*** **(The Ottawa Hospital, Ottawa, Ont.),** ***S. Sundaresan*** **(The Ottawa Hospital, Ottawa, Ont.),** ***P. Villeneuve*** **(The Ottawa Hospital, Ottawa, Ont.).**

Lung cancer is the most common cause of cancer-related death in Canada. Complete resection is essential for curative treatment; however, 5%–15% of patients will have residual disease at the tumour resection margin, for which the optimal management remains controversial. Our objective was to quantify the impact of postsurgical positive parenchymal margins (PPM) on disease-free and overall survival of non-small cell lung cancer (NSCLC) patients and to characterize the impact of postsurgical therapy (chemotherapy, radiotherapy or radiographic surveillance) on the clinical outcome of these patients. Our retrospective analysis included 610 patients who underwent NSCLC non-pneumonectomy lung cancer resection between 2008 and 2014. Patients were divided into 2 cohorts based on the pathologic assessment of postresection parenchymal margin status. Patients in the 2 cohorts were propensity score matched to account for differences in baseline patient characteristics. Overall and disease-free survival were estimated using Kaplan–Meier curves, and Cox proportional hazards modelling was used to identify factors associated with patient outcome. The PPM rate during the study period was 3.6%. Disease-free survival was significantly decreased in patients with postresection PPMs ($p = 0.0039$). Adjuvant therapy offered to PPM patients was predominantly radiotherapy (36.4%). This probably contributed to the similarity of overall survival between the cohorts ($p = 0.2$), suggesting that current utilization of treatment in the adjuvant setting is highly effective. Patients with PPMs were also more likely to have undergone a wedge resection, emphasizing the need for further optimization of surgical techniques in sublobar resections to ensure complete disease resection.

08

Uniportal video-assisted thoracoscopic pulmonary resection: first series in Western Canada. ***J. Ojah***, ***A. Ashrafi*****. From Surrey Memorial Hospital, Fraser Health, University of British Columbia, Surrey, B.C.**

Single-port video-assisted thoracoscopic surgery (uniportal VATS) facilitates reduced pain, expedient recovery and abbreviated hospital stay. This technique has been adopted by advanced VATS centres around the world since early 2000, with the first uniportal lobectomy reported in 2010. Here, we present initial results of uniportal pulmonary resection in a single Canadian institution. A review of our departmental prospectively maintained database was undertaken. To establish a baseline from which to improve, starting in February 2018, 14 consecutive patients (8 women, 6 men) so far have undergone intentional uniportal VATS pulmonary resection (7 anatomic lobectomies; 7 non-anatomic wedge resections). Mean patient age was 62.3 years with mean body mass index of 29.2 kg/m^2. Mean operative time was 142 ± 90 minutes (mean wedge 51 min; mean lobectomy 206 min). Mean estimated blood loss was 65 ± 60 mL. Mean uniportal incision size was 3.7 ± 0.5 cm. Three patients required extensive decortication before pulmonary resection. No conversion to formal thoracotomy was required. One patient needed the addition of 2 ports due to challenging lobectomy dissection (third case). Thus far, all procedures have been performed without subspecialized uniportal instruments. Mean tumour size was 2.85 ± 1.47 cm, 60% histology confirmed non-small cell lung cancer with 3-station lymph node sampling performed in 72%. All tumours achieved R0 resection and all nodes sampled were pathologically negative for malignancy. Median hospital length of stay was 3 days. Subjective pain assessment did not appear different compared with multiport VATS patients. One patient required insertion of a second chest tube for subcutaneous emphysema following extensive decortication and lobectomy. Zero in-hospital mortality occurred. This early experience represents the first reported series of pure uniportal VATS lung resection in Western Canada. We intend to advance and refine this technique at our centre with future dissemination of data regarding learning curves and lessons learned.

09

A huge posterior mediastinal retrosternal goiter surgically removed through cervicosternal approach. ***A. Najjar* (Umm Al-Qura University, Makkah, Saudi Arabia), *I. Yamani* (Umm Al-Qura University, Makkah, Saudi Arabia), *S. Sersar* (King Abdullah Medical City, Makkah, Saudi Arabia), *A. Batouk* (King Abdullah Medical City, Makkah, Saudi Arabia).**

Retrosternal goiter is commonly defined as ≥ 50% size of the thyroid mass located in the mediastinum. It represents 2%–19% of all operated goiters. It is mostly anterior mediastinal with less than 15% in the posterior mediastinum. The indications for an extracervical approach are a mass larger than the thoracic inlet or a mass that cannot be completely excised from the neck, a posterior mediastinal mass that is extending to the aortic arch or toward the tracheal bifurcation, recurrent postoperative goiter, superior vena cava obstruction, and malignancy with questionable involvement of the neighbouring structures. A 30-year-old woman was referred to King Abdullah Medical City, Makkah, as a case of retrosternal goiter causing severe stridor and thyrotoxicosis. Contrast CT of the chest and neck showed a huge cervical goiter with associated multiple bilateral thyroid nodules and masses, the right thyroid lobe reaching the superior/middle mediastinum. There was associated trachea esophageal groove extension on both sides, mass effect, displacement, moderate narrowing of the trachea and right main bronchial stem. T3 and T4 were moderately high and TSH was low. We started with cervical incision but were not able to remove the mediastinal mass completely, so sternotomy was performed. The mass was completely excised and separated from the trachea and esophagus. The patient was extubated in the operating room. Stridor disappeared in a week's time. Pathology showed colloid goiter with no evidence of malignancy. An 8-month follow-up was uneventful with no stridor and on a small dose of levothyroxine. Retrosternal goiter is one of the differential diagnoses of anterior and rarely posterior mediastinal masses especially if there is a cervical goiter. Sternotomy and/or thoracotomy is needed when the mass is posterior mediastinal.

10

Safety and efficacy of dose reduction of tissue plasminogen activator in the treatment of empyema: a retrospective cohort study. ***D. Parente*, *A. Laliberte*, *M. McInnis*, *C. McDonald*, *Y. Hasnain*, *K. Yasufuku*, *N. Safieddine*, *T. Waddell*. From the University of Toronto, Toronto, Ont.**

The use of intrapleural fibrinolytic therapy has revolutionized the treatment of empyema in North America. Despite evidence of its efficacy, barriers exist to its use, which include both cost and intensive administration schedule. The purpose of our study was to determine if a decreased dose of intrapleural tissue plasminogen activator (TPA) with deoxyribonuclease (Dnase) is equally effective in the treatment of empyema. We performed a retrospective chart review of patients treated with intrapleural fibrinolytic therapy in 2 hospitals affiliated with the University of Toronto between Jan. 1, 2011, and Dec. 1, 2016. Subjects were assigned into 2 groups. Group A consisted of patients who were given 4 mg of TPA with 5 mg of Dnase and group B served as the control group receiving 10 mg of TPA with 5 mg of Dnase. Patients were excluded if fibrinolytics were given without evidence of empyema or if doses were different than defined by the 2 groups. The rate of decortication after intrapleural fibrinolytic therapy was 12% (n = 18/150) for group A and 7.41% (n = 2/27) for group B, which was not statistically significant (p = 0.49). Objective radiologic evaluation showed 33.84% (n = 44/130) have improvement over 50% on chest x-ray in group A compared with 24% (n = 6/25) in group B. There was no significant difference between groups on 30-day mortality (5.33% group A v. 11.11% group B) or 30-day morbidity (13.33% group A v. 3.7% group B). Mean number of doses did not differ between groups (p = 0.43). There is no statistical difference in the efficiency and complications between the 2 doses of TPA studied. It is both safe and effective to use a reduced dose of intrapleural TPA for the treatment of empyema. The reduction in dose along with the daily dosing schedule has the potential to reduce both the cost and burden of using intrapleural fibrinolytics.

11

Lung surface tracking during VATS can help characterize lung tissue stiffness variations. ***N. Chopra* (Canadian Surgical Technologies & Advanced Robotics, London, Ont), *C. Nicholson-Smith* (Canadian Surgical Technologies & Advanced Robotics, London, Ont.), *R. Malthaner* (Canadian Surgical Technologies & Advanced Robotics and Western University, London, Ont.) *R. Patel* (Canadian Surgical Technologies & Advanced Robotics and Western University, London, Ont.).**

The sense of touch provides critical feedback for surgeons during open surgical procedures to localize tumours. The detection of occult lung tumours before resection is challenging during video-assisted thoracoscopic surgery (VATS). The aim of this research was to determine a characterizing parameter that could enhance the likelihood of tumour detection during VATS where feedback from manual palpation is not available. The composition and physical properties of a tumour are different from those of healthy tissue. Therefore, we hypothesize that when the surface of the lung stretches, the strain developed on the tumour is less than that on healthy tissue. This was numerically validated, at varying pressures, by simulating a finite element model of a lung having varying stiffnesses. At a pressure of 1.6 KPa, where the tumour material was 3.6 times stiffer than healthy tissue, the strain developed on the healthy tissue surface was observed to be 31.8 times that developed on the tumour. The lung surface has prominent markers. In particular, a smoker's lung contains scavenger cells filled with the impurities absorbed from smoking. For in vivo validation, a vision-based framework was developed to track distinctive biological markers on the surface of the deflated lung. The tracking enabled us to quantify the motion and estimate strain at different locations on the lung surface that correspond to areas having varying stiffnesses. The framework was tested on 3 real VATS videos and the tests demonstrated that contactless measurement of strain can detect lung tissue stiffness variations. The ultimate goal of this research is to develop an automated tumour localization mechanism using the proposed strain-based indicators to detect occult tumours during VATS procedures.

12

Symptom control and quality of life over time following laparoscopic Heller myotomy and Dor fundoplication for achalasia. ***M. Doubova*, *H. Robaidi*, *C. Anstee*, *E. Delic*,**

***A. Fazekas, S. Gilbert, D. Maziak, F. Shamji, S. Sundaresan, P. Villeneuve, A. Seely*. From the University of Ottawa, Ottawa, Ont.**

Achalasia is a primary esophageal motility disorder characterized by incomplete relaxation of the lower esophageal sphincter and aperistalsis of the esophageal body. Laparoscopic Heller myotomy with Dor fundoplication is the preferred surgical procedure for management of achalasia. The short-term outcomes of this intervention are well documented, but the stability and durability of postoperative symptom control over time are less understood. Between 2004 and 2016, 55 patients with achalasia underwent laparoscopic Heller myotomy and Dor fundoplication. Using validated questionnaires, patients rated their symptoms in 5 domains: pain, gastroesophageal reflux, dysphagia, regurgitation and quality of life, rating their symptoms preoperatively, 4 weeks postoperatively, 6 months postoperatively and yearly following the operation. Responses were graded and the sum was used as a score for all 5 domains. Patients reported significant improvement in their symptom score of dysphagia, pain, gastroesophageal reflux and regurgitation immediately postoperatively ($p < 0.001$). This improvement was maintained up to 7 and 11 years postoperatively, respectively, for pain ($p < 0.001$, $p = 0.05$), dysphagia ($p < 0.001$, $p = 0.02$) and regurgitation ($p = 0.003$, $p = 0.05$). Symptoms of gastroesophageal reflux remained decreased up to 3 and 5 years following the operation ($p = 0.001$, $p = 0.04$, respectively). Compared with their preoperative score, patients reported some return of reflux symptoms 6–7 years (score 6.2 v. 4.1, $p = 0.057$) and 8–11 years after the operation (score 5.3 v. 3.7, $p = 0.4$). Patients reported an improved quality of life postoperatively (score 0.5 v. 3.7, $p < 0.001$) and this was maintained consistently up to 11 years after the operation ($p = 0.001$). Following the initial procedure, no patient required reoperation, 3 patients required further endoscopic dilatation and 3 patients required endoscopic investigation without additional management due to recurrence of symptoms. Patients undergoing a Heller myotomy with Dor fundoplication for the management of achalasia have consistent reduction in symptoms of pain, dysphagia and regurgitation and improvement in quality of life up to 11 years after the procedure.

13

The addition of mobile app technology to a postdischarge home care program following major lung resection reduces the rate of emergency department visits. ***J. Taylor* (McMaster University, Hamilton, Ont.), *W. Hanna* (McMaster University, Hamilton, Ont.), *K. Hughes* (McMaster University, Hamilton, Ont.), *P. Pinkney* (McMaster University, Hamilton, Ont.), *Y. Lopez-Hernandez* (McMaster University, Hamilton, Ont.), *M. Coret* (McMaster University, Hamilton, Ont.), *L. Schneider* (McMaster University, Hamilton, Ont.), *J. Agzarian* (McMaster University, Hamilton, Ont.), *C. Finley* (McMaster University, Hamilton, Ont.), *A. Tran* (St. Joseph's Healthcare Hamilton, Hamilton, Ont.), *Y. Shargall* (McMaster University, Hamilton, Ont.).**

Postdischarge readmissions and emergency department (ED) visits following thoracic surgery are a major health care problem. Web-based mobile applications were found to reduce follow-up clinic visits after breast surgery, but their role remains unexplored in thoracic surgery. We hypothesized that the addition of a novel thoracic surgery-specific postdischarge patient mobile app to an existing home-care program will reduce ED visits and readmissions when compared with the home-care program alone. A retrospective cohort study of patients who underwent major lung resection between November 2016 and October 2017 compared a control group of home-care alone (No App) and an intervention group of home-care + patient-input app (App). Data were collected on demographics, perioperative factors, and postdischarge variables. Continuous variables were compared using Student *t* tests. We used χ^2 and Wilcoxon rank sum tests for categorical and nonparametric variables, respectively. Multivariate logistic regression was used to determine independent predictors for ED visits. There were no differences in baseline demographics and comorbidities (Table 17) between the No App ($n = 247$) and App ($n = 99$) cohorts. Patients in the App cohort had a higher incidence of lobar resections (78.8% v. 63.2%, $p = 0.005$), and thoracotomy (36.4% v. 24.3%, $p = 0.023$). Yet, while 30-day readmission rates were similar between the App and No App cohorts (6.1% v. 6.1%, $p = 0.997$), patients using the mobile app were less likely to visit the ED than the control group (15.15% v. 27.94%, $p = 0.012$). Multivariate logistic regression identified that App usage was the only independent predictor for ED visits reduction (OR = 0.47, $p = 0.018$). The addition of a mobile app to a postdischarge home care program significantly reduced the frequency of ED visits after thoracic surgery, in spite of higher proportions of thoracotomies and anatomic resections in the App cohort. A longitudinal comparative study is needed to determine the full effect of this emerging technology on health care outcomes and cost reduction.

14

Contemporary trends in level of evidence in general thoracic surgery clinical research. ***M. Mehta, K. Pearce, W. Hanna, L. Schneider, F. Farrokhyar, J. Agzarian, C. Finley, Y. Shargall*. From McMaster University, Hamilton, Ont.**

Clinical research relies on high-level evidence. We wanted to evaluate the contemporary level of evidence (LOE) for general thoracic surgery (GTS) clinical research. Clinical research GTS articles in the *Journal of Thoracic and Cardiovascular Surgery*, *European Journal of Cardio-Thoracic Surgery* and *Annals of Thoracic Surgery* between 2014 and 2017 were reviewed. Two authors independently assigned LOE scores of 1 to 5 to articles according to the Oxford Centre for Evidence-based Medicine Classification, with level 1 (systematic review of randomized controlled trials [RCTs]) and level 2 (RCTs) representing the highest levels. Reviewers underwent training with a methodologist and 2 senior thoracic surgeons, including 2 rounds of audits to assure competency. Krippendorff's α was used to estimate between reviewer reliability for judging the LOE. We used the χ^2 test to compare the level of evidence between the journals and by the year of publication. Multiple linear regression was used to describe interaction of year and journal on LOE. In total, 1384 articles were reviewed (Table 18). The level of agreement between reviewers was excellent, at 0.972 (95% CI 0.950–0.988) for LOE and 0.961 (95% CI 0.874–1.00) for type of study. A total of 86.5% were retrospective in nature; 78.4% of studies had a low LOE (levels 4/5).

Overall distribution was 7.5% (n = 90) level 1, 11.4% (n = 136) level 2, 0.8% (n = 9) level 3, 58.3% (n = 697) level 4 and 22.1% (n = 264) level 5 (Fig. 8). Over the years reviewed, the LOE of published literature significantly varied (p < 0.001) but did not improve. There was no difference in the distribution of retrospective versus prospective studies across journals (p = 0.718) and across years (p = 0.137). Anonymized journals A and B performed better than Journal C (p < 0.001). The thoracic surgical literature consisted mostly of low-level studies and did not improve over time. Future efforts should be focused on higher level clinical research studies.

15

Tools for individualized survival prediction in esophageal and gastresophageal junction cancer. *V. Gupta* (University of Toronto, Toronto, Ont.), *N. Coburn* (University of Toronto, Toronto, Ont.), *B. Kidane* (University of Manitoba, Winnipeg, Man.), *K. Hess* (The University of Texas MD Anderson Cancer Center, Houston, Tex.), *C. Compton* (Arizona State University, Tempe, Ariz.), *J. Ringash* (University of Toronto, Toronto, Ont.), *G. Darling* (University of Toronto, Toronto, Ont.), *A. Mahar* (University of Manitoba, Winnipeg, Man.).

Clinical, pathological and molecular information combined with cancer stage in prognostication algorithms can offer more personalized estimates of survival, which may guide treatment choices. Our aim was to evaluate the quality of prognostication tools in esophageal cancer. We systematically searched Medline and Embase from 2005to 2017 for studies reporting development or validation of models predicting long-term survival in esophageal cancer. We evaluated tools using the Critical Appraisal and Data Extraction for Systematic Reviews of Prediction Modelling Studies guidelines and the American Joint Committee on Cancer acceptance criteria for risk models. We identified 16 prognostication tools for patients treated with curative intent and 1 for patients with metastatic disease. These tools frequently excluded adenocarcinoma, contained outdated data and were developed with a limited sample size. Nine tools were developed in China for squamous cell cancer, and 11 used data on patients diagnosed before 2010. The majority of tools excluded key prognostic factors such as age and sex. Tumour stage and grade were the most commonly, but not universally, included factors. Twelve tools were designed to predict overall survival; 5 predicted cancer-specific survival. Bootstrap internal validation was performed for most tools; c-statistics ranged from 0.63 to 0.77 and graphically evaluated calibration was "good." Five tools were externally validated; c-statistics ranged from 0.70 to 0.77. Existing tools cannot be confidently used for esophageal cancer prognostication in

Table 17. Difference in demographics and results between the 2 study cohorts

Variable	No App n = 247	App n = 99	p value
Demographics			
Age (mean ± SD)	65.17 ± 14.3	66.71 ± 9.6	0.34
Male (%)	50	41.57	0.177
Minimally invasive (%)	75.71	63.64	0.023
Sublobar resection (%)	36.8	21.2	0.005
Smoker (%)	69.23	71.72	0.648
Diabetes mellitus (%)	14.98	12.12	0.491
Cardiovascular disease (%)	14.17	10.10	0.309
Chronic kidney disease (%)	0.44	1.12	0.491
Chronic obstructive pulmonary disease (%)	23.35	20.22	0.550
Length of stay (median [range])	2 (1–21)	2 (1–15)	0.057
Results			
Emergency department visit within 30 days (%)	27.94	15.15	0.012
1 visit (% of above)	74.29	93.33	
2 visits (% of above)	22.86	6.67	
3 visits (% of above)	1.43	0	
Readmission within 30 days (%)	6.07	6.06	0.997
Generalized Anxiety Depression Scale Score = 0 (%)	79.78	79.49	0.955

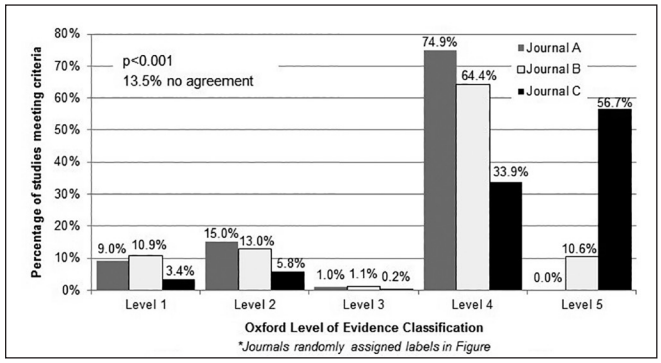


Fig. 8. Distribution of thoracic surgical literature levels of evidence.

Table 18. Distribution of thoracic surgical literature according to the Oxford Centre for Evidence-based Medicine Classification of Levels of Evidence (level 1 highest), 2014–2017

		Journal A	Journal B	Journal C	Total
Level of evidence classification	Level 1	9% (45/499)	10.9% (31/284)	3.4% (14/413)	90
	Level 2	15% (75/499)	13% (37/284)	5.8% (24/413)	136
	Level 3	1% (5/499)	1.1% (3/284)	0.2% (1/413)	9
	Level 4	74.9% (374/499)	64.4% (183/284)	33.9% (140/413)	697
	Level 5	0% (0/499)	10.6% (30/284)	56.7% (234/413)	264
	Undetermined	98/597 (16.4%)	58/342 (17.0%)	32/445 (7.2%)	188 (13.5%)
	Total	597	342	445	1384

current clinical practice. Better quality tools may help to more individually and accurately estimate disease course, select further treatments and risk stratify for future clinical trials.

16

Survival for esophageal cancer during regionalization in Ontario. *V. Gupta* (University of Toronto, Toronto, Ont.), *B. Kidane* (University of Manitoba, Winnipeg, Man.), *J. Ringash* (University of Toronto, Toronto, Ont.), *R. Sutradhar* (University of Toronto, Toronto, Ont.), *G. Darling* (University of Toronto, Toronto, Ont.), *N. Coburn* (University of Toronto, Toronto, Ont.).

Esophageal cancer is highly fatal. Regionalized surgery may improve survival. The purpose of this study is to define and assess the effect of thoracic surgery regionalization on perioperative and long-term survival for esophageal cancer in Ontario. A population-based retrospective cohort study was performed using linked health administrative data in Ontario. Adults diagnosed with esophageal cancer between 2002 and 2014 were included. The Kaplan–Meier method was used to estimate median survival. Rates of perioperative mortality (in-hospital and 90-day postdischarge death) were calculated before and after regionalization. Multivariable logistic and Cox regression were used to identify factors associated with survival. For 13 930 patients included in the study, median survival was 10.1 months from diagnosis (95% CI 9.9–10.5). Age, socioeconomic status and region of residence were significantly associated with long-term survival. Approximately 30% of the cohort (n = 3880) underwent resection and had a median survival of 24.5 months from surgery (95% CI 23.4–25.9). In these patients, age, socioeconomic status, major surgical complications and year of diagnosis were significantly associated with long-term survival (p < 0.001). Thoracic surgery was regionalized to 15 centres by 2010. Perioperative mortality decreased from 13.8% in 2002 to 5.4% in 2014 (p < 0.001). Surgery at a thoracic centre reduced the odds of perioperative mortality (OR 0.63, 95% CI 0.49–0.81), but did not influence long-term survival (p = 0.79). Median survival is 2 years following esophageal cancer resection. Regionalized surgery helped decrease perioperative mortality but did not affect long-term survival in Ontario.

17

Intense surveillance with low-dose computed tomography after resection of early-stage non-small cell lung cancer: Are we doing too many scans? *P. Thomas, J. Vernon, Y. Shargall, C. Schieman, C. Finley, J. Agzarian, W. Hanna.* From McMaster University, Hamilton, Ont.

Computed tomography (CT) of the chest has become the accepted modality for surveillance after resection of early-stage non-small cell lung cancer (NSCLC). Most guidelines advocate intense surveillance with CTs at 3- or 6-month intervals. We hypothesized that only 1 scan every 12 months would be sufficient for adequate surveillance. In this prospective cohort trial, we evaluate the utility of intense surveillance by measuring the associated reintervention rates and quality of life outcomes. Adults after complete resection of stage I–II NSCLC were eligible to enrol. Patients underwent surveillance with clinical visits and low-dose CT (LDCT) at 3, 6 and 12 months postoperatively. The EQ-5D-5L health-related quality of life instrument was administered at each encounter. Descriptive statistics were generated. Of 311 patients recruited, 38 (12.2%) were not able to adhere to the surveillance schedule and opted out of the trial. The median age for the cohort was 70 years (range 39 years), and 52.38% were female. The adherence rates for the scans were 86.4% at 3 months, 84.3% at 6 months and 82.8% at 12 months. The reintervention rates with either curative intent radiotherapy or surgery were 4.4%, 2.56% and 2.93%, at 3, 6 and 12 months, respectively. All reinterventions within the first year were targeted to treat previously reported nodules, synchronous or metachronous lung cancers. A third of survivors (32.58%) reported moderate to extreme pain and discomfort, 17.8% reported symptoms of anxiety and depression and 17.8% qualified their overall health status as "low." The low rate of reintervention within the first year after surgery, added to the high proportion of survivors reporting impaired quality of life, calls into question the adequacy of intense surveillance regimens. Further research should focus on less intense surveillance regimens that are geared toward patient-centred outcomes.

18

Anatomic resections improve survival following lung metastasectomy of colorectal cancer harboring KRAS mutations. *J. Spicer* (McGill University Health Centre, Montreal, Que.), *S. Renaud* (McGill University Health Centre, Montreal, Que.), *J. Seitlinger* (Strasbourg University Hospital, Strasbourg, France), *Y. Al Lawati* (McGill University Health Centre, Montreal, Que.), *F. Guerrera* (Turin University Hospital, Turin, Italy), *P. Falcoz* (Strasbourg University Hospital, Strasbourg, France), *G. Massard* (Strasbourg University Hospital, Strasbourg, France), *L. Ferri* (McGill University Health Centre, Montreal, Que.).

Our objective was to evaluate the benefit of anatomic resection (AR) in lung metastasectomy (LM) of colorectal cancer (CRC) harboring KRAS mutations KRAS mutations are related to high aggressiveness in lung metastasis of CRC. It is unknown if AR can lead to better outcomes than can non-anatomic resection (NAR) in KRAS patients. We retrospectively reviewed the data from 574 consecutive patients who underwent a LM for CRC. We focused on patients exhibiting 1 lung metastasis who underwent an AR (segmentectomy) or a NAR (wedge) and for whom the KRAS mutational status was known. Overall survival (OS) and time to pulmonary recurrence (TTPR) were analyzed. We included 168 patients, of whom 95 (56.5%) harboured KRAS mutations. An AR was performed in 74 patients (44%). The type of resection did not impact the median OS in wild-type (WT) patients (p = 0.67) but was significantly better following AR in KRAS patients (101 v. 45 mo, p = 0.02) according to the multivariate analysis (HR 6.524 (95% CI 2.312–18.405), p < 0.0001). TTPR was not affected by the type of resection in WT patients (p = 0.32) but was significantly better for AR in KRAS patients (50 v. 15 mo, p = 0.01) in the multivariate analysis (HR 5.273 (95% CI 1.731–16.064), p = 0.003). The resection-margin recurrence rate was significantly higher for NAR in KRAS patients (4.8% v. 54.2%, p = 0.001) but not in WT patients (p = 0.97). AR seems to improve both the OS and TTPR in LM of CRC harbouring KRAS mutations.

19

The Canada Lymph Node Sonographic Score: national validation of a sonographic score to determine the probability of malignancy in mediastinal lymph nodes at the time of endoscopic ultrasound assessment. ***D. Hylton*** **(McMaster University, Hamilton, Ont.),** ***J. Huang*** **(McMaster University, Hamilton, Ont.),** ***S. Turner*** **(University of Alberta, Edmonton, Alta.),** ***D. French*** **(Dalhousie University, Halifax, NS),** ***C. Wen*** **(McMaster University, Hamilton, Ont.),** ***J. Masters*** **(Laurentian University, Sudbury, Ont.),** ***B. Kidane*** **(University of Manitoba, Winnipeg, Man.),** ***J. Spicer*** **(McGill University, Montreal, Que.),** ***J. Taylor*** **(McMaster University, Hamilton, Ont.),** ***C. Finley*** **(McMaster University, Hamilton, Ont.),** ***Y. Shargall*** **(McMaster University, Hamilton, Ont.),** ***C. Fahim*** **(Johns Hopkins University, Baltimore, Md.),** ***F. Farrokhyar*** **(McMaster University, Hamilton, Ont.),** ***K. Yasufuku*** **(University of Toronto, Toronto, Ont.),** ***J. Agzarian*** **(McMaster University, Hamilton, Ont.),** ***W. Hanna*** **(McMaster University, Hamilton, Ont.).**

At the time of endobronchial ultrasound (EBUS) staging for non-small cell lung cancer (NSCLC), 6 ultrasonic criteria (Fig. 9) are used to assign a Lymph Node Sonographic Score (LNSS) that is predictive of malignancy. The LNSS has not gained widespread use due to lack of research demonstrating its validity and reliability among endoscopists. We hypothesized that LNSS correlates well with the probability of malignancy, potentially guiding decisions for lymph node (LN) biopsy. We conducted a prospective study to assess the validity and reliability of the LNSS. The validation cohort comprised LN that were videorecorded from patients with NSCLC and assigned a LNSS by an experienced endoscopist. Videos were then circulated to thoracic surgeons and interventional respirologists across Canada, who were asked to assign a score to each LN. All raters had demonstrated proficiency using our online education module and were blinded to staging information and to each other. Each LN was scored by at least 3 independent raters. Pathological specimens were used as the gold standard for determination of malignancy. Regression, receiver operator curve (ROC) and Gwet's AC1 analyses were used to test LNSS score performance, discriminatory capacity and inter-rater reliability. A total of 300 LNs (18% malignant) from 140 patients were analyzed by 11 endoscopists across 7 Canadian centres. LNSS = 0 was strongly predictive of benign LN (NPV = 95.69%, OR = 49.2, $p = 0.001$). LNSS ≤ 2.5 (OR = 44, $p = 0.001$) was determined as the cutoff for malignancy based on ROC analysis (c = 0.7757, 95% CI 0.70281–0.84853). Inter-rater reliability for LNSS = 0 was 0.8553 (95% CI 0.8158–0.8947, $p = 0.0001$) and 0.46 for LNSS ≤ 2.5 (95% CI 0.3521–0.5012, $p = 0.0001$). The Canada LNSS shows excellent performance in identifying benign LN at the time of EBUS. A cutoff ≤ 2.5 has the potential to inform decision-making regarding biopsy or repeat biopsy/mediastinoscopy if the initial results are inconclusive. Further teaching and education are required to improve inter-rater reliability.

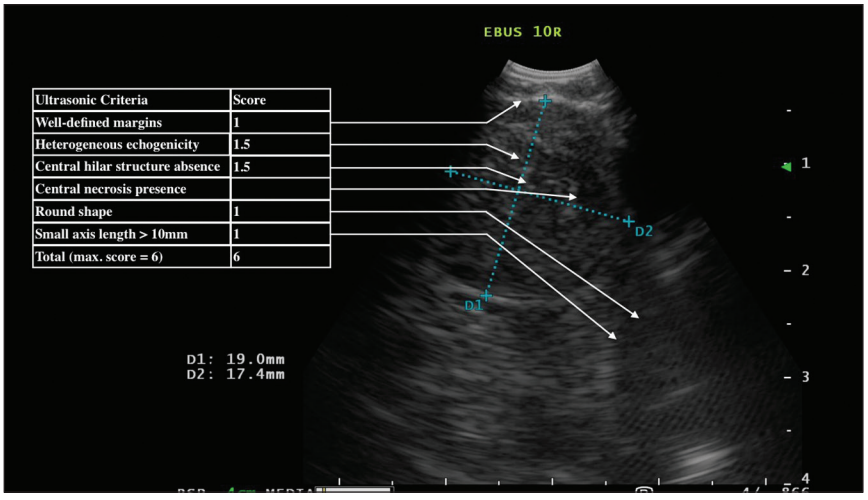


Fig. 9. Ultrasonic criteria included in the lymph node sonographic score.

20

Prognostic value of neutrophil to lymphocyte ratio in lung metastasectomy of colorectal cancer. ***J. Spicer*** **(McGill University Health Centre, Montreal, Que.),** ***S. Renaud*** **(McGill University Health Centre, Montreal, Que.),** ***J. Seitlinger*** **(Strasbourg University Hospital, Strasbourg, France),** ***D. St-Pierre*** **(McGill University Health Centre, Montreal, Que.),** ***R. Garfinkle*** **(McGill University Health Centre, Montreal, Que.),** ***Y. Al Lawati*** **(McGill University Health Centre, Montreal, Que.),** ***F. Guerrera*** **(Turin University Hospital, Turin, Italy),** ***E. Ruffini*** **(McGill University Health Centre, Montreal, Que.),** ***P. Falcoz*** **(Strasbourg University Hospital, Strasbourg, France),** ***G. Massard*** **(Strasbourg University Hospital, Strasbourg, France),** ***L. Ferri*** **(McGill University Health Centre, Montreal, Que.).**

The neutrophil to lymphocyte ratio (NLR) has been shown to be a promising biomarker in several cancers. Prognostic biomarkers are still needed to define good candidates for lung metastasectomy (LM) of colorectal cancer (CRC). We aimed to evaluate the role of NLR. Data from 574 patients who underwent LM for CRC in 3 departments of thoracic surgery from 2004 to 2014 were retrospectively reviewed. Overall survival (OS) and time to pulmonary recurrence (TTPR) were the main end points. Correlations between NLR and OS ($R^2 = 0.53$), NLR and TTPR ($R^2 = 0.389$) were significant ($p < 0.0001$ for both), with corresponding Pearson R of –0.728 ($p < 0.0001$) and –0.624 ($p < 0.0001$), respectively. ROC curve analysis highlighted a NLR cutoff value of 4.05 as the best predictor of OS and TTPR. NLR ≤ 4.05 was observed in 238 patients (41.4%). In univariate analysis, median OS was 117 months for patients with NLR ≤ 4.05 and decreased to 40 months for patients with NLR > 4.05 ($p < 0.0001$). Median TTPR reached 52 months in cases of NLR ≤ 4.05 and decreased to 12 months in patients with NLR > 4.05. In multivariate analysis, NLR ≤ 4.05 remained an independent favourable prognostic factor on both OS (HR 0.29 [95% CI 0.167–0.503], $p < 0.0001$) and TTPR (HR 0.346 [95% CI 0.221–0.54], $p < 0.0001$). Significant correlations between NLR > 4.05 and KRAS (Cramer's V = 0.241, $p < 0.0001$) and BRAF (Cramer's V = 0.153, $p = 0.003$) mutations were observed. NLR is a simple and

powerful predictor of outcome for patients undergoing pulmonary metastasectomy for colorectal cancer.

21

Where to start: comparing induction chemoradiotherapy and upfront surgery in the treatment of clinical T2N0 esophageal cancer. ***J. Agzarian*** **(McMaster University, Hamilton, Ont.),** ***M. Inra*** **(Mayo Clinic, Rochester, Minn.),** ***Z. Abdelsattar*** **(Mayo Clinic, Rochester, Minn.),** ***M. Allen*** **(Mayo Clinic, Rochester, Minn.),** ***S. Cassivi*** **(Mayo Clinic, Rochester, Minn.),** ***F. Nichols III*** **(Mayo Clinic, Rochester, Minn.),** ***D. Wigle*** **(Mayo Clinic, Rochester, Minn.),** ***S. Blackmon*** **(Mayo Clinic, Rochester, Minn.),** ***K. Shen*** **(Mayo Clinic, Rochester, Minn.).**

The purpose of this study was to evaluate the survival difference in clinical T2N0 esophageal cancer patients receiving neoadjuvant chemoradiotherapy (CRT) versus upfront surgery. Between Jan. 1, 1995, and Dec. 31, 2012, a prospectively maintained database was used to identify patients with cT2N0 esophageal cancer. Exclusion criteria included lack of endoscopic esophageal ultrasonographic (EUS) staging and incomplete resection. Cox proportional hazard ratios were used to compare the primary outcomes of overall (OS) and disease-free survival (DFS). Secondary outcomes included rates of postoperative complications, rate of pathologic upstaging/response and induction/adjuvant treatment completion rate. Pre hoc subgroup analysis compared pathologically upstaged patients receiving upfront surgery followed by adjuvant chemotherapy with those treated with neoadjuvant CRT. A total of 161 cT2N0 esophageal cancer patients were identified. Upfront surgery was offered to 134 patients (83%), with 27 patients (17%) receiving induction CRT. Univariate analysis did not demonstrate any significant baseline differences between groups. In the upfront surgery group, 53 (39.6%), 28 (20.9%) and 53 (39.6%) patients were pathologically down-staged, accurately staged and upstaged, respectively. Upstaging was higher in the upfront surgery group (53/134, 39.6% v. 4/27, 14.8%; p = 0.02), while 11/27 (40.7%) patients receiving neoadjuvant CRT demonstrated complete pathologic response. Of those eligible for adjuvant chemotherapy, only 21/55 (38.2%) received treatment. In the neoadjuvant CRT group, 51.9% completed all planned therapy, compared with 23.6% of patients treated with upfront surgery followed by chemotherapy (p = 0.01). Cox proportional hazard ratio did not demonstrate an advantage to induction CRT in terms of OS (HR = 1.64, p = 0.43) or DFS (HR = 1.36, p = 0.69). In general, patients with pathologic upstaging had worse OS (HR = 2.73, p = 0.001) and DFS (HR = 4.18, p = 0.003). EUS was only accurate in staging T2N0 patients in 20.9% of cases. While neoadjuvant CRT did not confer a survival advantage, it was associated with lower rates of pathologic upstaging and higher rates of treatment completion.

22

Pilot study of implementation of an enhanced recovery pathway following minimally invasive esophagectomy in a Canadian thoracic academic centre. ***S. Gowing, H. Robaidi, C. Anstee, A. Seely*****. From the University of Ottawa, Ottawa, Ont.**

Open and minimally invasive esophagectomy (MIE) remain the cornerstone of curative-intent management of esophageal and esophagogastric junction malignancies. Despite being integral to enhanced recovery after surgery (ERAS) programs, the safety of early PO intake and rapid nasogastric tube (NG) removal following MIE is limited. In a pilot study, we sought to estimate the safety and impact of this approach. Thirty-three consecutive single-surgeon MIE patients in 2 cohorts were compared: 17 who received traditional postoperative care and subsequently 16 who followed the ERAS early PO intake pathway. For the traditional group laparoscopic feeding jejunostomy was performed at surgery with tube feeds initiated postoperative day 1 (POD1). NG tube removal and routine contrast swallow were performed POD6 followed by a progressive oral diet. For ERAS early PO intake patients, feeding jejunostomy was not performed, sips of water commenced on POD 0–2, NG tube was removed on POD3, clear fluids were instituted on POD3–4 and full fluids were instituted on POD5–10. Blue dye tests were performed POD2 and POD4 (no routine postoperative contrast swallows were performed). LOS and postoperative adverse events (AEs) were compared (median [interquartile range]). Overall LOS (d) was significantly reduced following implementation of pathway in all patients (traditional 13.5 [11–27]) v. ERAS 8.0 [7–15], $p < 0.05$) and in patients experiencing no AEs (traditional 9 [8.5–10] v. ERAS 7 [6–8], p = NS). The proportion of patients who experienced no AEs was comparable (traditional 41.2% v. ERAS 43.8%, p = NS). Incidence of TM&M AEs grade 3 or higher was 41.2% (traditional) versus 31.3% (ERAS), p = NS). There were no postoperative mortalities within 90 days of surgery. Albeit in a pilot study limited by longitudinal design, implementation of early institution of PO intake and removal of NG tube on POD3 without feeding jejunostomy following MIE incorporating resulted in a significantly reduced LOS without an increase in postoperative AEs.

23

Withdrawn

24

Follow-up report of chest wall reconstruction with sternal allograft in 2 cases. ***F. Sadegh Beigee, K. Sheikhy, A. Abbasi Dezfouli*****. From the Shahid Beheshti University of Medical Sciences, Masih Daneshvari Hospital, Lung Transplantation Research Centre, Tehran, Iran.**

Radical resection of the sternum is indicated in different situations such as primary or secondary malignant tumours. In most cases surgical resection of sternal lesions is not problematic but reconstruction of this part of the chest wall is challenging for most thoracic and reconstructive surgeons. In this group of patients, reconstruction of the chest wall is very important for prevention of flail chest and ventilation impairment. Cosmetic issues must also be considered. At the 2017 Canadian Surgery Forum we reported 2 cases of chest wall reconstruction with sternal allograft and here is the second report in follow-up. The first case was a 20-year-old woman with sternal aneurysmal bone cyst and the second one was a 5-year-old girl with sternal hemangioma. In both cases complete resection of the sternum was required, and after resection, reconstruction was done by sternal allograft prepared from cadaveric donors. At the present time the follow-up for the first case is 34 months and for the second case 15 months. There is no flail chest, displacement and infection in the follow-up. Cosmetic result was achieved and

especially in the second case the cosmetic result was very satisfying. Sternal and rib allografts are good choices for chest wall reconstruction. Their superiority to current materials is that they have natural properties close to native bone, the chance of neovascularization and no fear of infection and rejection.

25

The VTE PRO: an initial analysis of a pilot feasibility, double-blind, randomized controlled trial comparing extended, postdischarge VTE prophylaxis with placebo in patients undergoing major oncological lung resections. ***Y. Shargall*** **(McMaster University, Hamilton, Ont.),** ***Y. Lopez-Hernandez*** **(McMaster University, Hamilton, Ont.),** ***T. Schnurr*** **(McMaster University, Hamilton, Ont.),** ***L. Schneider*** **(McMaster University, Hamilton, Ont.),** ***L. Linkins*** **(McMaster University, Hamilton, Ont.),** ***M. Crowther*** **(McMaster University, Hamilton, Ont.),** ***J. Agzarian*** **(McMaster University, Hamilton, Ont.),** ***W. Hanna*** **(McMaster University, Hamilton, Ont.),** ***C. Finley*** **(McMaster University, Hamilton, Ont.),** ***T. Waddell*** **(University of Toronto, Toronto, Ont.),** ***M. de Perrot*** **(University of Toronto, Toronto, Ont.),** ***S. Uddin*** **(University of Toronto),** ***J. Douketis*** **(McMaster University, Hamilton, Ont.)**

Venous thromboembolism (VTE), including pulmonary embolus (PE) and deep vein thrombosis (DVT), is a significant cause for postoperative morbidity and mortality. Guidelines for perioperative and extended VTE prophylaxis after orthopedic and general oncology surgeries are based on high-level evidence, but neither evidence nor guidelines exist for thoracic surgery (TS). This pilot randomized controlled trial (RCT) evaluated the feasibility of a large-scale RCT investigating the impact of extended, postdischarge prophylaxis for patients undergoing major oncological lung resections. Patients undergoing lung resections in 3 tertiary centres were randomized to receive postdischarge low molecular weight heparin or placebo injections once daily for 30 days. All patients received in-hospital guideline-based chemical prophylaxis and underwent lower extremities ultrasound doppler (US) perioperatively to exclude predischarge DVT. Block randomization was done with stratification on type (open v. minimally invasive surgery/robotic) and extent (lobar v. sublobar) of resections. At 30 days postoperatively, all patients underwent a chest CT with PE protocol and US. Feasibility outcomes included recruitment, retention and attrition rates, adherence to protocol and adverse event rates. There were no differences in type/extent of resection, demographics and comorbidities (Table 19). After screening, 262 eligible patients were approached, with 157 (59.9%) consenting and 126 randomized to intervention. One hundred patients (79.4%) are currently completing the study (Fig. 10). The main reasons for dropout before randomization (n = 22) included patient discomfort with study activities (n = 7) and administrative challenges such as scheduling and pharmacy issues (n = 6). Post-randomization withdrawals (n = 26) were due to patient wishes (n = 9), surgeon judgment (n = 6) and 3 minor adverse events. There was no mortality. Six (6%) asymptomatic VTE events (4 PE and 2 DVT) were detected. This study is the first to demonstrate the feasibility and safety of extended VTE prophylaxis in TS. It will serve as the foundation for a large-scale, multicentre trial to evaluate the benefit of extended prophylaxis.

Table 19. On-study patient demographics

Characteristic	Group 1, n (%) n = 46	Group 2, n (%) n = 48	p value
Age (mean, SD)	65.67 (11.16)	66.58 (7.43)	0.642
Gender			
Male	17 (41%)	29 (55%)	0.291
Female	29 (59%)	24 (45%)	
Chronic obstructive pulmonary disease			
Yes	7 (16%)	13 (30%)	0.203
No	37 (84%)	31 (70%)	
Ischemic heart disease			
Yes	2 (5%)	2 (5%)	> 0.99
No	42 (95%)	42 (95%)	
Chronic kidney disease			
Yes	2 (5%)	2 (5%)	> 0.99
No	42 (95%)	42 (50%)	
Type of resection			
MIS	27 (59%)	29 (60%)	> 0.99
Open	19 (41%)	19 (40%)	
Degree of resection			
Lobar	31 (67%)	36 (75%)	0.496
Sublobar	15 (33%)	12 (35%)	

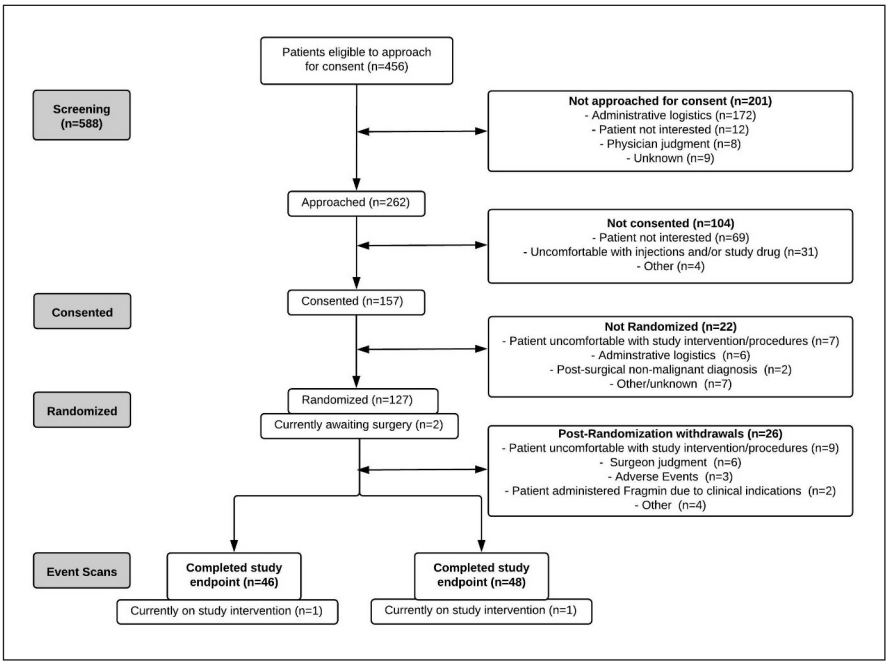


Fig. 10. CONSORT flow chart of participants and reasons for dropout/withdrawal, June 2016 – March 2018.

26

Patient trajectory in the evaluation and treatment of high-grade dysplasia and T1 esophageal cancer with endoscopic mucosal resection versus esophagectomy. ***J. Taylor, C. Finley, Y. Shargall, J. Agzarian, W. Hanna*. From McMaster University, Hamilton, Ont.**

Endoscopic mucosal resection (EMR) has emerged as the new first-line treatment for eradication of high-grade dysplasia (HGD) and T1a carcinoma of the esophagus. One barrier to the uptake of EMR by surgeons is the need for repeated procedures and access to endoscopy time. We hypothesized that despite the staged approach to therapy, patient trajectory in the health care system will be more straightforward for patients receiving EMR than those receiving esophagectomy. To that end, we conducted a retrospective review of our patients who underwent EMR for HGD and T1a carcinoma, compared with those who underwent esophagectomy. Our primary outcome was patient trajectory, as represented by the number of clinical visits throughout the 3 phases of care: preoperative, operative and postoperative. All patients who underwent EMR between August 2016 and February 2018 (n = 15) and esophagectomy between January 2011 and December 2017 (n = 32) for HGD or T1a cancer were included in this review. In the EMR cohort 66.67% (8/15) patients had HGD, 33.3% (4/15) had T0 and 20% (3/15) had T1a cancer. Complete eradication was achieved in 14/15 patients with HGD/T1a, and 1 patient proceeded to esophagectomy. The median (range) number of visits for the EMR cohort was significantly lower than that of patients in the esophagectomy cohort in the preoperative phase (5 [2–6] v. 8 [4–11], p = 0.04) throughout the operative phase (2 [1–4] v. 23 [8–91], p < 0.01) and in the postoperative phase (2 [1–4] v. 13 [2–26], p < 0.01). Despite the need for repeated treatments, the trajectory for patients in the EMR cohort was significantly shorter in all 3 phases of care than that of the esophagectomy cohort. In addition to offering lower morbidity and mortality rates than esophagectomy, EMR shortens hospital trajectory for patients with HGD/T1a carcinoma of the esophagus.

Canadian Society of Surgical Oncology (CSSO)

01

Withdrawn

02

Natural killer cell IFNγ secretion is profoundly suppressed following colorectal cancer surgery. ***A. Martel* (University of Ottawa and Ottawa Hospital Research Institute, Centre for Innovative Cancer Research, Ottawa, Ont.), *L. Angka* (Ottawa Hospital Research Institute, Centre for Innovative Cancer Research, Ottawa, Ont.), *A. Jeong* (Ottawa Hospital Research Institute, Centre for Innovative Cancer Research, Ottawa, Ont.), *M. Sadiq* (Ottawa Hospital Research Institute, Centre for Innovative Cancer Research, Ottawa, Ont.), *M. Kilgour* (BC Cancer Agency Vancouver Island Centre, Deely Research Centre, Ottawa, Ont.), *C. Tanese de Souza* (Ottawa Hospital Research Institute, Centre for Innovative Cancer Research, Ottawa, Ont.), *L. Baker* (University of Ottawa, Ottawa, Ont.), *M. Kennedy* (Ottawa Hospital Research Institute, Ottawa, Ont.), *R. Auer* (The Ottawa Hospital, University of Ottawa, Ottawa, Ont.).**

Surgical stress results in significant reduction in natural killer (NK) cell cytotoxicity (NKC), which has been linked to postoperative cancer metastases. However, few studies have measured the impact of surgical stress upon NK cell IFNγ secretion (NKA), a cytokine with essential roles in controlling infection and metastases. The objective of this study was to investigate the impact of surgical stress on NKA in colorectal cancer (CRC) surgery patients. The effects of surgery on NKA have not been previously reported. A total of 22 healthy participants and 38 CRC surgery patients were enrolled in an observational study (May 2016 to June 2017) (Fig. 11). Peripheral blood was collected from CRC surgery patients (n = 42) preoperatively and on postoperative days (POD) 1, 3, 5, 28 and 56. Healthy donor blood (n = 27) was collected for controls. We assessed NKA by production of IFNγ following whole blood cytokine stimulation, NKC by ^{51}Cr-release assay, and immune cell profiling by flow cytometry. The mean reduction in NKA on POD1 as compared with baseline was 83.1% (SD 25.2%, CI 75–91) and therefore the study met the primary end point of demonstrating

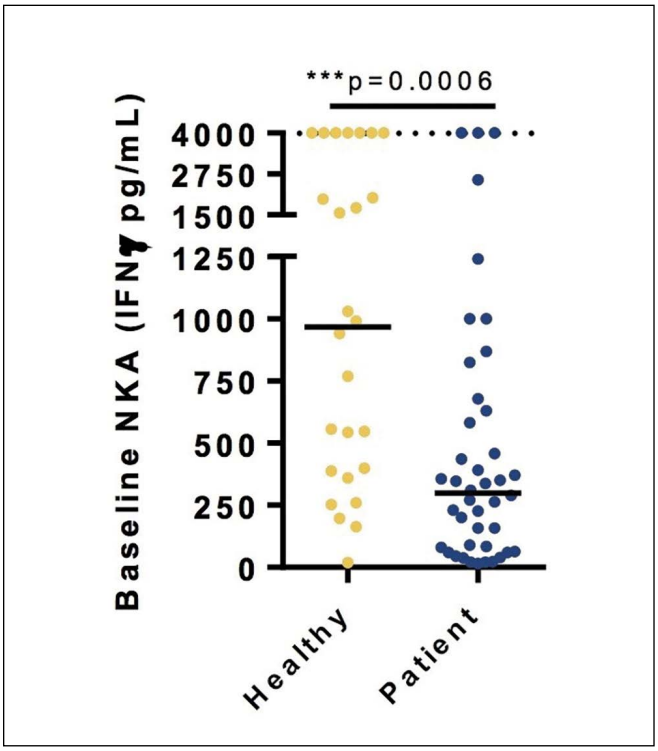


Fig. 11. NK cell IFNγ secretion (NKA) is reduced in patients with colorectal cancer (CRC). NKA from healthy donors (n = 27) and CRC patients (n = 42) before surgery (baseline) was assessed following a 24-h stimulation with Promoca cytokine cocktail. Upper limit of detection for the NK Vue assay is 4000 pg/mL. Median indicated by solid line. Mann–Whitney U test.

a > 75% decrease in a cohort of CRC surgery patients (p < 0.0001). The profound and universal suppression of NKA persisted with 65.5% (19/29) and 33.3% (4/12) of patients with levels measuring < 75% of baseline on POD28 and POD56, respectively. The NKC was significantly reduced on POD1 but the degree was less pronounced (24.6%, p = 0.0024). Immune cell profiling did not reveal differences in the absolute number of NK cells (CD3-CD56+) or the ratio of CD56dim-to-CD56bright subsets. NKA is significantly suppressed for up to 2 months following surgery in CRC patients, a degree of surgery-induced immunosuppression far worse than previously reported. NKA is a more sensitive measure of postoperative NK cell dysfunction than NKC.

03

Is R1 hepatectomy still relevant in the contemporary management of colorectal liver metastases? Long-term outcomes from a multi-institutional bi-national analysis. ***J. Hallet*** **(Sunnybrook Health Sciences Centre, Toronto, Ont.),** ***R. Adam*** **(Hôpital Paul-Brousse, Villejuif, France),** ***P. Karanicolas*** **(Sunnybrook Health Sciences Centre, Toronto, Ont.),** ***R. Memeo*** **(Nouvel Hôpital Civil, Strasbourg, France),** ***D. Goéré*** **(Institut Gustave Roussy, Villejuif, France),** ***T. Piardi*** **(Centre Hospitalier Universitaire de Reims, Reims, France),** ***E. Lermite*** **(Centre Hospitalier Universitaire d'Angers, Angers, France),** ***O. Turrini*** **(Institute Paoli-Calmettes, Marseille, France),** ***M. Lemke*** **(Sunnybrook Research Institute, Toronto, Ont.),** ***J. Li*** **(University of Calgary, Calgary, Alta.),** ***E. Dixon*** **(University of Calgary, Calgary, Alta.),** ***M. Tun-Abraham*** **(Western University, London, Ont.),** ***R. Hernandez-Alejandro*** **(Western University, London, Ont.),** ***S. Bennett*** **(University of Ottawa, Ottawa, Ont.),** ***G. Martel*** **(The Ottawa Hospital, Ottawa, Ont.),** ***F. Navarro*** **(Centre Hospitalier Universitaire de Montpellier, Montpellier, France),** ***A. Sa Cunha*** **(Hôpital Paul-Brousse, Villejuif, France),** ***P. Pessaux*** **(Institut Hospitalo-Universitaire de Strasbourg, Strasbourg, France).**

Benefits of narrow margins below 1 mm for resection of colorectal cancer liver metastases (CRLMs) have been suggested in historical cohorts but remain controversial. We compared the outcomes of R1 (margin < 1 mm) to R0 (margin > 1 mm) hepatectomy with contemporary multimodal management of CRLMs. We performed a multi-institutional analysis of hepatectomy for CRLMs in France and Canada (2006–2013). Primary outcome of interest was overall survival (OS). Multivariable regression analyses assessed the association between R1 and OS, and factors associated with R1. Of 2439 hepatectomies, 985 (40.4%) had R1 resections. Five-year OS was lower for R1 with 57.0% (95% CI 54.4–59.6) compared with 70.4% (95% CI 68.6–72.2) for R0 (p < 0.0001). After adjusting for country, age, locally advanced primary, node positive primary, synchronous CRLM, more than 3 metastases, largest metastasis over 5 cm, extrahepatic disease, prehepatectomy chemotherapy, major liver resection, operative time and perioperative transfusion, R1 was independently associated with increased risk of mortality (HR 1.47, 95% CI 1.16–1.86). Factors independently associated with R1 included node positive primary (RR 1.26, 95% CI 1.03–1.55), more than 3 metastases (RR 2.08, 95% CI 1.65–2.63), largest metastasis over 5 cm (RR 1.74, 95% CI 1.35–2.24) and receipt of prehepatectomy chemotherapy (RR 1.27, 95% CI 1.03–1.58). In a contemporary multi-institutional cohort of resected CRLMs, R1 was independently associated with poorer long-term outcomes than R0 resection. Factors associated with R1 can help identify higher risk patients preoperatively. R1 yielded OS superior to known results of systemic therapy. While the need for narrower margins should not preclude hepatectomy, clinical discussion and counselling should be informed by these data.

04

Integrating patient-reported outcomes (PROs) in neuroendocrine tumours (NETs) care: an assessment of cognitive and psychological screening tools during follow-up. ***J. Hallet*****,** ***E. Isenberg-Grzeda*****,** ***J. Kazdan*****,** ***K. Beyfuss*****,** ***S. Myrehaug*****,** ***S. Singh*****,** ***D. Chan*****,** ***C. Law*****, Sunnybrook Health Sciences Centre, Toronto, Ont.**

An association between neuroendocrine tumours (NETs) and neuropsychological symptoms has been suggested, but objective data are limited. We aimed to assess the burden of neuropsychological symptoms in NETs using validated patient-reported outcomes (PROs). We conducted a prospective cohort study of adult patients with WHO grade 1 and 2 bronchopulmonary (BP) and gastro-entero-pancreatic (GEP) NETs followed at a high-volume specialized multidisciplinary clinic. The Beck Depression Inventory (BDI-II), Functional Assessment of Cancer Therapy Cognitive domain (FACT-Cog) and EORTC-GEPNET 21 were administered to patients. Patients were also asked about their preference for psychosocial support. Of 80 patients, 27.5% had BP and 65.2% GEP primary NETs. Metastases were present in 65% and 30% were hormonally active (elevated 24-h urinary 5-HIAA). No patients had an established cognitive or psychiatric diagnosis. Median time from NETs diagnosis to PROs measure was 82 (IQR 64.5–125) months. Using the BDI-II, 16.3% of patients presented mood disturbances, 17.5% signs at or above the level of clinical borderline depression, and 8.8% moderate to severe depression. FACT-Cog assessment revealed moderate perceived cognitive impairment (median 61, IQR 50–68, possible range 0 to 72) and considerable reduction in perceived cognitive ability (median 5, IQR 2–10, possible score 0 to 28). On the EORTC-GEPNET 21, social functioning was the most impacted domain (median 16.7, IQRL 8.3–33.3). Gastrointestinal, endocrine and treatment-related symptoms were mildly impacted. Patient preference (very likely/likely to use) for psychosocial support was as follows: social work 23.8%, psychology services 32.6%, psychiatry services 36.2% and patient support group 36.3%. Using validated PROs, 1 out of 5 patients presented signs of clinical depression and perceived cognitive ability was impaired during the maintenance phase of care. While symptoms appeared to be controlled, social functioning was impacted. These results provide insight into the need to routinely screen patients with NETs during follow-up to offer support and improve patient-centred longitudinal care.

05

The treatment and outcome of merkel cell carcinoma in the last 15 years: a multi-institutional study. **C.** ***Nessim*** **(University of Ottawa, Ottawa, Ont.),** ***G. Paull*** **(University of Ottawa, Ottawa, Ont.),** ***A. Ibrahim*** **(Ottawa Hospital Research Institute, Ottawa, Ont.),** ***E. Sabri*** **(Ottawa Hospital Research Institute, Ottawa, Ont.),** ***S. Rodriguez-Qizilbash*** **(University of Sherbrooke, Sherbrooke, Que.),** ***D. Berger-Richardson***

(University of Toronto, Toronto, Ont.), *R. Younan* (University of Montreal, Montreal, Que.), *J. Hétu* (University of Sherbrooke, Sherbrooke, Que.), *F. Wright* (University of Toronto, Toronto, Ont.), *S. Johnson-Obaseki* (University of Ottawa, Ottawa, Ont.).

Limited studies have reported on treatment outcomes in Merkel cell carcinoma (MCC). In this study, we describe treatment and survival outcomes of MCC in Canada. A multicentre retrospective review of early-stage MCC at four Canadian institutions was conducted. Patient demographics, primary tumour characteristics, treatment and survival data were collected between June 1, 2000, and June 30, 2015. Recurrence-free (RFS) and overall survival (OS) were calculated using the Kaplan–Meier method. Statistical comparisons (log-rank test and Cox regression) were conducted. We idenified 171 patients (36.4% stage I, 12.4% stage IIA, 17.3% stage IIB, 12.4% stage IIIA, 21.6% stage IIIB). The majority of patients were male (64.3%), with a mean age of 73 years and 12.1% having prior immunosuppression. The most common primary site of disease was head and neck (50.3%) followed by upper extremity (17.5%), lower extremity (17.0%), trunk (10.5%) and unknown primary (4.7%). Of all stages, 36.8% of patients were treated with surgery alone, 48.5% with surgery + neo- or adjuvant treatment and 14.7% with radiation alone. The median follow-up time was 2.22 years (IQR 0.97–4.17) for the whole cohort (3.01 years for patients still alive [IQR 1.28–4.74]) whereby 35.1% of patients recurred: 11.7% local, 25.7% regional, 19.9% distant. All-stage 5-year RFS and OS were 59.2% and 61.4%, respectively. RFS correlated with stage (p = 0.013) but not treatment (p = NS). Five-year OS for stages I, II and III was 72.3%, 57.3% and 52.9%, respectively. Patients treated with surgery + neo- or adjuvant treatment had better outcomes than patients treated with radiation (HR 0.34, 95% CI 0.15–0.75, p = 0.008) or surgery (HR 0.50, 95% CI 0.25–0.99; p = 0.046) alone. MCC is a rare and aggressive cutaneous malignancy with a rising incidence. While surgery remains the primary treatment, new adjuvant therapies are required to improve outcomes in higher risk patients.

06

Withdrawn

07

Patient-reported factors influencing the treatment decision-making process of elderly women with breast cancer: a systematic review of qualitative evidence. ***F. Angarita*** **(University of Toronto, Toronto, Ont.),** ***M. Elmi*** **(University of Toronto, Toronto, Ont.),** ***Y. Zhang*** **(University of Ottawa, Ottawa, Ont.),** ***N. Look Hong*** **(University of Toronto, Toronto, Ont.).**

Elderly women with breast cancer undergo different treatments than young women. Studies have examined items that influence this disparity, but synthesized patient-reported data are lacking in the literature. This study aimed to synthesize the data of patient-reported factors contributing to the treatment decision-making process of elderly women with breast cancer. A systematic review was performed in accordance with PRISMA principles. Medline, Embase, and PsycINFO were searched for qualitative studies describing patient-reported factors influencing the decision-making process of elderly women (≥ 70 yr old) with invasive breast cancer. Quality was assessed using the Standards for Reporting Qualitative Research (SRQR) criteria. Common ideas were coded, thematically organized and synthesized within a theoretical framework. Of 5998 studies identified, 10 met eligibility criteria. The median SRQR total score was 13.04 (IQR 12.84–13.81). The studies represented a range of cancer treatments; however, most focused on surgery and primary endocrine therapy. Our data show that the most common patient-reported factors in the decision-making process included treatment characteristics, personal goals/beliefs, patient characteristics, physician's recommendation and personal/family experience. These factors led the patient to either accept or decline treatment and were not consistent across all studies included. Studies used different interview guides, which may have affected these results. This systematic review highlights the complexity of factors that influence an elderly women's treatment decision-making process. Acknowledging and addressing these factors may improve discussions about treatment choices between elderly women and their health providers and encourage maximization of a patient-centred approach to comprehensive breast cancer care.

08

Impairments in bowel function, social function and quality of life after cytoreductive surgery and HIPEC. ***A. Govindarajan*****, *E. Taylor*****, *Z. Bayat*****, *D. Bischof*****, *A. McCart*****. From the University of Toronto, Toronto, Ont.**

Quality of life (QOL) after cytoreductive surgery (CRS) and heated intraperitoneal chemotherapy (HIPEC) improves with time and approaches population normals. However, little is known about bowel function and related QOL, as these are not sensitively measured by commonly used generic QOL measures. This study aimed to assess the impact of bowel resection during CRS/HIPEC on overall and bowel-related QOL. We conducted a prospective cohort study including patients undergoing CRS + HIPEC from 2011 to 2017. Patients were grouped based on type of bowel resection (low anterior resection [LAR] + stoma, LAR, other bowel resection, no bowel resection). All patients were administered validated questionnaires (EORTC QLQ-C30 and CR29) at 3, 6 and 12 months after CRS/HIPEC. Differences across groups and time were evaluated. A total of 158 patients were included. Bowel resections were performed in 77% of patients with 31% undergoing an LAR. There was no significant difference between groups for patient and tumour factors or perioperative complications. Global QOL scores improved over time but were not significantly different between groups. Function scores were significantly impaired for social function (72.9–82.6), sexual interest (20.4–45.5), anxiety (43.6–70.4) and body image (58.6–84.1). LAR patients had significantly worse bowel symptom (stool frequency, fecal incontinence, sore skin) and embarrassment scores, with ostomy use being associated with worse embarrassment scores. Many of the impaired function and symptom domains showed no improvement with time. Although overall QOL after CRS/HIPEC is good, significant impairments in bowel-related symptoms and function were noted that persisted over time. The use of LAR and ostomies was associated with worse QOL.

09

Surgical morbidity of full-thickness chest wall resection for breast cancer: a coarsened exact matching study. ***M. Elmi*****, *E. Wakeam*****, *A. Azin*****, *R. Presutti*****, *S. Keshavjee*****, *D. McCready*****, *T. Cil*****. From the University of Toronto, Toronto, Ont.**

Chest wall resection is an infrequently used modality for potentially curative or palliative treatment of primary or recurrent breast cancer invading the chest wall. We examined the postoperative morbidity in patients undergoing full-thickness chest wall resection (FTCWR) surgery using a large multinational surgical outcomes database. A cohort analysis was conducted using the American College of Surgeons' National Surgical Quality Improvement Program (ACS NSQIP) database, 2007–2016. Patients undergoing FTCWR for breast cancer were examined. Outcomes of interest included 30-day postoperative morbidity, respiratory complications and hospital length of stay (LOS). Our secondary aim was to compare, via the coarsened exact matching (CEM) technique, the postoperative morbidity of FTCWR with that of patients undergoing mastectomy only. Two groups were created, and data were preprocessed by CEM, balancing for the following variables: age, sex, BMI, diabetes, smoking, dyspnea, ventilator, chronic obstructive pulmonary disease, ascites, congestive heart failure, hypertension, renal failure, dialysis, disseminated cancer, wound infection, steroid use, weight loss, bleeding disorder, preoperative transfusion, ASA class and concurrent breast reconstruction. A total of 137 patients with a mean age of 60.3 ± 14.2 years were included. The overall postoperative morbidity was 11.7%. Respiratory morbidity was low; 2 patients (1.5%) required either an unplanned reintubation or prolonged intubation. Median hospital LOS was 2 ± 3.1 days. In the CEM analysis, 122 women were included in each of the 2 balanced groups. After matching for the aforementioned variables, the overall morbidity for the FTCWR group (11.5%) was slightly higher than for the mastectomy group (8.2%), but this did not reach statistical significance ($p = 0.52$). FTCWR for the local treatment of breast cancer can be performed with relatively low morbidity and respiratory complications. This is the largest series looking at postoperative complications for FTCWR in the treatment of locally advanced breast cancer. Future studies are needed to determine the long-term oncological results of FTCWR in this unique population of patients.

10

The surgical treatment of male breast cancer: an analysis of the National Surgical Quality Improvement Program (NSQIP) database. ***M. Elmi, S. Sequeira, A. Azin, A. Elnahas, D. McCready, T. Cil.*** **From the University of Toronto, Toronto, Ont.**

Male breast cancer (MBC) is a rare malignancy, and gender-specific treatment outcomes are lacking. We examined the treatment patterns and postoperative complication rates in male patients undergoing oncological breast surgery using a large multinational surgical outcomes database. A cohort analysis was conducted using the American College of Surgeons' National Surgical Quality Improvement Program database (NSQIP), 2007–2016. Clinical characteristics, demographics and surgical treatment plan for all men undergoing breast surgery for invasive or in situ carcinoma of the breast were examined. Thirty-day postoperative complication rates were assessed. Major morbidity was defined as having 1 or more of the following postoperative 30-day complications: wound infection, pneumonia, pulmonary embolus, reintubation or prolonged mechanical ventilation, renal failure, sepsis, myocardial infarction, cardiac arrest, and cerebral vascular accident. A total of 1763 patients were included. Mean age at the time of surgery was 65 years old (IQR 56–74 yr old). Mean body mass index was 29.1 (IQR 25.4–33.8). A total of 177 (10.0%) had a diagnosis of in situ breast cancer, while the remaining 1596 (90.0%) had invasive disease. While most underwent mastectomy, 282 (15.9%) had breast-conserving surgery. Seventy-four (4.2%) underwent immediate breast reconstruction. A total of 118 (6.7%) patients elected to have a contralateral prophylactic mastectomy. Overall, the rate of morbidity was 4.6%; 3.2% had wound complications. Analysis of this large prospective multi-institutional cohort showed that the complication rates are low and comparable to what has been described in the literature for the female breast cancer population. In some cases, men are undergoing breast-conserving surgery for the treatment of their breast cancer or immediate breast reconstruction, highlighting the importance of cosmetic considerations in this population. Contralateral prophylactic mastectomy in the treatment of MBC is on the rise. This study adds to the literature regarding surgical treatment for this uncommon malignancy in men.

11

Treatment patterns, recurrence and breast cancer-specific mortality in a cohort of elderly patients with breast cancer: a population-based study. ***S. Samman, S. Cornacchi, G. Foster, L. Thabane, S. Thomson, O. Lovrics, S. Martin, P. Lovrics.*** **From McMaster University, Hamilton, Ont.**

Studies suggest that elderly women with breast cancer (BC) may be undertreated, may be underrepresented in trials and may experience worse outcomes. The purpose of this study was to compare management, disease recurrence and mortality between elderly and younger BC patients. Consecutive BC surgical cases from 12 hospitals in our region diagnosed with invasive or in situ BC from January 2006 to June 2007 were included. Data collected included demographics, tumour factors, comorbidities, surgery type, adjuvant treatment received, BC recurrence and mortality. Multivariable Cox proportional hazards regression analyses assessed the relationship between predictor variables and 2 primary outcomes: 10-year recurrence (local recurrence or regional recurrence or distant metastases) and 10-year BC-specific mortality. Our sample comprised 774 women, $n = 515$ in the elderly group (> 75 yr) and $n = 259$ in the younger group (60–75 yr) with median follow-up of 6.9 years and 9.9 years, respectively. Comparing age groups (χ^2), tumour grade ($p = 0.45$), disease stage ($p = 0.08$) and ER positivity ($p = 0.14$) were similar for both groups although elderly women had larger mean tumour size (cm) ($p < 0.01$), more node-positive cases ($p = 0.02$) and more comorbidities ($p < 0.01$). Elderly patients had mastectomies more often (46% v. 30%), less nodal surgery (57% v. 90%) and fewer received adjuvant therapies (all $p < 0.05$). The elderly group experienced more recurrences (24% v. 12%, $p < 0.001$) and more BC-specific deaths than the younger group (15% v. 7%, $p < 0.01$). In multivariable analyses, older age (> 75 yr) ($p < 0.01$), higher tumour grade ($p < 0.05$), higher disease stage ($p < 0.01$) and not receiving breast irradiation ($p < 0.05$) were all significant predictors of recurrence and BC-specific mortality. In conclusion, we found that elderly women with BC received less treatment than younger women. Age greater than 75 years was an independent predictor of increased recurrence and BC-specific mortality. These findings merit further study to ensure that elderly women with BC receive optimal care.

12

Does fragmentation of care impact long-term cancer outcomes? A 10-year population-based analysis of adjuvant therapy decentralization for pancreatic adenocarcinoma.

N. Latchana **(University of Toronto, Toronto, Ont.),** ***L. Davis*** **(Sunnybrook Research Institute, Toronto, Ont.),** ***N. Coburn*** **(Odette Cancer Centre, Sunnybrook Health Sciences Centre, University of Toronto, Toronto, Ont.),** ***A. Mahar*** **(University of Manitoba, Winnipeg, Man.),** ***Y. Liu*** **(Institute of Clinical Evaluative Sciences, Toronto, Ont.),** ***A. Hammad*** **(Sunnybrook Research Institute, Toronto, Ont.),** ***D. Kagedan*** **(University of Toronto, Toronto, Ont.),** ***C. Earle*** **(Odette Cancer Centre, Sunnybrook Health Sciences Centre, University of Toronto, Toronto, Ont.),** ***J. Hallet*** **(Odette Cancer Centre, Sunnybrook Health Sciences Centre, University of Toronto, Toronto, Ont.).**

With regionalization of cancer surgery, treatments are often fragmented across different institutions. Patients and providers have voiced concerns regarding potential associated outcomes disparities. We examined the impact of adjuvant chemotherapy (AC) decentralization (receipt at a different institution than where surgery is performed) on survival for pancreatic adenocarcinoma (PA). We conducted a provincial population-based study of patients receiving AC after PA resection performed at 10 designated hepato-pancreato-biliary centres over 2004–2014. Groups were based on whether AC was administered at the same (SI) or different institution than surgery (DI). Primary outcome was overall survival (OS) examined using Kaplan–Meier methods and log-rank test. Multivariable Cox regression assessed the association between OS and AC group while accounting for potential confounders. Among 589 patients, no difference was observed in baseline characteristics between groups. Median time from surgery to AC did not differ, with 70 days (IQR 58–85) for SI and 69 days (IQR 57–84) for DI (p = 0.51). Patients received the same median number of AC cycles. Median OS was 21.3 months (IQR 12.8–37.5) for SI compared with 23.5 months (IQR 11.5–40.4) for DI (p = 0.66). Actuarial 5-year OS of 16.8% (95% CI 13.2–20.9%) for SI and 19.3% (95% CI 14.2–25.1) for DI did not differ (log-rank p = 0.44) (Fig. 12). When adjusting for age group, sex, comorbidity burden, socioeconomic status, rural living, stage, positive margin and year of surgery, the AC institution was not associated with OS (hazard ratio [HR] 1.04, 95% CI 0.86-1.26) (Fig. 13). For patients undergoing AC at DI, mean travel distance was longer to access the surgery institution (106.7 km v. 30.9 km, p < 0.001). Receiving AC at a different institution than surgery did not impact OS for PA. Partnerships between specialized surgical centres and community institutions for delivery of AC are safe and effective. They contribute to patient-centred care by reducing travel to access care.

13

Qualitative experiences of elderly women with breast cancer care: a systematic review.

Y. Zhang **(University of Ottawa, Ottawa, Ont.),** ***M. Elmi*** **(University of Toronto, Toronto, Ont.),** ***F. Angarita*** **(University of Toronto, Toronto, Ont.),** ***N. Look Hong*** **(University of Toronto, Toronto, Ont.).**

Various studies have demonstrated suboptimal treatment in older breast cancer patients. Our objective was to explore, summarize and understand the overall treatment experience of elderly women with breast cancer. A systematic review of qualitative studies was performed using Medline, Embase, PsycINFO and CINAHL databases between Jan. 1, 2005, and Jan. 1, 2016. Inclusion criteria were female patients, age ≥ 65 years, non-BRCA mutation carriers and first presentation of breast cancer. Two independent reviewers assessed manuscripts for quality using the Standards for Reporting Qualitative Research score. Thematic analysis was performed to synthesize findings. The search produced 5477 titles; 4808 abstracts were reviewed after removing duplicates, and 852 articles were reviewed in full. Fifteen studies were included for final analysis. Study design included purely qualitative data (14 studies) and survey data with a qualitative component (1 study). Study quality scores ranged from 11.3 to 14.5 (maximum score 21). The overarching theme was that elderly women experienced breast cancer as a journey with challenges for each stage (diagnosis, pretreatment, treatment, survivorship). Elderly women tended to delay seeking medical care for diagnosis. During pretreatment, they preferred

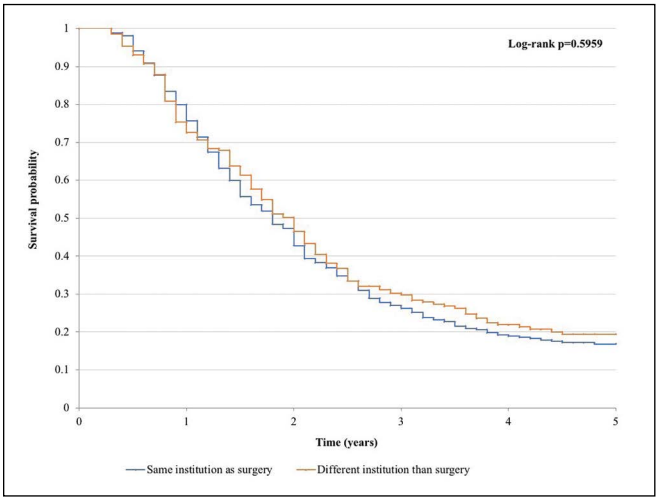


Fig. 12. Overall survival following pancreatectomy for adenocarcinoma, stratified by location of receipt of adjuvant chemotherapy.

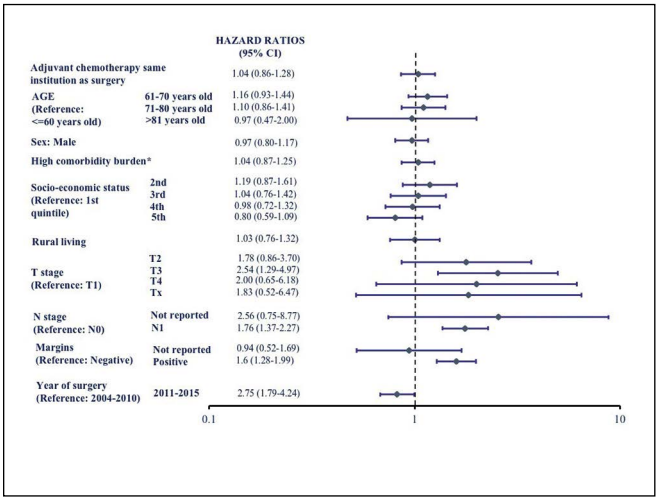


Fig. 13. Factors associated with overall survival following pancreatectomy and adjuvant chemotherapy for pancreas adenocarcinoma.

clear direction from health care professionals (HCPs) for decision-making and information addressing their individual needs. During treatment, elderly women experienced more barriers to care and depended on their social network for access to care. In survivorship, many experienced adverse effects from treatment but were able to conceptually use "moving on" and "compartmentalization" as coping mechanisms. Elderly women have unique challenges specific to each part of their breast cancer treatment journey. Older age, pre-existing comorbidities and social responsibilities influenced their experiences with the health care system. They may benefit from more proactive treatment discussions with HCPs that address their specific needs. As well, the implementation of outreach services may be useful in guiding older patients through each step of their cancer journey.

14

Squamous cell carcinoma with regional metastasis to axilla or groin lymph nodes: a multicentre analysis of outcomes. ***G. Pang*** **(Western University, London, Ont.),** ***N. Look Hong*** **(University of Toronto, Toronto, Ont.),** ***G. Paull*** **(University of Ottawa, Ottawa, Ont.),** ***S. Kupper*** **(University of Alberta, Edmonton, Alta.),** ***D. Kagedan*** **(University of Toronto, Toronto, Ont.),** ***C. Nessim*** **(University of Ottawa, Ottawa, Ont.),** ***M. Quan*** **(University of Alberta, Edmonton, Alta.),** ***F. Wright*** **(University of Toronto, Toronto, Ont.).**

Cutaneous squamous cell carcinoma (cSCC) is increasing in incidence worldwide. cSCC of the trunk and extremities with nodal metastasis is uncommon but presents a significant clinical challenge. Treatment patterns and outcomes are poorly described and limited to single-centre studies. This study aims to examine the clinical outcomes of this patient group across multiple Canadian cancer centres. Patients diagnosed with cSCC who developed axilla or groin lymph node metastasis and underwent curative-intent nodal surgery between 2004 and 2016 were identified at 3 Canadian academic cancer centres. Demographics, tumour characteristics, mortality, treatment patterns and recurrence rates were described. Overall survival (OS) and disease-free survival (DFS) were calculated using Kaplan–Meier analysis. Of 41 patients identified, 28 (68%) were male, and the median age was 74 years. Median follow-up was 38 months. Median primary lesion size was 30 mm and median time to nodal metastasis was 11.3 months. Twenty-nine patients had nodal metastasis to the axilla, of whom 6 (21%) underwent level I–II dissections and 23 (79%) underwent level I–III dissections. Twelve patients had groin metastasis, of whom 7 (58%) underwent superficial dissection and 5 (42%) underwent a combined superficial and deep dissection. Twenty-nine (71%) patients received adjuvant nodal radiotherapy; 3 (7%) received neoadjuvant nodal radiotherapy and 1 (2%) received adjuvant systemic chemotherapy. Following nodal surgery, 9 (22%) patients developed nodal and/or distant disease recurrence. Crude mortality rate was 37%. Mean OS was 5.6 years (95% CI 4.10–7.07) and DFS was 5.0 years (95% CI 3.54–6.48). Five-year OS was 58%, and five-year DFS was 52%. This study represents the largest series to date, and the first Canadian data, for outcomes of patients with nodal metastases from limb/truncal cSCC. Despite aggressive treatment, contemporary outcomes remain poor, pointing to a need for a continued multidisciplinary approach and integration of new systemic agents.

15

Retrospective analysis of size as an independent risk factor for recurrence of low-risk well-differentiated thyroid cancer. ***R. Hsiao*****,** ***P. Bongers*****,** ***M. Lustgarten*****,** ***D. Goldstein*****,** ***P. Dhar*****,** ***L. Rotstein*****,** ***J. Pasternak*****. From the University Health Network, Toronto, Ont.**

Current ATA guidelines suggest thyroid lobectomy for low-risk well-differentiated thyroid cancer (WDTC) up to 4 cm in size (T1/T2). Our objective was to determine whether patients with larger tumours greater than 4 cm (T3), without other high-risk features, may also be classified as low-risk and offered partial thyroidectomy. We conducted a retrospective review of all patients who received surgery for WDTC from 2005 to 2016 at a university referral centre. Patients were excluded if they had the following high-risk features: extrathyroidal tumour extension, positive resection margins, tumoural vascular invasion, and distal or lymph node metastases. We analyzed and compared the characteristics between the resultant low-risk T1/2 and T3 cohorts and their recurrence rates. A total of 430 T1/2 patients and 170 T3 patients met our criteria for low-risk WDTC with a mean follow-up of 65.8 months and 59.9 months, respectively (p = 0.075). Recurrence rates did not differ between the T1/2 and T3 patient groups (0.93% v. 1.18%; p = 0.678). For reasons related to historical practice patterns, the use of radioactive iodine was higher among those in the T3 group than in the T1/T2 group (88.8% v. 34.2%; $p < 0.0001$). To control for this confounder, a subgroup analysis of patients who did not receive adjuvant radioactive iodine was performed and did not show a significant difference between the recurrence rates of T1/2 and T3 patients (1.41% v. 0%, $p > 0.99$). In this study, all patients with disease recurrence had received total thyroidectomies and had recurrence in the form of lymph node metastases. Patients with recurrence from T1/2 WDTC were older (45.3 yr v. 35.5 yr; p = 0.089) and had more lymph nodes examined (3 v. 0; p = 0.014) than the T3 group. In recent years, treatment for WDTC has seen a trend towards de-escalation. Future size criteria for labelling low-risk disease should be evidence-based and may include larger tumours (T3) without high-risk features.

16

Utility of chest CT in gastric cancer staging. ***J. Nostedt*****,** ***L. Gibson-Brokop*****,** ***M. McCall*****,** ***D. Schiller*****. From the University of Alberta, Edmonton, Alta.**

Most international guidelines recommend chest computed tomography (CT) routinely for staging of gastric cancer. However, in Asian countries where the incidence of pulmonary metastases at the time of diagnosis is less than 1%, guidelines utilize chest CT selectively for gastroesophageal junction (GEJ) tumours. If Canadian rates are similar, routine chest CT may be of questionable benefit. A retrospective review of newly diagnosed gastric cancer patients from January 2010 to July 2016 in our zone was carried out. Neuroendocrine and gastrointestinal stromal tumours were excluded from analysis. CT reports were reviewed for pulmonary lesions as identified by the reporting radiologist. Other imaging data collected included liver metastases, abdominal lymphadenopathy (>1 cm), ascites and omental/peritoneal nodules. Other factors included age, gender, primary tumour location, histologic type and tumour grade. A total of 511

cases were reviewed; 52 had missing data, leaving 459 (310 male, 149 female) patients included for analysis. The average age was 68.9 years. There were 39 pulmonary lesions (8.5%). When GEJ tumours were excluded this decreased to 17 of 298 (5.7%). Liver metastases increased the risk of pulmonary lesions 5.32 times ($p < 0.001$, 95% CI 2.67–10.56). Pulmonary lesions were 2.55 times more likely in patients with abdominal lymphadenopathy ($p = 0.01$, 95% CI 1.26–5.16). In non-GEJ tumours with pulmonary lesions, advanced abdominal disease was present in 15/17 cases (88.2%). Despite the limitations of this retrospective study, only 2 of 459 patients (0.4%) would have undergone an operation with a possible missed pulmonary lesion if staging CT chest was used selectively for patients with GEJ tumours or advanced abdominal disease. This suggests staging with abdominal CT, chest x-ray and selective chest CT may be sufficient. A prospective database has been established to further evaluate these findings.

17

An interprovincial collaboration for large-scale surgical quality improvement using a synoptic reporting and feedback system. ***J. Park*** **(CancerCare Manitoba, Winnipeg, Man.),** ***I. Ratnayake*** **(CancerCare Manitoba, Winnipeg, Man.),** ***P. Hebbard*** **(CancerCare Manitoba, Winnipeg, Man.),** ***S. Mukhi*** **(Canadian Partnership Against Cancer, Toronto, Ont.),** ***L. Mack*** **(Alberta Health Services, Calgary, Alta.),** ***N. Singh*** **(Alberta Health Services, Calgary, Alta.),** ***M. Chanco*** **(Alberta Health Services, Calgary, Alta.),** ***A. Hilchie-Pye*** **(Nova Scotia Health Authority, Halifax, N.S.),** ***C. Kenyon*** **(Nova Scotia Health Authority, Halifax, N.S.),** ***A. Mathieson*** **(Eastern Health, Newfoundland and Labrador, St. John's, Nfld.),** ***J. Burke*** **(Eastern Health, Newfoundland and Labrador, St. John's, Nfld.),** ***R. Nason*** **(CancerCare Manitoba, Winnipeg, Man.)**

Practice variation in surgical oncology exists between surgeons across the country, but there are few systems in place to identify variations or provide feedback to individual practitioners to improve performance. Timely feedback is key to quality improvement. This study used surgeon-entered synoptic operative reporting data to identify interprovincial practice variation on quality indicators in near real time in 3 of the most common cancer surgery disease sites. We also assessed whether timely feedback reports could reduce variations in practice. We reviewed the electronic surgical synoptic reporting databases in 3 provinces from May 2016 to October 2016. The sample included 1330 breast, 450 colorectal and 362 thyroid cancer procedures performed by 89 individual surgeons. Anonymized audit and feedback reports comparing performance on quality indicators with colleagues within and between participating provinces were sent to individual surgeons on a quarterly basis. Fifty percent of preoperative and treatment-related quality indicators showed significant variation between provinces. Key indicators that showed variability included diagnostic imaging among breast and rectal cancer patients, neoadjuvant therapy among breast and rectal cancer patients, lymph node removal among breast cancer patients, immediate reconstruction following mastectomy among breast cancer patients, and radiographic lymph node assessment among thyroid cancer patients ($p < 0.05$ for all of the listed indicators). Performance of quality measures showed a definite trend toward decreasing variability between the first and last reporting periods (I-42% v. II-38% v. III-19%, $p = 0.167$). This interprovincial collaboration demonstrates how a surgical synoptic reporting and feedback system can identify and potentially affect large-scale practice changes by reducing variation to improve cancer surgery performance across provinces and in near real time. We are currently working on a quality improvement framework that combines 2 interventions (feedback reports and communities of practice) to further improve the delivery of cancer care services and cancer-related outcomes across the country.

18

Extent of groin dissection in melanoma: a mixed-methods, population-based study of practice patterns and outcomes. ***S. Kupper*** **(University of Calgary, Calgary, Alta.),** ***J. Austin*** **(University of Toronto, Toronto, Ont.),** ***M. Brar*** **(University of Toronto, Toronto, Ont.),** ***F. Wright*** **(University of Toronto, Toronto, Ont.),** ***M. Quan*** **(University of Calgary, Calgary, Alta.).**

In patients with melanoma metastatic to the groin, data are lacking on the extent of nodal dissection required. The purpose of this study is to (1) determine the indications for, and frequency of, deep pelvic dissections performed for melanoma and (2) to determine whether the addition of a deep dissection affects patient outcomes. A retrospective review of two prospectively maintained databases, in two provinces, was performed. A supplemental review of charts was carried out to capture variables not contained within the database. In addition, surgeons were interviewed to assess the provider-level approach to deep pelvic dissection. Variables collected included patient demographics, disease demographics and perioperative and oncologic outcomes. A total of 322 patients were included, of whom 208 (64.4%) received a superficial dissection and 114 (35.3%) received a combined dissection. The most common indications for deep dissection cited were palpable disease and radiologic disease. Recurrence was identified in 161 patients (50.2%) with a median time to recurrence of 9 months. At a median follow-up of 31 months, 166 (51.4%) were alive with no evidence of disease, 52 (16.1%) were alive with disease and 107 (33.1%) had died. There was no difference in adjusted overall survival (OS) between the superficial and combined dissection groups. Recurrence-free survival (RFS) was worse in the combined dissection group (HR 1.4 [1.01–1.99, $p = 0.04$]). Approximately a third of inguinal node dissections performed for melanoma include a deep dissection, which is utilized predominantly for clinically evident disease. The addition of a deep dissection is associated with a decreased RFS but no difference in OS. This probably reflects selection bias, with surgeons opting to perform more extensive surgery in patients with higher risk disease.

19

Withdrawn

20

Receptor subtype is associated with type of treatment and overall survival in very elderly (> 80 yr) breast cancer patients. ***S. Hurton, M. Quan, S. Kong, Y. Xu, M. Thibedeau, W. Cheung, J. Dort, S. Karim, T. Crump, A. Bouchard-Fortier.*** **From the University of Calgary, Calgary, Alta.**

The treatment and prognosis of breast cancer (BC) in women > 80 years is not clearly understood, with variable treatment methods and survival by receptor subtype. The primary objective was to describe the treatment and overall survival (OS) of BC patients > 80 years. A population-based cohort of women > 80 years with BC was studied between 2004 and 2015 in Alberta. Treatment characteristics and median were stratified by receptor subtype (luminal A/B [LA/B], human epidermal receptor 2 [HER2+], triple negative breast cancer [TNBC] subtypes). The mean population age (n = 2314) was 85.2 ± 4.3 years; 320 patients (13.8%) were > 90 years. The majority of the patients underwent surgical treatment (77.9%, Table 20). More patients with LA/B underwent breast-conserving surgey than in HER2+ and TNBC, of which 43.8%, 50.0%, and 41.5% received adjuvant radiation (p = 0.41). Palliative hormone treatment was more commonly used in LA/B (12.0%) and HER2+ (12.2%) than in TNBC (1.8%), and TNBC patients more often received no treatment than LA/B and HER2+ patients (19.7%, 10.1%, 10.2%; $p < 0.01$). BC-specific mortality in TNBC is greater than in the LA/B and HER2+ subgroups (34.9%, 15.5%, 26.5%; $p < 0.001$, Table 20). Median OS (months) was greater in LA/B (64.4, 95% CI 60.5–69.1) than in the HER2+ (40.4, 95% CI 26.9–64.8) and TNBC (30.6, 95% CI 25.2–37.8) subtypes. Despite competing mortality risks, a significant proportion of elderly patients die from BC. The majority of elderly BC patients do not receive adjuvant chemotherapy and radiation treatments. As expected, TNBC patients are less likely to receive treatment and more likely to die from BC. Further study on treatment selection is required for elderly BC patients.

21

Cancer surgery centre designation and outcomes for resected gastric cancer patients. *Y. Jeong* (University of Toronto, Toronto, Ont.), *A. Mahar* (University of Manitoba, Winnipeg, Man.), *Q. Li* (Institute for Clinical Evaluative Sciences, Toronto, Ont.), *L. Bubis* (University of Toronto, Toronto, Ont.), *V. Gupta* (University of Toronto, Toronto, Ont.), *N. Coburn* (University of Toronto, Toronto, Ont.).

Cancer surgery centre designation (CSCD) has been established to ensure quality and safety standards for cancers such as hepato-pancreato-biliary and thoracic cancers. Although gastrectomy is similarly complex with high associated morbidity and mortality, no such designation exists specific to gastric cancer (GC) surgical care. We compared mortality rates and long-term survival between patients who underwent surgery at centres with and without CSCD. We conducted a population-based retrospective study on patients diagnosed with GC between Jan. 1, 2002, and Dec. 31, 2014, who underwent gastrectomy. Patients with metastatic disease, non-adenocarcinomas, diagnosis at death or missing institution were excluded from analysis. Multivariable logistic regression with adjustment for demographic and clinical covariates analyzed the association between CSCD and 30-day as well as 90-day postoperative mortality. A Cox proportional hazards model was used to examine the association between CSCD and long-term survival while adjusting for covariates. A total of 3431 patients with GC were identified; gastrectomies were performed in 1694 (49.3%) patients at centres with CSCD and 1737 (50.6%) patients at centres without CSCD. Mortality rates were higher at non-CSCD centres than at CSCD centres (30-day: 5.5% v. 3.5 %; p = 0.007; 90-day: 8.3% v. 5.6%; p = 0.002). Gastrectomy at centres with CSCD was protective with 33% less odds of 30-day mortality (p = 0.03) and 29% less odds of 90-day mortality (p = 0.02) compared with gastrectomy conducted at centres without CSCD. A non-significant trend toward improved long-term survival was observed for patients undergoing gastrectomy at centres with CSCD compared with those without CSCD. GC patients who underwent gastrectomy at centres with CSCD compared with centres without CSCD had lower 30- and 90-day mortality rates, but similar long-term survival. Further investigation into outcomes following gastrectomy at centres with and without CSCD incorporating pathologic variables is necessary to confirm these results.

22

Is laparoscopy protective of adverse events in increasingly obese patients with rectal cancer? A multi-institutional comparative analysis of outcomes. *D. Hirpara* (University of Toronto, Toronto, Ont.), *C. O'Rourke* (Fred Hutchinson Cancer Research Center, Seattle, Wash.), *A. Azin* (University of Toronto, Toronto, Ont.), *F. Quereshy* (University Health Network, Toronto, Ont.), *S. Chadi* (University Health Network, Toronto, Ont.).

The objective of this study was to assess whether the effect of surgical modality (i.e., laparoscopy versus open) on short-term clinical outcomes changes as a function of body mass index (BMI) in patients undergoing surgical resection for rectal cancer. A retrospective cohort analysis was conducted using the multi-institutional ACS-NSQIP 2012–2016 database. All patients undergoing resectional surgery for malignant neoplasms of the rectosigmoid or rectum were identified using the appropriate International Classification of Diseases (ICD) and current procedural terminology (CPT) codes. Laparoscopic and open cohorts were compared with respect to all-cause and stratified

Table 20. Treatment characteristics and outcomes of women ≥ 80 years diagnosed with breast cancer, stratified by receptor subtype

Characteristic	Luminal A/B (n = 1987)	HER2+ (n = 98)	Triple negative (n = 229)	p value
Surgical treatment				
Breast-conserving surgery (BCS)	655 (33.0%)	22 (22.5%)	51 (22.3%)	0.003
BCS + radiation	287 (43.8%)	11 (50.0%)	21 (41.2%)	
Unilateral mastectomy	857 (43.1%)	54 (55.1%)	124 (54.2%)	
No surgery	440 (22.1%)	22 (22.5%)	49 (21.4%)	
Chemotherapy	12 (0.6%)	4 (4.1%)	16 (7.0%)	< 0.001
Palliative hormone therapy	239 (12.0%)	12 (12.2%)	4 (1.8%)	< 0.01
No treatment	201 (10.1%)	10 (10.2%)	45 (19.7%)	< 0.01
Mortality				
Overall	1071 (53.9%)	46 (46.9%)	161 (70.3%)	< 0.001
Breast cancer specific	308 (15.5%)	26 (26.5%)	80 (34.9%)	< 0.001

morbidity and mortality, as well as total length of stay (LOS), operative time, readmission and reoperation rates. Binary outcomes were modelled using logistic regression and time-to-event outcomes were modelled using the Cox proportional hazards model. These models included terms for BMI, surgical approach and interactions between the two, and adjusted for a clinically relevant set of covariates. A total of 16 145 patients were grouped into open (n = 6759, 42%) and laparoscopic (n = 9386, 58%) cohorts. Patients with higher BMI ($p < 0.001$) and those undergoing open surgery ($p < 0.001$) were at an increased risk of all-cause morbidity. The risks associated with BMI, however, did not differ significantly between surgical approaches ($p = 0.572$) and the odds ratio for morbidity comparing open and laparoscopic surgery did not increase with rising BMI. Thirty-day mortality ($p = 0.102$), readmission ($p = 0.807$) and reoperation rates ($p = 0.881$) did not differ by surgical modality. While overall LOS was significantly shorter in the laparoscopy group ($p < 0.001$), there was no incremental benefit for increasingly obese patients ($p = 0.277$). Surgical approach is not an effect modifier for BMI with respect to short-term clinical outcomes. As laparoscopy is not incrementally protective of adverse events in increasingly obese patients, early conversion to open surgery may be justified in select patients with a challenging body habitus.

23

Cost-effectiveness analysis of molecular testing for cytologically indeterminate thyroid nodules. ***N. Dharampal*** **(University of Calgary, Calgary, Alta.),** ***K. Smith*** **(University of Utah, Salt Lake City, Utah),** ***A. Harvey*** **(University of Calgary, Calgary, Alta.),** ***R. Pasbcke*** **(University of Calgary, Calgary, Alta.),** ***L. Rudmik*** **(University of Calgary, Calgary, Alta.),** ***S. Chandarana*** **(University of Calgary, Calgary, Alta.).**

Thyroid nodules affect 8%–65% of the population. Although fine-needle aspirate (FNA) cytology is the gold standard for diagnosis, 20%–30% of results are indeterminate. Molecular testing may aid in the diagnosis of benign nodules and potentially reduce unnecessary surgery. However, these tests are associated with significant costs, which are not covered in Canada. Understanding the potential value of molecular testing may help guide the allocation of restricted health care resources. The objective of this study was to evaluate the cost-effectiveness of Afirma in cytologically indeterminate thyroid nodules. The base case was a solitary thyroid nodule with no additional high-risk features and an indeterminate FNA. A decision tree analysis was performed from the societal perspective with a 1-year time horizon. Costing data were collected through a micro-costing methodology. A probabilistic sensitivity analysis was performed. The primary outcome was the incremental cost-effectiveness ratio (ICER) of cost per thyroid surgery avoided. Over 1 year, mean cost estimates were $8242.31 with 0.58 effectiveness for the molecular testing strategy and $6083.30 with 0.07 effectiveness for current standard management. The ICER was $4209.82 per surgery avoided. At a willingness-to-pay (WTP) threshold of $5000 per surgery avoided, the molecular testing strategy is cost-effective with 63% certainty. The value of Afirma for patients with indeterminate thyroid nodules depends on the WTP threshold to avoid unnecessary thyroid surgery. This study suggests that at a $5000 WTP threshold, molecular testing has a 63% chance of being the more cost-effective strategy.

24

In the presence of post-mastectomy radiation, immediate and delayed breast reconstruction have similar cosmetic outcomes and patient satisfaction. ***S. Buac, S. Latosinsky.*** **From Western University, London, Ont.**

In breast cancer patients requiring post-mastectomy radiotherapy, immediate breast reconstruction has traditionally been thought to offer the advantage of avoiding amastia, while increasing complication rates and worsening cosmetic outcomes when compared with delayed reconstruction. This retrospective study reviewed the experience at a Canadian academic centre over an 8-year period. After research ethics board approval, 84 women were identified who underwent post-mastectomy radiation and breast reconstruction between 2008 and 2016. A total of 8 patients had immediate reconstruction. The delayed reconstruction cohort of 24 patients was then randomly selected from the remaining population. A chart review was conducted regarding patient and tumour characteristics, chemotherapy and radiotherapy treatment, surgery dates and indications, as well as complications, cosmetic outcomes and patient satisfaction. The Student t test and the Fisher's exact test were used where appropriate. The immediate and delayed reconstruction groups were similar with respect to age, BMI, Charlson comorbidity index, smoking status, nodal status, hormone receptor status, HER2 status and TNM stage. Most patients received chemotherapy, and all patients received radiotherapy with similar total Gray (54 v. 53). Major complications needing repeat surgery were more common in the immediate group without statistical significance (38% v. 17%, $p = 0.33$), as were the rates of contracture (38% v. 25%, $p = 0.65$). Positive cosmetic outcomes were ultimately documented in 63% of immediate reconstruction patients and 58% of delayed reconstruction patients. Patient satisfaction was documented as 50% versus 42%, respectively. Neither difference was statistically significant. As expected, the immediate group experienced a significantly shorter interval from diagnosis to breast reconstruction (5 mo v. 2.4 yr, $p = 0.0001$) and significantly less time to their final breast surgery (1.7 yr v. 4.7 yr, $p = 0.01$). This small retrospective study suggests that in post-mastectomy patients receiving radiation, immediate breast reconstruction is comparable to delayed breast reconstruction with respect to cosmetic outcomes and patient satisfaction.

25

Retroperitoneal sarcoma — a retrospective study on survival outcomes and complication rates. ***N. Shahvary*** **(University of Montréal, Montreal, Que.),** ***M. Gervais*** **(University of Montréal, Montreal, Que.),** ***G. Leblanc*** **(Hôpital Maisonneuve-Rosemont, Montreal, Que.).**

Sarcomas are rare tumours, accounting for 1% of all adult cancers. Approximately 1400 new cases of sarcomas are diagnosed per year in Canada. Retroperitoneal sarcomas have a worse prognosis than extremity sarcomas and often require multi-visceral resection to obtain negative margins. This retrospective study aims to evaluate survival rates and complication rates of retroperitoneal sarcoma patients treated at our institution. The primary outcome of this study is overall survival (OS). Secondary objectives include recurrence-free survival (RFS), clinical and histopathologic characteristics of our sarcoma patient population and complication rates. Kaplan–Meier and log rank test were used for OS and DFS. Between 2006 and

2016, 56 patients with a pathologically proven diagnosis of retroperitoneal and abdominal sarcomas intended for surgery were included in the study. Median follow-up was 29.5 months (2–148 months). Most patients (90%) presented with primary tumour and 10% with recurrent disease. A total of 87% of our patients underwent surgery, of which 90% had multi-visceral resection. R0 and R1 resection margins were attained in 76% of cases. Overall median survival was 35 months. The overall recurrence rate was 33% with median time to recurrence of 16 months (2–46 months). The overall postoperative complication rate was 29%, with 1 postoperative mortality. Retroperitoneal sarcomas are aggressive cancers with poor prognosis. Survival outcomes and postoperative complication rates of our sarcoma patient population are comparable to the reported literature.

26

Stereotactic image-guided neo-adjuvant single-dose radiation then lumpectomy (SIGNAL trial) for early breast cancer: a novel method of breast conserving therapy that optimizes patient cosmesis and quality of life. ***M. Brackstone*** **(Western University, London, Ont.),** ***K. Guidolin*** **(University of Toronto, Toronto, Ont.),** ***B. Yaremko*** **(Western University, London, Ont.),** ***S. Gaede*** **(Western University, London, Ont.),** ***K. Lynn*** **(Lawson Health Research Institute, London, Ont.),** ***A. Kornecki*** **(Western University, London, Ont.),** ***G. Muscedere*** **(Western University, London, Ont.),** ***O. Shmuilovich*** **(Western University, London, Ont.),** ***I. BenNachum*** **(Western University, London, Ont.),** ***M. Mouawad*** **(Western University, London, Ont.),** ***N. Gelman*** **(Lawson Health Research Institute, London, Ont.),** ***M. Lock*** **(Western University, London, Ont.).**

The radiotherapeutic management of resectable low-risk carcinoma of the breast is increasingly involving hypofractionated partial-breast irradiation, enabling patients to be treated over a much shorter time, safely and conveniently. MRI-guided, preoperative stereotactic single-fraction external beam radiotherapy to the unresected primary breast lesion represents a novel method, reducing radiation treatment from 25 treatments in 5 weeks to mere minutes. Our hypothesis was that for selected patients with low-risk carcinoma of the breast, this approach would be cosmetically acceptable with minimal toxicity. Patients presenting with early-stage (T < 3 cm), estrogen-positive, clinically node-negative invasive carcinoma of the breast with tumours at least 2 cm away from skin and chest wall were enrolled. All patients received prone breast MRI and co-registered prone CT simulation. Treatable patients received 21 Gy in a single fraction to the primary lesion in the breast, followed by lumpectomy within the week. Strict constraints to minimize dose to skin and normal tissues were used. The primary end points of toxicity and cosmesis were reviewed. Twenty-seven patients were successfully treated in this pilot study. At 6 months after the operation, toxicity, patient- and physician-rated cosmesis and quality of life were not significantly different from baseline measures (one grade 2 toxicity; 95% of patients and 100% of physicians rated cosmesis as good or excellent at baseline and at 6 months, $p = 1.0$). This trial presents a feasible method of implementing single-dose radiotherapy for neoadjuvant treatment of early breast cancer, with excellent cosmesis and patient satisfaction. Delivering radiation in the neoadjuvant setting will allow for the development of genomic signatures to predict individual responses to this therapy, minimizing recurrence. Future trials involve extending this method to higher risk cancers, where hypofractionated partial breast irradiation may confer an immunogenic priming benefit to patients, thus reducing their recurrence risk.

CANADIAN HEPATO-PANCREATO-BILIARY ASSOCIATION (CHPBA)

01

VARD (video-assisted retroperitoneal debridement) for severe necrotizing pancreatitis. ***S. Jayaraman*** **(University of Toronto, Toronto, Ont.).**

The video-assisted retroperitoneal debridement (VARD) is a novel and effective strategy in selected cases of necrotizing pancreatitis. It is an established and safe means of surgically managing very complex cases of severe necrotizing pancreatitis and is an established modality in the modern management of such cases. This video demonstrates a typical VARD case.
YouTube video link: www.youtube.com/watch?v=Gqft-GytlEs

02

Laparoscopic transmesentericapproach to the duodenum. ***S. Jayaraman*** **(University of Toronto, Toronto, Ont).**

This video demonstrates a safe and reliable technique for laparoscopic mobilization and resection of any part of the duodenum. This novel approach has never been reported and it is termed the TorTAD manoeuvre: Toronto transmesentic approach to the duodenum.
YouTube video link: www.youtube.com/watch?v=0un27yezeuo

03

A meta-analysis exploring the role of PET and PET-CT in the management of potentially resectable colorectal cancer liver metastases. ***J. Daza*** **(McMaster University, Hamilton, Ont.),** ***N. Solis*** **(McMaster University, Hamilton, Ont.),** ***S. Parpia*** **(McMaster University, Hamilton, Ont.),** ***S. Gallinger*** **(University of Toronto, Toronto, Ont.),** ***C. Moulton*** **(University of Toronto, Toronto, Ont.),** ***M. Levine*** **(McMaster University, Hamilton, Ont.),** ***P. Serrano*** **(McMaster University, Hamilton, Ont.).**

It has been proposed that positron emission tomography (PET) alone or combined with computed tomography (CT) improves the detection of extrahepatic disease in colorectal cancer liver metastases (CRCLM). The objective of this study was to determine whether PET/PET-CT has a role in the preoperative workup of patients with potentially resectable disease. A systematic search of the following databases was conducted: Medline, Embase, and Central. Both randomized and non-randomized studies were eligible for inclusion. Screening, data collection and risk of bias assessments were performed in duplicate. The primary outcome was overall survival (OS). Secondary outcomes included disease-free survival (DFS), change in surgical management and futile laparotomy. The quality of the evidence was assessed using the Grading of Recommendations Assessment, Development, and Evaluation (GRADE) tool. Random effect models were used to pool treatment effects. Moderate to high

heterogeneity was explored via subgroup analyses established a priori. A total of 4034 studies were reviewed, of which 13 were included for subsequent analysis. PET/PET-CT did not improve OS (hazard ratio [HR] 0.94, 95% CI 0.69–1.26, I^2 = 0%) or DFS (HR 1.01, 95% CI 0.82–1.26, I^2 = 0%) when used preoperatively to determine surgical candidacy. In subgroup analyses, PET/PET-CT changed surgical management in 8% of cases (95% CI 5–11%, I^2 = 0) and did not reduce futile laparotomies (risk ratio 0.59, 95% CI 0.24 – 1.47, I^2 = 47%) in randomized studies. In contrast, PET/PET-CT changed surgical management in 20% of cases (95% CI 17–22, I^2 = 0) and resulted in fewer futile laparotomies (odds ratio 0.51, 95% CI 0.32–0.81, I^2 = 0%) in non-randomized studies. These results do not support routine PET/PET-CT in CRCLM when patients are deemed resectable on conventional imaging. Limitations of this study included a small number of high-quality studies.

04

Bile spillage results in adverse oncological outcomes in incidental gallbladder cancer. *M. Horkoff, F. Sutherland, E. Dixon, C. Ball, O. Bathe.* From the University of Calgary, Calgary, Alta.

Gallbladder cancer (GBC) is a rare but lethal cancer. The only hope for cure is complete resection. About 30% of gallbladder cancers are discovered incidentally on pathology after cholecystectomy for presumed benign pathology. Case reports suggest an association between peritoneal dissemination and bile spillage during the index cholecystectomy. However, no population-based studies have provided estimates for the magnitude of the problem and the consequences of bile spillage. We conducted a retrospective cohort comparison of patients with incidental GBC to determine whether there are measurable adverse outcomes associated with bile spillage. GBCs identified between 2000 and 2015 were reviewed and incidental cancers discovered after cholecystectomy were identified. Operative events and oncological outcomes were examined as a function of bile spillage during the index operation. Between 2000 and 2015, 107 008 cholecystectomies were performed (97 130 were laparoscopic). A total of 533 GBCs were diagnosed over the same time period. GBCs were discovered incidentally in 129 patients (24.2% of all GBCs) and 82 incidental GBCs were included in our analysis. In 55 cases (67%), there was spillage of bile during the index cholecystectomy. Peritoneal carcinomatosis occurred more frequently in those who had bile spillage (24% v. 4%, p = 0.0446, OR = 7.5). The bile spillage cohort also had a significantly shorter disease-free survival (median time to recurrence = 18.5 months v. 55.8 months, p = 0.0264), and they were less likely to undergo a radical re-resection (25% v. 56%, p = 0.0131). In GBCs found incidentally, bile spillage during the index cholecystectomy has measurable adverse consequences including peritoneal dissemination and reduced disease-free survival. Surgeons must be aware of this and should consider aborting a cholecystectomy if there are concerning features in the gallbladder appearance.

05

Early experience with irreversible electroporation in a Canadian program: safe ablation of anatomically sensitive tumours. *M. Moser* (University of Saskatchewan, Saskatoon, Sask.), *J. Shaw* (University of Saskatchewan, Saskatoon, Sask.), *G. Beck* (University of Saskatchewan, Saskatoon, Sask.), *Y. Luo* (University of Saskatchewan, Saskatoon, Sask.), *S. Ahmed* (Saskatchewan Cancer Agency, Saskatoon, Sask.), *C. Wall* (Saskatchewan Health Authority, Saskatoon, Sask.), *T. Domes* (University of Saskatchewan, Saskatoon, Sask.), *K. Jana* (Saskatchewan Health Authority, Saskatoon, Sask.).

Irreversible electroporation (IRE) is an ablation technology recently adopted in a few centres in Canada. Because very little heat is generated, IRE is safe around blood vessels, ducts and the bowel, making it suitable for the treatment of hepato-pancreato-biliary (HPB) malignancies and other tumours in anatomically sensitive locations. We report on our centre's initial experience with IRE. A single-centre multidisciplinary team assessed patients with neoplasms of the pancreas, liver or kidney where the tumour was locally invasive and unresectable or located in an anatomically sensitive location. Electrodes were placed using CT and ultrasound guidance under general anesthetic by a single interventional radiologist and treatments administered using current best practice techniques. A total of 27 treatments in 25 patients were performed (12 HPB and 15 non-HPB). Median patient age was 57 years (range 25–75 yr). Median tumour diameter was 2.7 cm (range 1.5–3.6 cm) and in most cases (22/27), 4 probes were used. Follow-up CT and MRI scans showed satisfactory ablation zones and the preservation of nearby large vessels and ducts. There have been 3 Clavien–Dindo grade 1 early complications (1 subcutaneous hematoma, 1 perinephric hematoma and 1 fever requiring antibiotics) and no cases of pancreatitis. With a median follow-up time of 14 months, 3 patients have had local recurrence, and 23 out of 25 patients are alive. There is a learning curve to performing IRE, and strong interventional radiology support is needed; however, our initial experience suggests that IRE is safe in our centre. We have learned several key details from our initial experience, information that we hope will be useful as more Canadian programs adopt this promising and safe technology.

06

Implementation of a clinical pathway for the Whipple procedure: impact and opportunities. *E. Waugh, M. Tsang, S. Jayaraman.* From the University of Toronto, Toronto, Ont.

High pancreaticoduodenectomy (PD) case volume is associated with improved patient outcomes. Despite regionalization of care to high-volume centres, perioperative outcomes remain variable, suggesting the need for improvement of the process of care. Clinical pathways have been shown to safely increase the efficiency of care of PD patients by reducing length of stay and hospital costs without change in readmission, postoperative clinic visits or postoperative complications. This study aims to determine the effects of implementing a clinical pathway on postoperative PD outcomes in an urban community hospital and to identify areas to target in future quality improvement initiatives. This is a retrospective comparison of a prospectively acquired database of patients undergoing PD during the 3 months before pathway implementation and those undergoing PD immediately following pathway implementation over a period of 16 months. Patient outcomes included length of stay (LOS) and in-hospital complications at 30 and at 90 days after surgery. Pre-pathway patients had a significantly shorter LOS (median = 7 d) than post-pathway patients (median = 9 d, p = 0.01). No significant difference in incidence of any postoperative

complications between pre-pathway and post-pathway groups was identified. While there was no immediate benefit of implementing the pathway on patient outcomes, we identified areas of postoperative management to target for future improvement. Areas of care necessitating improvement include postoperative pain management, Foley catheter removal, early mobilization and early transition to a solid diet. Future improvement in these areas has the potential to reduce length of stay and enhance patient care as a whole. Our results may have been influenced by a small sample size as there were only 13 patients in the pre-pathway group and 66 in the post-pathway group. A longer term study encompassing a larger patient population would provide a more complete representation of our patients' outcomes.

07

Evaluating the safety and effectiveness of STING ligands in a murine model of locally advanced pancreatic cancer. ***E. Tang*** **(Providence Cancer Center, Portland, Ore.),** ***J. Baird*** **(Earle A Chiles Research Institute at Providence Cancer Center, Portland, Ore.),** ***P. Newell*** **(The Oregon Clinic Gastrointestinal and Minimally Invasive Surgery, Portland, Ore.),** ***P. Hansen*** **(The Oregon Clinic Gastrointestinal and Minimally Invasive Surgery, Portland, Ore.),** ***M. Gough*** **(Earle A Chiles Research Institute at Providence Cancer Center, Portland, Ore.).**

The objective of our study was to evaluate the effectiveness and safety of stimulator of interferon genes (STING) ligands in a murine model of locally advanced pancreatic cancer. To this end we used both a flank model and a surgical model of femoral vessel encasement to test the application of STING ligands applied in a neoadjuvant strategy, and in a margin accentuation strategy after partial resection. C57BL6 mice were used with the PANC-02 syngeneic cell line to generate subcutaneous flank tumours, as well as tumours encasing the right femoral vessels. When tumours had reached 5–7 mm in average diameter, they were injected intratumourally with ADU-S100, a synthetic STING agonist, on 3 consecutive days in the neoadjuvant approach. In the margin accentuation strategy, tumours were pretreated with PBS (phosphate-buffered saline) or a subtherapeutic dose of ADU-S100 on the day before resection. This was followed by partial resection and subsequent implantation of a hydrogel containing ADU-S100 in the resection bed. Intra-tumoural injection of ADU-S100 in flank tumours readily cleared tumours and resulted in long-term survival when compared with PBS control. Within the setting of vascular encasement, direct injection of ADU-S100 resulted in delayed tumour growth kinetics without histologic evidence of vascular complications. In the margin accentuation model, ADU-S100 within the resection cavity of flank tumours delayed tumour growth kinetics but did not clear tumours. However, when flank tumours were pretreated with subtherapeutic doses of ADU-S100 or external beam radiation, tumour clearance and long-term survival without recurrence were observed. Based on our preclinical model, STING ligands can be applied intra-tumourally to clear pancreatic tumours without injury to vascular structures. In addition, application of STING ligands within the resection bed can induce margin clearance, especially when coupled with pretreatment using STING ligands or radiation.

08

Overall complications with the use of preoperative biliary stenting versus pancreaticoduodenectomy alone in patients with obstructive jaundice and pancreatic adenocarcinoma. An analysis of the ACS NSQIP registry. ***C. Garcia-Ochoa, E. McArthur, M. Tun-Abraham, J. Hawel, A. Skaro, K. Leslie.*** **From the London Health Sciences Centre, London, Ont.**

The use of preoperative biliary stenting has been associated with a higher complication rate after pancreaticoduodenectomy. Our aim was to compare postoperative complication rates among patients with preoperative biliary stenting versus surgery alone in patients with adenocarcinoma and obstructive jaundice. We used the American College of Surgeons' National Surgical Quality Improvement Program (ACS NSQIP) registry from 2014 to 2016 and compared preoperative biliary stenting with surgery alone in patients with obstructive jaundice and pancreatic adenocarcinoma undergoing pancreaticoduodenectomy. The primary outcome was a postoperative complication in the first 30 days after surgery. We used propensity score matching to ensure balanced baseline characteristics between the 2 groups. Using a modified Poisson regression model, we estimated the association of preoperative biliary stenting versus surgery alone with postoperative complication. From 3628 patients with pancreaticoduodenectomy and obstructive jaundice, we matched 904 (97%) patients with surgery alone to up to 3 patients who received preoperative stenting (n = 2318) for a matched cohort of 3222. A total of 493 (55%) patients with surgery alone experienced a postoperative complication compared with 1285 (55%) patients with preoperative stenting (risk ratio 0.99, 95% CI 0.91–1.05, p = 0.65). Previous studies have shown an increased rate of complications with preoperative biliary stenting; however, some of these studies lacked an adequate sample size or restricted certain baseline characteristics. Our study showed that preoperative biliary stenting was not associated with an increased risk of overall postoperative complications in patients who had pancreaticoduodenectomy with obstructive jaundice. This favours the increasing indications of preoperative stenting to allow the use of neoadjuvant therapy for pancreatic adenocarcinoma.

09

HOSPITAAL: a score to predict blood transfusion in patients undergoing pancreaticoduodenectomy. ***C. Garcia-Ochoa, E. McArthur, M. Tun-Abraham, K. Leslie, A. Skaro.*** **From the London Health Sciences Centre, London, Ont.**

Blood transfusion is associated with worse outcomes and increased resource utilization after pancreaticoduodenectomy. The aim of this study is to develop a risk score to predict blood transfusion after pancreaticoduodenectomy. We used the American College of Surgeons' National Surgical Quality Improvement Program (ACS NSQIP) registry from 2014 to 2016 to develop and validate a prediction model of blood transfusion within 30 days after pancreaticoduodenectomy. We used univariable analysis to determine potential predictors, and best subsets logistic regression was used for variable selection, restricting to 8 variables. Model discrimination was assessed using the c-statistic and was adjusted using bootstrapping and estimation of Harrell's optimism. We used a LOESS-based smoothing algorithm to graphically assess calibration. Of 17 463 patients who received

pancreatic surgery, 11 183 patients underwent a pancreaticoduodenectomy and 2130 (19%) had a blood transfusion. Fifteen preoperative variables were associated with risk of transfusion and 7 were selected for inclusion in the final model (Hematocrit < 38%, Open-pancreatectomy, pre-operative Sepsis, Insulin-dependent diabetes, presurgical blood Transfusion, American society of anesthesiologists classification > 3, Albumin < 4 g/dL; HOSPITAAL). The 7-variable model had a c-statistic of 0.68 (95% CI 0.67–0.69) with an optimism of <0.01. The model showed good calibration with concordance between the predicted and observed probabilities. Blood transfusion is a prominent quality indicator in pancreatic surgery. The HOSPITAAL score shows moderate discrimination in predicting blood transfusion after pancreaticoduodenectomy. This could be used to augment risk adjustment, standardize performance measurement and develop strategies preoperatively to reduce the risk of blood transfusion.

10

Total neoadjuvant therapy in distal pancreatic cancer: single institution outcomes. ***G. Gauvin*** **(Fox Chase Cancer Center, Philadelphia, Pa.),** ***N. Goel*** **(Fox Chase Cancer Center, Philadelphia, Pa.),** ***D. Mutabdzic*** **(Fox Chase Cancer Center, Philadelphia, Pa.),** ***F. Lambreton*** **(Fox Chase Cancer Center, Philadelphia, Pa.),** ***M. Kilcoyne*** **(Fox Chase Cancer Center, Philadelphia, Pa.),** ***A. Nadler*** **(Sunnybrook Health Sciences Centre, Toronto, Ont.),** ***K. Ang*** **(Fox Chase Cancer Center, Philadelphia, Pa.),** ***A. Karachristos*** **(Fox Chase Cancer Center, Philadelphia, Pa.),** ***H. Cooper*** **(Fox Chase Cancer Center, Philadelphia, Pa.),** ***J. Hoffman*** **(Fox Chase Cancer Center, Philadelphia, Pa.),** ***S. Reddy*** **(Fox Chase Cancer Center, Philadelphia, Pa.).**

While the role of neoadjuvant therapy (NAT) in advanced and borderline resectable pancreatic cancer is known, we hypothesize that total neoadjuvant therapy (TNT) could be beneficial at all stages of disease. We define TNT as a combination of chemotherapy alone, followed by chemoradiation. We report our experience with TNT in cancers of the body and tail of the pancreas. We conducted a retrospective chart review of the 54 patients who underwent a distal pancreatectomy in our institution between 2000 and 2016. Clinical and pathological information was reviewed, and statistical analysis was performed. One patient was excluded due to loss to follow-up. The average age at diagnosis was 64 years (38–87 yr). Twenty-eight of the 53 patients underwent surgery first, 14 received TNT, 6 had neoadjuvant chemoradiation (CRT) and 5 had neoadjuvant chemotherapy (NAC). One hundred percent of the TNT patients had a R0 resection, 83.3% with CRT, 82.1% with surgery first and 80% with NAC ($p = 0.308$). Final pathologic stage was 26.4% stage I, 60.4% stage II, 1.9% stage III and 7.5% stage IV. The only 2 patients (3.8%) who had a pathologic complete response (pCR) received TNT. The 2-year OS rate was 84.6% for TNT, 80% for CRT, 49% for surgery first and 0% for NAC ($p = 0.872$). Median DFS was 20.5 months with TNT, 16 months with surgery first, 12.5 months with CRT and 12 months with NAC ($p = 0.54$). Recurrence developed in 8 (57%) of the TNT patients, 14 (50%) of the surgery-first patients and 4 (67%) of the CRT patients, with a median time to recurrence of 14.1, 11.5 and 10.5 months, respectively. TNT could play an important role in the treatment of tumours of the body and tail of the pancreas. These interesting findings will need to be expanded to the next step: a multicentre prospective trial.

11

The safety and effectiveness of hypovolemic phlebotomy on patients undergoing liver surgery: a systematic review and meta-analysis. ***L. Park*** **(University of Ottawa, Ottawa, Ont.),** ***R. Gilbert*** **(University of Ottawa, Ottawa, Ont.),** ***R. Shorr*** **(The Ottawa Hospital, Ottawa, Ont.),** ***A. Workneh*** **(The Ottawa Hospital, Ottawa, Ont.),** ***K. Bertens*** **(University of Ottawa, Ottawa, Ont.),** ***J. Abou-Khalil*** **(University of Ottawa, Ottawa, Ont.),** ***F. Balaa*** **(University of Ottawa, Ottawa, Ont.),** ***G. Martel*** **(University of Ottawa, Ottawa, Ont.).**

Hypovolemic phlebotomy (HP) is an under-reported intervention demonstrating potential to reduce the high morbidity rates associated with liver surgeries by decreasing blood loss and subsequent need for blood transfusion. It involves intraoperative removal of whole blood from the patient, without volume replacement, to induce a controlled hypovolemic state throughout surgery. The objective of this systematic review was to amalgamate existing data on the safety and effectiveness of HP for liver surgery patients. Medline, Embase, and Cochrane Library databases were searched from inception to February 2018. Primary studies investigating the safety and effectiveness of HP in adults undergoing liver resections and liver transplantation surgeries were considered. Outcomes assessed included blood loss, transfusion proportion, major complications and minor complications. Six studies involving 1296 patients were included. All 6 studies were reviewed narratively while the 4 studies involving solely liver resections were evaluated quantitatively. Difference in means and odds ratios (OR) were calculated using the random effects model. Meta-analysis of 1 randomized control trial (RCT) and 3 high-quality observational studies identified a significant reduction in blood loss with HP (–228.72 mL, $p = 0.01$). There were no differences in transfusion proportion (OR 0.34, $p = 0.30$), major complications (OR 0.84, $p = 0.84$) or minor complications (OR 0.95, $p = 0.84$). Due to heterogeneity in study design, the RCT was removed during subsequent sensitivity analysis. This demonstrated significant reductions in blood loss (–286.18 mL, $p < 0.00001$) and transfusion (OR 0.11, $p < 0.00001$) with HP. Narrative summary corroborated these findings. Evidence from existing studies suggests associations between HP and reduced blood loss and potentially transfusion proportion. No significant differences were demonstrated regarding major and minor complications. More high-quality evidence is required to draw robust conclusions. The present data lend support for continued exploration of HP as a means of decreasing liver surgery morbidity rates.

12

Standardizing early drain removal after pancreatectomy to reduce pancreatic fistula and surgical site infection: a quality improvement project. ***H. Smith, K. Bertens*****. From the University of Ottawa, Ottawa, Ont.**

Intra-abdominal drains are routinely left in place after pancreatectomy to mitigate the development of a pancreatic fistula but may contribute to the risk of organ space infections in a patient population where surgical site infections are a major contributor to morbidity. To address this issue, the hepatopancreaticobiliary surgery and quality improvement (QI) teams developed a protocol to detect patients at low risk of pancreatic anastomotic leak and facilitate early drain removal. A multidisciplinary meeting

was held and a protocol developed. In November 2016 the protocol was implemented. Verbal feedback was obtained from the care team and QI team to assess access and usability. A retrospective chart review was conducted of all patients undergoing distal pancreatectomy and the Whipple procedure between January 1, 2016, and October 2017, excluding November 2016 (month of implementation). A Mann–Whitney *U* test was used to compare outcomes. The protocol was implemented for 100% of patients undergoing pancreatectomy with no significant barriers to usability. In comparing the 42 patients before the protocol implementation (7 distal pancreatectomy, 35 Whipple) and 47 patients after implementation (19 distal pancreatectomy, 28 Whipple), we found that the median day of drain removal was significantly reduced from 8 to 5 days ($p = 0.03$). On subgroup analysis, the median length of stay significantly decreased from 8 days to 5 days among patients undergoing distal pancreatectomy who did not develop a postoperative pancreatic fistula ($p = 0.05$). The surgical site infection and fistula rate were reduced but not statistically significantly so (from 30% to 23%, $p = 0.42$; and from 42% to 36%, $p = 0.51$, respectively). We found the implementation of a standardized protocol for drain management after pancreatectomy was associated with earlier drain removal and decreased length of stay. It may be a useful tool for other hepatopancreaticobiliary surgery teams looking to facilitate early drain removal after pancreatectomy.

13

Disparities in surgical therapy for pancreas cancer: a population based study. ***J. Levy*** **(University of Toronto, Toronto, Ont.),** ***A. Hammad*** **(University of Toronto, Toronto, Ont.),** ***L. Davis*** **(University of Toronto, Toronto, Ont.),** ***V. Gupta*** **(University of Toronto, Toronto, Ont.),** ***Y. Jeong*** **(University of Toronto, Toronto, Ont.),** ***A. Mahar*** **(University of Manitoba, Winnipeg, Man.),** ***N. Coburn*** **(University of Toronto, Toronto, Ont.).**

Pancreas cancer is an aggressive malignancy, which, when diagnosed early, can be amenable to resection with resulting survival benefit. Unfortunately, several studies have shown the underutilization of surgery in eligible patients without increasing trends. This study aims to identify factors predicting receiving surgery. A cohort of pancreas cancer patients diagnosed between 2004 and 2014 was created using data from the Surveillance, Epidemiology, and End Results (SEER) cancer registry program. A multivariable logistic regression analysis was modelled to identify predictors of receiving surgery in this cohort. Generalized estimating equations were used to account for clustering by geographic region. Among 80 579 patients with pancreas adenocarcinoma, surgery was performed in 15%. This surgical group was younger with a mean age of 65.1 years (STD 10.9) versus 70.3 years (STD 12.6) and was more often married (64.6% v. 52.1%). After adjusting for age, geographic region and tumour site, grade and stage, factors associated with receiving surgery included female sex (OR 1.15, $p < 0.0001$), while black versus white race (OR 0.80, $p < 0.0001$) and being married versus not (OR 0.70, $p < 0.0001$) decreased the odds of receiving surgery. While surgery may represent the only opportunity for cure in patients with pancreas cancer, race and marital status significantly impact the odds of receiving optimal care.

14

Critical appraisal of predictive tools to assess the difficulty of laparoscopic liver resection: a systematic review. ***J. Hallet*** **(Sunnybrook Health Sciences Centre, Toronto, Ont.),** ***A. Mahar*** **(University of Manitoba, Winnipeg, Man.),** ***S. Jayaraman*** **(St. Joseph's Health Centre, Toronto, Ont.),** ***P. Serrano*** **(McMaster University, Hamilton, Ont.),** ***G. Martel*** **(The Ottawa Hospital, Ottawa, Ont.),** ***K. Beyfuss*** **(Sunnybrook Research Institute, Toronto, Ont.),** ***N. Coburn*** **(Sunnybrook Health Sciences Centre, Toronto, Ont.),** ***T. Piardi*** **(Centre Hospitalier Universitaire de Reims, Reims, France),** ***P. Pessaux*** **(Institut Hospitalo-Universitaire de Strasbourg, Strasbourg, France).**

Objective assessment of the difficulty of laparoscopic liver resection (LLR) preoperatively is key in improving its uptake. Difficulty scores are proposed but are not used routinely in practice. We identified and appraised predictive models to estimate LLR difficulty. We systematically searched the literature for tools predicting LLR difficulty. Two independent reviewers selected studies, abstracted data and assessed methodology. We evaluated tools' quality and clinical relevance using the Critical Appraisal and Data Extraction for Systematic Reviews of Prediction Modelling Studies (CHARMS) guidelines. From 1037 citations, we included 5 studies reporting on 4 predictive tools using data from 2003 to 2016 in Asia. In 2 development studies, tools were designed to predict difficulty as assigned by experts using a 10-level difficulty index or operative time. Neither internal validation nor performance metrics were reported. In 3 validation studies, 1 LLR tool was subjected to 3 external validations (1 independent and geographic), and 2 open surgery tools were validated in a LLR population. Validations compared postoperative outcomes (operative time, blood loss, transfusion, major morbidity and conversion) between the risk categories. One study validated discrimination (AUROC 0.53). Calibration was not assessed. Existing tools cannot be used confidently to predict LLR difficulty. Consistent objective clinical outcomes to predict LLR difficulty should be established, and better quality tools should be developed and validated in a wide array of populations and clinical settings, following best practices for predictive tools development and validation. This will contribute to broader uptake of LLR and risk-stratification for future trials.

15

Development and implementation of a clinical pathway for liver resection: a quality improvement initiative. ***J. Hallet*** **(Odette Cancer Centre – Sunnybrook Health Sciences Centre, University of Toronto, Toronto, Ont.),** ***J. Ellis*** **(Sunnybrook Health Sciences Centre, Toronto, Ont.),** ***B. Bakanisi*** **(University of Toronto, Toronto, Ont.),** ***M. Sadeghi*** **(Sunnybrook Health Sciences Centre, Toronto, Ont.),** ***K. Beyfuss*** **(Sunnybrook Research Institute, Toronto, Ont.),** ***S. Michaelson*** **(Sunnybook Health Sciences Centre, Toronto, Ont.),** ***P. Karanicolas*** **(Odette Cancer Centre – Sunnybrook Health Sciences Centre, University of Toronto, Toronto, Ont.),** ***C. Law*** **(Odette Cancer Centre – Sunnybrook Health Sciences Centre, University of Toronto, Toronto, Ont.),** ***A. Nathens*** **(Sunnybrook Health Sciences Centre, University of Toronto, Toronto, Ont.),** ***N. Coburn*** **(Odette Cancer Centre – Sunnybrook Health Sciences Centre, University of Toronto, Toronto, Ont.).**

Liver resection (LR) is increasingly performed for benign and malignant diseases. Perioperative care varies between and within institutions, which may result in a burden for health care providers, institutions and patients. We sought to develop and implement a clinical pathway (CP) for LR to standardize care, using quality improvement methodology. We used a series of Plan-Do-Study-Act cycles. We conducted interdisciplinary needs assessment surveys. We identified best practices via literature review. We reviewed our practices in 30 LR to define factors to target for standardization. Stakeholders were engaged in working groups to get consensus on CP components and implementation strategies. Morbidity, mortality and readmission were assessed as balancing measures. Practices and outcomes were monitored using the merican College of Surgeons' National Surgical Quality Improvement Program (ACS NSQIP) registry, including institutional performance reported as odds ratios (OR; reference: other institutions). The highest variability of care was in preoperative risk assessment, postoperative nutrition, step-down unit stay, glycemic control, mobilization and patient education. The CP was accompanied by order sets and educational tools. Key targets included the following: preoperative risk assessment, sips by POD 0, diet by POD 2, discharge from step-down unit by POD 1, glycemia below 11 mmol/L, no Foley catheter by POD 2, mobilization on POD 0–2 and physiotherapy for high-risk patients. During CP implementation, ACS NSQIP institutional performance improved for mortality (OR 2.17 to 0.98 – 5th decile) and morbidity (OR 0.89 to 0.72 – 1st decile) and was stable for readmission (OR 0.89 to 0.92 – 3rd decile) and length of stay (OR 0.63 to 0.64 – 1st decile). Development and implementation of a tailored institutional CP for LR using structured quality improvement methods is feasible, without compromising readmission or complications. It contributes to reduced variability in care and improved institutional risk-adjusted performance. Ongoing monitoring is warranted to assess the definitive impact on length of stay and assess the satisfaction of providers and patients, to ensure CP sustainability.

16

The laparoscopic hepatectomy proficiency learning curve: a 10-year single-institution experience. ***A. Giles, J. Daza, A. Doumouras, P. Serrano, V. Tandan, L. Ruo, M. Marcaccio, D. Dath*****. From McMaster University, Hamilton, Ont.**

Learning curve analyses of laparoscopic liver surgery have been limited, largely, to single-surgeon series and minor resections. A high proportion of major laparoscopic hepatectomies performed at our institution allowed us to undertake a learning curve analysis of this experience. We conducted a longitudinal analysis of 5 surgeons over 10 years of laparoscopic liver surgery at an academic centre. Minor and major (≥3 contiguous Couinaud segments) resections were included. We collected operative (duration, blood loss, conversion) and postoperative outcomes (length of stay, major morbidity [Clavien–Dindo >2], mortality) and compared laparoscopic with open outcome data. Learning was analyzed using cumulative statistics in sequential blocks of 15 cases. A total of 342 laparoscopic hepatectomies (173 [50.6%] major resections) were performed from 2005 to 2016. For major resections, the conversion rate was 12.1%, the major morbidity rate was 24.3% and 90-day mortality was 5.2%. Outcome results for major resections were equivalent with the open technique. The proportion of major hepatectomy performed laparoscopically increased from 28% to 72%. Comparing a surgeon's first 15 cases with those beyond the 50th case, the odds of prolonged admission were lower (odds ratio [OR] 0.48, 95% confidence interval [CI] 0.19–0.97, $p = 0.048$), operative time was reduced by 78.4 minutes (95%CI 112.1–44.8 fewer minutes, $p < 0.001$) and the odds of conversion was 73% less (OR 0.23, 95% CI 0.08–0.66, $p = 0.006$). Analysis of learning detected no effect on blood loss (OR 12.4 mL, 95% CI 416–445 mL, $p = 0.956$) or overall major morbidity (OR 1.09, 95% CI 0.50–2.14, $p = 0.954$). Learning laparoscopic liver surgery was undertaken safely as patient outcomes for major laparoscopic surgery were equivalent to those for open operations. Intuitively, improvement in operative time, conversion rate and length of stay were markers of learning, achieved after 50 cases. Blood loss and complication rate were not affected by surgeon experience; perhaps case factors (i.e., cirrhosis) play a larger role than technique. Laparoscopic liver resection can be learned slowly but safely.

Canadian Hernia Society (CHS)

01

Incidence of incisional hernias following single-incision versus traditional laparoscopic surgery: a meta-analysis. ***M. Connell, R. Selvam, S. Patel.*** **Queen's University, Kingston, Ont.**

Single-incision laparoscopic surgery has been proposed as an alternative to multiport laparoscopic surgery. Given recent literature suggesting an increased risk of incisional hernias following this procedure, an updated meta-analysis was needed. The purpose of this study was to compare, using a meta-analysis of randomized controlled trials, the risk of incisional hernia in patients undergoing single-incision laparoscopic surgery with that in patients undergoing traditional laparoscopic surgery. The Medline and Embase databases were searched. Randomized controlled trials comparing single-incision laparoscopic surgery with traditional laparoscopic surgery and that reported incisional hernias over a minimum 6-month follow-up period were eligible for inclusion in this review. Risk of bias was assessed as outlined in the Cochrane Handbook. Pooled odds ratios were calculated using RevMan. Of 309 identified studies, 22 were included in this meta-analysis. Pooled results showed higher odds of incisional hernia following single-incision laparoscopic surgery relative to traditional laparoscopic surgery (odds ratio 2.83, 95% CI 1.34–5.98, $p = 0.006$, $I^2 = 0\%$). There was no difference in the odds of incisional hernias requiring surgery ($p = 0.10$). Subgroup analysis found no difference in the odds of incisional hernias based on procedure type ($p = 0.69$) or method of follow-up ($p = 0.85$). The quality of evidence was determined to be moderate, having been downgraded due to risk of bias. Single-incision laparoscopic surgery is associated with a three-fold increase in the odds of incisional hernia compared with traditional laparoscopic surgery.

02

Laparoscopic repair of a sciatic hernia with self-adherent mesh. ***A. Kleiman, A. Bennett, N. Wasey*****. From the University of Alberta, Edmonton, Alta.**

This is the case of a 41-year-old female with a longstanding history of vague pelvic discomfort. She presented to the emergency department with sudden-onset right lower quadrant pain, which was sharp, but colicky in nature. The pain lasted approximately 30 minutes before

resolving. CT scan was performed and demonstrated a right-sided sciatic foramen hernia containing the right ovary. Doppler US of the ovary was performed to ensure normal flow and absence of torsion. The patient was brought to the operating theatre electively on a semi-urgent basis for hernia repair. Sciatic hernias are rare, representing less than 0.01% of all abdominal hernias. There are fewer than 100 reported cases since it was first described in 1750. They are classified into 3 subtypes based on their anatomic relationship to the piriformis muscle and sacrospinous ligament. The hernia may contain ureter, ovary, small bowel or colon. Symptomatology is highly variable, although most patients will endorse a history of chronic pelvic, buttock or thigh pain. Laparoscopic, transabdominal and trans-gluteal approaches to repair have been described. In performing this operation, the proximity of multiple crucial structures, including the external iliac vessels, ureter and obturator nerve, needs to be taken into consideration. The use of self-adherent mesh as well as avoidance of surgical tacking devices may help to prevent injury. This video demonstrates laparoscopic repair of a sciatic hernia with a self-adherent mesh.
YouTube video link: https://youtu.be/LkXH1iJtKm0

03

Modern-era operative outcomes of paraesophageal hernia repair. *R. Sorial*. From McGill University, Montreal, Que.

Historically, elective laparoscopic paraesophageal hernia repair (LPEHR) was associated with significant risks, with serious complications arising in 10%–15%, and perioperative death of 1%–2%. Risk of death after emergency surgery ranged from 5% to 17%. Recent reports suggest modern-era outcomes for elective surgery have improved, while the morbidity of emergency surgery may still be significant. The objectives of this study were to determine modern-era surgical outcomes after elective and emergency repair of giant paraesophageal hernias at a high-volume tertiary care centre. A retrospective review was conducted of all type II–IV paraesophageal hernia repairs performed between Jan. 1, 2012, and Dec. 31, 2017. Type I hiatal hernias (HH), revisional cases and cases with planned co-procedures other than cholecystectomy were excluded. Multiple logistic regression was used to identify independent risk factors for morbidity. Multivariate analysis was performed using variables found to be significant on univariate analysis. A total of 309 cases were reviewed, of which 194 met the inclusion criteria (16 emergency, 178 elective). Eight had type II PEH, 141 had type III and 45 had type IV. Emergency patients were older (78 [SD 12.8] v. 70 [SD 10.6] yr; $p = 0.003$) and more comorbid (ASA ≥ 3: 94% v. 33%, $p < 0.0001$). Mean length of stay was shorter in the elective group (2 [SD 2.8] v. 11 [SD 17.7] d, $p < 0.0001$, and emergency patients were less likely to return directly to their original residence at discharge (70.6% v. 99.4%, $p < 0.0001$). There were significantly more major complications (Clavien–Dindo score ≥ 3) in the emergency group (29.4% v 5.6%, $p = 0.006$). All other perioperative outcome measures were similar between groups. There were no perioperative deaths in either group. The incidence of major complications and mortality in this series were substantially lower than those previously reported for PEHR. Emergency patients continue to have a more complex post-operative course than patients undergoing elective repair.

04

The management of incisional hernias: current practices of Canadian general surgeons. *S. Macdonald, D. Johnson, D. Klassen*. From Dalhousie University, Halifax, N.S.

The purpose of this research was to examine the self-reported practice patterns of Canadian general surgeons with regard to elective repair of incisional hernias. A mail survey was sent to all general surgeons in Canada. Data were collected regarding surgeon training, years in practice, practice setting and management of incisional hernias. Surgeons were asked to describe their usual surgical approach to a patient with a midline incisional hernia following a right hemicolectomy with a 10 × 6 cm fascial defect. After the first mail-out, 391 surveys were returned. Of the 317 surgeons who indicated that they perform incisional hernia repairs, 62% have been in practice > 10 years, 67% work in a community hospital and 66% reported that they regularly repair incisional hernias in their practices. In response to the clinical scenario 72% of surgeons indicated that they would perform an open repair, 21% would perform a laparoscopic repair and 7% would use a hybrid approach. Ninety-one percent of surgeons would use mesh to repair the hernia and permanent mesh would be used by 95% with the remainder using biologic mesh. The mesh would be placed intraperitoneally by 50%, in an inlay position (retrorectus/preperitoneal) by 43% and as an onlay by 7%. Of those surgeons who would perform a mesh repair, 69% would also perform primary closure of the fascia. To achieve this, 56% would perform a component separation and 30% would perform a transversus abdominus release. While almost all surgeons who perform incisional hernia repairs would use permanent mesh, there is substantial variation in surgical approach, mesh location, fascial closure and component separation techniques. It is unclear how this variation impacts patient outcomes.

05

Massive retroperitoneal lipoma presenting as symptomatic inguinal hernia. *C. Leung, A. Vergis, C. Botkin*. From the University of Manitoba, Winnipeg, Man.

Spermatic cord and round ligament lipomas are thought to be extensions of retroperitoneal tissue and are known to occur concurrently with inguinal hernias. There have been only 2 previously published cases of massive retroperitoneal lipomas presenting as symptomatic inguinal hernias, while other single-centre retrospective studies have described rare incidences of retroperitoneal liposarcomas presenting as inguinal hernias. This is the first described combined laparoscopic and open resection of a large retroperitoneal lipoma presenting as an inguinal hernia. YouTube video link: https://youtu.be/v9ASh3lzUQY

06

Emergency laparoscopic and open repair of incarcerated ventral hernias: a multi-institutional comparative analysis with coarsened exact matching. *A. Azin, D. Hirpara, T. Jackson, A. Okrainec, A. Elnahas, S. Chadi, F. Quereshy*. From the University of Toronto, Toronto, Ont.

The safety of emergency laparoscopic repair of incarcerated ventral hernias is not well established. The objective of this study was to determine if emergent laparoscopic repair of incarcerated ventral hernias is comparable to open repair with respect to short-term clinical outcomes. A retrospective analysis was conducted utilizing the National Surgical Quality Improvement

Program (NSQIP) 2012 to 2016 dataset. All patients undergoing emergency repair of an incarcerated ventral hernia with associated obstruction and/or gangrene were identified. One-to-one coarsened exact matching (CEM) was conducted between patients undergoing laparoscopic and open repair. Matched cohorts were compared with respect to morbidity, mortality, readmission, reoperation, missed enterotomies and length of stay. Multivariate analysis was conducted to determine adjusted predictors of 30-day morbidity. A total of 8136 patients were identified; after CEM 1642 patients were included in the final analysis. Laparoscopic compared with open repair was associated with a lower rate of 30-day wound morbidity (OR 0.35, 95% CI 0.22–0.57, $p < 0.001$). Laparoscopic repair was not associated with lower 30-day non-wound morbidity (OR 0.73, 95% CI 0.51–1.06, $p = 0.094$). Laparoscopic repair was associated with shorter total hospital length of stay (3.6 d v. 4.3 d, $p = 0.014$). Laparoscopic repair was associated with a higher rate of missed enterotomies (0.7% v. 0.0%, $p = 0.031$). There were no group differences with respect to 30-day readmission (6.0% v. 8.4%, $p = 0.056$), 30-day reoperation (2.8% v. 3.9%, $p = 0.217$), or 30-day mortality (1.3% v. 1.1%, $p = 0.653$). This study confirms that emergency laparoscopic repair of incarcerated ventral hernias is associated with a lower rate of wound-morbidity and shorter hospital stays compared with open repair. However, laparoscopic repair is associated with a higher rate of missed enterotomies, a complication confounded by the use of rigid non-tactile instruments in laparoscopy.

07

Trans-abdominal pre-peritoneal (TAPP) umbilical and ventral hernia repair. *M. Bahasadri, F. Saleh*. From Etobicoke General Hospital, Etobicoke, Ont.

This video demonstrates a novel approach for smaller (up to 4–5 cm) primary or incisional periumbilical hernia. It is a pre-peritoneal approach involving the creation of a peritoneal flap similar to a TAPP inguinal hernia. The hernia is reduced and the mesh is placed with tacks or suture. The flap is then closed either with tacks or suture. The benefit is that patients anecdotally have little to no pain and have a much quicker recovery. In addition mesh is kept out of the abdomen and it is uncoated and can be doubly incorporated. The cost is significantly less than laparoscopic intraperitoneal onlay mesh especially if not using tacks. This technique is feasible and easy to learn. Patients are discharged the same day. They are instructed to use abdominal binder, rest for 2 weeks and avoid excessive physical activity for 6–8 weeks. This video shows the technical feasibility of laparoscopic trans-abdominal preperitoneal ventral hernia.
YouTube video link: https://youtu.be/d91nHQjqHjc

08

Modified TAPP and Rives-Stoppa technique for primary or incisional umbilical and ventral hernias. *M. Bahasadri, F. Saleh*. From Etobicoke General Hospital, Etobicoke, Ont.

This patient was brought to the operationg room for an epigastric hernia, which was approached with laparoscopic trans-abdominal preperitoneal (TAPP) repair. The hernia was skeletonized and reduced. The hernia sac was removed. We also found a large umbilical hernia. After skeletonizing and reducing the hernia we encountered a large defect. We did not appreciate the size of the hernia in preop assessment, otherwise we would have approach these hernias with the e-TEP (enhanced view totally extraperitoneal) technique. Considering the size of the fascia defect we decided to enter into the retrorectus space to get better coverage with mesh. We started with the right side and then crossed over to the left retrorectus space. The fascia defect then was closed with number O non-absorbable barbed suture. A piece of medium-weight polypropylene mesh was introduced into the abdominal cavity and the mesh was laid open over both defects. The mesh then was covered with the peritoneal flap and posterior rectus sheet. We sutured them to the abdominal wall on the left side. We used 2-O absorbable barbed suture. A small rent in the peritoneum was closed with a simple suture. This operation took around 90 minutes.The patient was discharged the same day. They were instructed to use abdominal binder, rest for 2 weeks and avoid excessive physical activity for 6 to 8 weeks. This video shows the technical feasibility of laparoscopic trans-abdominal preperitoneal and also Rives–Stoppa technique for ventral hernia repair for hernias up to 4–5 cm.
YouTube video link: https://youtu.be/3_NnqbjYBM4

09

e-TEP Rives–Stoppa repair. *F. Saleh, M. Bahasadri*. From the William Osler Health System, Etobicoke, Ont.

This video demonstrates a novel way to deal with primary or incisional abdominal wall hernias. It also demonstrates a new way to access the retrorectus space using the e-TEP (enhanced view totally extraperitoneal) technique. Rives–Stoppa repairs are generally for hernias that are less than 10 cm in size and reside close to the midline. This repair involves separation of the anterior and posterior fascia, closure of both of these layers with suture, placement of a mesh and no fixation. This hernia repair will probably be the gold stardard for hernias greater than 2 cm. It is associated with a low recurrence rate, patients have little to no pain, and it restores abdominal wall function.
YouTube video link: www.youtube.com/watch?time_continue=7&v=B7XjJ1FW3W4

10

Robotic assisted retrorectus ventral hernia repair — a Canadian first. *S. MacLellan, J. Tan*. From Humber River Hospital, University of Toronto, Toronto, Ont.

Robotic assisted ventral hernia repair has been shown to be safe and effective in many centres worldwide, primarily in the United States and Europe. Hernia surgery constitutes one of the fastest growing areas of robotic surgery. Uptake in Canada has been limited, largely due to access and cost factors. We present the case of a 55-year-old man who underwent a robotic assisted ventral hernia repair, with midline closure of the fascia, and placement of retrorectus polypropylene uncoated mesh. He previously underwent a laparoscopic right hemicolectomy for colon cancer and subsequently developed a symptomatic, periumbilical incisional hernia at the extraction. This case represents the early experience of our robotic assisted ventral hernia program, which to the best of our knowledge is the first case series using this technique in Canada.
YouTube video link: https://youtu.be/bFHEJsA2mqQ

Canadian Obesity Network (CON)/Canadian Association of Bariatric Surgery (CABPS)

01

Improving fetal–maternal outcomes after bariatric surgery. ***H. Jun*** **(University of Newcastle, Newcastle, Australia),** ***H. Cheah*** **(Gosford District Hospital, Gosford, Australia),** ***K. Wong*** **(Gosford District Hospital, Gosford, Australia).**

Patients undergoing bariatric surgery are counselled to avoid pregnancy within 12–18 months of surgery. We review our experience with inadvertent pregnancies arising soon after gastric sleeve surgery, particularly reviewing management dilemmas arising due to concurrent pregnancy and surgery complications. We conducted a prospective database search of cases of inadvertent pregnancies after bariatric surgery. Patient demographics and maternal and neonatal outcomes were examined. Four cases of inadvertent pregnancies were identified in 980 sleeve gastrectomy patients. In 3 uncomplicated cases, the newborn was delivered at full term, within the normal gestational weight. Two mothers experienced early weight regain after delivery. One patient was pregnant at the time of operation and this was complicated by a functional stenosis. Postoperatively, this patient had multiple admissions for nausea, vomiting, hypokalaemia and abdominal pain. She underwent multiple gastroscopies and dilatations of a stenosis at the incisura, giving temporary relief. Radiological investigations and gastric bypass surgery were contraindicated in view of advanced pregnancy. As the patient's weight dropped, ultrasound scans from 20 weeks showed a small-for-gestational-age fetus. The patient refused supplemental enteral feeding to supplement fetus growth and the baby was delivered prematurely at 36 weeks with APGARs of 6, 9 and 9 and respiratory distress. While the majority of inadvertent pregnancies after bariatric surgery do not harm the newborn, they do limit the weight loss potential of the mother and fetus. More intensive counselling is indicated for patients undergoing bariatric surgery of childbearing potential to prevent adverse outcomes for the patient and fetus.

02

Internal hernia during pregnancy after gastric bypass. ***N. Harvey, A. Smith, S. Cassie, S. Sun*****. From the Northern Ontario School of Medicine, Thunder Bay, Ont.**

The epidemic of obesity is estimated to affect approximately 650 million individuals worldwide, a number that has nearly tripled over the last 40 years. Obesity is involved in the pathogenesis of multiple diseases, including type 2 diabetes, heart disease, stroke, several cancers, osteoarthritis, liver disease, obstructive sleep apnea and depression. Medical and behavioural approaches to weight loss may be ineffective in many instances and bariatric surgical procedures are increasingly common because of their efficacy in weight reduction, improvement in management of comorbidities and long-term reduction in mortality. Roux-en-Y gastric bypass (RYGB) is one of the most commonly performed surgeries, accounting for 53% of the bariatric procedures done in Canada. Despite advances in surgical technique, postoperative internal hernias remain a significant cause of morbidity, with an incidence of 1%–4%. Approximately 50 cases in pregnant patients have been reported in the literature, with a mean gestational age at diagnosis of 28 weeks. It is unclear whether anatomic and physiologic changes inherent to pregnancy have the potential to precipitate herniation of intra-abdominal content through a patent defect. This video illustrates the case of a 24-week pregnant patient who developed subacute intermittent abdominal pain and nausea related to transient herniation of small bowel through the small bowel mesenteric defect. Intraoperative findings and surgical management are depicted. YouTube video link: https://youtu.be/kKOy4BbNxl4

03

The economic impact of bariatric surgery: a retrospective cohort study. ***J. Vallis, L. Twells, K. Lester, D. Gregory*****. From Memorial University of Newfoundland, St. John's, Nfld.**

Individuals living with severe obesity report impaired quality of life, increased health services use and costs and increased indirect costs due to absenteeism, disability and reduced workplace productivity. The objective of this study is to determine the impact of bariatric surgery on short-term economic outcomes in patients undergoing laparoscopic sleeve gastrectomy (LSG). A retrospective cohort study was conducted to examine the effect of LSG on economic outcomes. Bariatric surgery clinic patients consented and self-reported, using standardized case report forms, data on use of weight loss interventions and mobility aid purchases, workforce productivity, home productivity and employment status for 12 months before surgery and every 6 months after surgery for up to 2 years. Economic outcomes were compared before and after surgery. Two hundred and one patients were enrolled: 81.6% female, 91% Caucasian, with an average age and BMI of 44 years and 48.78 kg/m^2, respectively. In the year before surgery 76% of patients purchased a weight loss product. At 1 and 2 years after surgery this was reduced to 43.8% and 23.8%, respectively ($p < 0.05$). Similarly, before surgery 13.2% of patients reported requiring mobility aids. This was reduced to 5.2% and 3.6% at 1 and 2 years after surgery ($p < 0.05$). Patients also required less assistance from others. Before surgery, 17.3% of patients reported assistance and this was reduced to 15.4% and 8.3% at 1 and 2 years after surgery ($p < 0.05$). Patients 2 years after surgery were less likely to require sick or disability leave than 1 year before surgery (4.8% and 12.2%, $p = 0.45$). Bariatric surgery as a treatment for severe obesity significantly reduces the economic impact of severe obesity by reducing the indirect costs to both the individual and society.

04

Health service use 12 months before and 24 months after laparoscopic sleeve gastrectomy. ***J. Vallis, K. Lester, D. Gregory, L. Twells*****. From Memorial University of Newfoundland, St. John's, Nfld.**

Bariatric surgery is an effective treatment for severe obesity. As surgeries continue to increase in Canada, there is a need for data to estimate related health services use (HSU) and to inform health policy. Uncertainties exist about the extent to which surgery is associated with reductions in HSU. The objective of this study is to determine the impact of bariatric surgery on short-term HSU in patients undergoing laparoscopic sleeve gastrectomy. We conducted a retrospective cohort study examining the effect of bariatric surgery on HSU (e.g., physician, hospital, emergency department). Eligible patients recruited through the provincial bariatric surgery clinic provided self-reported HSU

data using standardized case report forms at baseline for 12 months before surgery and every 6 months for 2 years. HSU was compared before and after surgery. Two hundred and one surgical patients were enrolled. Approximately 82% were female, with a mean age and BMI of 44 years and 48.78 kg/m^2, respectively. Compared with the pre-surgical year, the average number of family physician visits and utilization of outpatient clinic visits, procedures and other health care professional visits (e.g., dietician, diabetic nurse educator) were significantly reduced at 2 years after surgery ($p < 0.05$). Emergency department visits were not significantly reduced after 2 years compared with before surgery. No significant differences were reported in hospital admissions before and after surgery. Laparoscopic bariatric surgery leads to a significant reduction in the short-term use of direct health care services in the 2 years following surgery.

05

Evaluating the safety of intragastric balloon: a propensity-matched analysis of the Metabolic and Bariatric Surgery Accreditation and Quality Improvement Program (MBSAQIP) database. ***J. Dang*** **(University of Alberta, Edmonton, Alta.),** ***W. Sun*** **(University of Alberta, Edmonton, Alta.),** ***N. Switzer*** **(University of Alberta, Edmonton, Alta.),** ***F. Raghavji*** **(University of Limerick, Limerick, Ireland),** ***D. Birch*** **(University of Alberta, Edmonton, Alta.),** ***S. Karmali*** **(University of Alberta, Edmonton, Alta.).**

Laparoscopic bariatric surgery (LBS) is effective for the treatment of severe obesity, but it is invasive and costly. Intragastric balloons (IGBs) have become increasingly popular as an alternative to LBS with modest short-term weight loss. However, IGBs have been associated with complications, and a comparison of the safety of IGB to LBS is warranted. The objective of this study was to compare the safety profile of IGB with that of LBS through analysis of the Metabolic and Bariatric Surgery Accreditation and Quality Improvement Program (MBSAQIP) database. The MBSAQIP collects data from 791 bariatric surgery centres in the United States and Canada and captures approximately 95% of all bariatric procedures performed in the United States. This registry began recording IGB in 2016 and this offers a valuable opportunity to study IGB in comparison with LBS. LBS included Roux-en-Y gastric bypass (LRYGB) and sleeve gastrectomy (LSG). A propensity-matched analysis was performed between IGB and LBS. Multivariable logistic regression analysis was performed to determine if IGBs were independently associated with major adverse outcomes. A total of 145 408 patients were included in this study: 105 929 (73.2%) underwent LSG, 38 698 (26.8%) underwent LRYGB and 781 (0.5%) underwent IGB therapy. With one-to-one propensity score matching, 684 pairs of IGB and LBS patients were selected. Multivariable logistic regression found that IGB (OR 1.97, CI 1.10–3.52, $p = 0.023$) was independently predictive of 30-day major adverse outcomes. This was due to a significantly higher nonoperative reintervention rate in the IGB cohort (4.2% v 1.0%, $p < 0.001$) from early balloon removal (2.8%). In this propensity-matched analysis, IGBs were associated with a higher major adverse event rate than LBS, due to a 4-times higher nonoperative reintervention rate. The utility of IGB as a primary weight loss intervention should be reconsidered due to its poor safety profile compared with LBS.

06

Predicting venous thromboembolism following laparoscopic bariatric surgery: development of the BariClot tool using the MBSAQIP database. ***J. Dang*** **(University of Alberta, Edmonton, Alta.),** ***N. Switzer*** **(University of Alberta, Edmonton, Alta.),** ***M. Delisle*** **(University of Manitoba, Winnipeg, Man.),** ***M. Laffin*** **(University of Alberta, Edmonton, Alta.),** ***R. Gill*** **(University of Calgary, Calgary, Alta.),** ***D. Birch*** **(University of Alberta, Edmonton, Alta.),** ***S. Karmali*** **(University of Alberta, Edmonton, Alta.).**

Bariatric surgery is an effective treatment for severe obesity; however, postoperative venous thromboembolism (VTE) remains a leading cause of morbidity and mortality. The objective of this study is to develop a tool to stratify individuals undergoing laparoscopic bariatric surgery according to their 30-day VTE risk. This is a retrospective cohort study of the Metabolic and Bariatric Surgery Accreditation and Quality Improvement Program (MBSAQIP) database. This registry collects data specific for metabolic or bariatric surgery with 30-day outcomes from 791 centres. Individuals undergoing primary laparoscopic Roux-en-Y gastric bypass (LRYGB) or laparoscopic sleeve gastrectomy (LSG) were included. Characteristics associated with 30-day VTE were identified using univariate and multivariable analyses. A predictive model, BariClot, was derived from a randomly generated derivation cohort using a forward selection algorithm. BariClot's robustness was tested against a validation cohort of subjects not included in the derivation cohort. The calibration and discrimination of 2 previously published VTE risk tools were assessed in the MBSAQIP population and compared with BariClot. A total of 274 221 patients underwent LRYGB or LSG. Overall, 1106 (0.4%) patients developed VTE, 452 (0.2%) developed pulmonary embolism and 43 (0.02%) died due to VTE. VTE was the most commonly identified cause of 30-day mortality. A prediction model to assess for risk of VTE, BariClot, was derived and validated. BariClot consists of history of VTE, operative time, race and functional status. It stratifies individuals into very high (> 2%), high (1%–2%), medium (0.3%–1%) and low risk groups (< 0.3%). This model accurately predicted events in the validation cohort and outperformed previously published scoring systems. BariClot is a predictive tool that stratifies individuals undergoing bariatric surgery based on 30-day VTE risk. Stratifying low- and high-risk populations for VTE allows for informed clinical decision-making and potentially enables further research on customized prophylactic measures for low- and high-risk populations.

07

The incidence of fractures following bariatric surgery: a systematic review. ***G. Marcil*** **(University of Calgary, Calgary, Alta.),** ***J. Bourget-Murray*** **(University of Calgary, Calgary, Alta.),** ***N. Switzer*** **(University of Alberta, Edmonton, Alta.),** ***S. Shinde*** **(University of Calgary Calgary, Alta.),** ***E. Debru*** **(University of Calgary, Calgary, Alta.),** ***N. Church*** **(University of Calgary, Calgary, Alta.),** ***A. Reso*** **(University of Calgary, Calgary, Alta.),** ***P. Mitchell*** **(University of Calgary, Calgary, Alta.),** ***R. Gill*** **(University of Calgary, Calgary, Alta.).**

Bariatric surgery is a highly effective treatment for severe obesity. While its effect on improvement of the metabolic syndrome is well described, its effect on intrinsic bone fragility and fracture

propagation is unclear. Therefore, the aims of this systematic review of the literature were to examine (1) the incidence of fracture following bariatric surgery, (2) the association of fracture with the specific bariatric surgical procedure and (3) site-specific types of fractures associated with bariatric surgery. A comprehensive literature search was conducted through Medline, Embase, Scopus, Web of Science, Dare, Cochrane Library and HTA database. The search terms used were gastric bypass, sleeve gastrectomy and fracture. For the systematic review, 8 studies were included (n = 42 567 patients). This included no randomized controlled trials. The average patient age was 43.3 ± 4.98 years and 24.9% of patients were male. The average follow-up time was 3.7 ± 1.96 years. A total of 1960 patients had at least 1 fracture of any type, and the total absolute number of fractures encountered was 2326. In all, 4.6% of patients who underwent bariatric surgery suffered from a fracture postoperatively. The greatest risk of fractures was associated with biliopancreatic diversion (BPD) (10.66%), followed by restrictive procedures such as adjustable gastric band (AGB) and sleeve gastrectomy (5.71%), with the Roux-en-Y gastric bypass (RYGB) having the lowest risk (2.66%). Of the fractures encountered, 1466 (63.03%) were of the lower extremity and pelvis and 763 (32.8%) were of the upper extremity. Only 90 (3.87%) axial skeleton fractures were recorded. It appears that the overall risk of sustaining a fracture of any type after undergoing bariatric surgery is approximately 5% after an average follow-up of 3.7 years. The greatest risk of fractures is associated with the BPD, with the RYGB being the most favourable. Fractures following bariatric surgeries tend to follow osteoporotic and fragility patterns. Postoperative supplementation of vitamin D, calcium and weight-bearing exercises need to be optimized, and long-term follow-up studies will be needed to confirm that these interventions will indeed reduce fracture risk following bariatric surgery.

08

The relationship between thyroid hormone levels and bariatric surgery: a systematic review. ***W. Sun, J. Dang, N. Switzer, C. Tian, C. de Gara, D. Birch, S. Karmali.* From the University of Alberta, Edmonton, Alta.**

The imbalance between energy expenditure and storage regulated by thyroid hormones plays an integral role in metabolic disorders such as obesity. Several studies have tried to identify the relationship between thyroid hormone levels and weight loss. We aimed to systematically review the literature to study the relationship between thyroid hormone levels and weight loss for patients undergoing bariatric surgery. A comprehensive search of Medline, Embase, Scopus, the Cochrane Library and Web of Science before May 2017 was completed. Title searching keywords included ["sleeve gastrectomy" OR "gastric bypass"] AND "thyroid." Inclusion criteria included English studies with 5 or more patients, age 16 years or older, patients undergoing primary bariatric surgery, and outcome reporting of pre- or post-operative weight, TSH, free T4 (FT4) or free T3 (FT3). Exclusion criteria included patients diagnosed with overt hyper- or hypo-thyroidism and patients on thyroid replacement therapy. Sixteen primary studies (n = 1556) were included in the systematic review. The average BMI decreased by 12.97 kg/m^2 following bariatric surgery (n = 798; p < 0.00001). TSH decreased by an average of 0.88 mU/L (n = 698; p < 0.0001). FT4 increased by 0.62 pmol/L (n = 246; p = 0.33) and FT3 decreased by 0.57 pmol/L (n = 35; p < 0.0001). Two studies identified 79 patients with subclinical hypothyroidism (SH) preoperatively. Following gastric bypass, TSH decreased on average by 2.84 mU/L (n = 79; p < 0.00001) into euthyroid range, and FT4 increased by 0.36 pmol/L (n = 79; p = 0.69). Four studies found a statistically significant positive correlation between TSH and BMI at baseline. No correlation was identified between baseline TSH and weight loss with bariatric surgery. There is a positive correlation between TSH and BMI at baseline, but no predictors of weight loss were identified. Bariatric surgery leads to a significant decrease in TSH and significant increase in free T4. SH improved or resolved after Roux-en-Y gastric bypass. Further research is needed to try to identify potential hormonal predictors of weight loss associated with bariatric surgery.

09

Do laparoscopic transversus abdominis plane and rectus sheath blocks improve enhanced recovery after bariatric surgery outcomes? ***A. Jarrar, N. Eipe, A. Budiansky, C. Walsh, J. Mamazza.* From the University of Ottawa, The Ottawa Hospital, Ottawa, Ont.**

This study aims to evaluate the efficacy of a laparoscopically guided, surgeon-performed transversus abdominis plane (TAP) and rectus-sheath (RS) block in reducing pain while improving functional outcomes in patients undergoing bariatric surgery. Based on our previous research, 150 patients undergoing elective laparoscopic Roux-En-Y gastric bypass (LRYGB) will be recruited to this double-blinded, placebo-controlled randomized controlled trial from a provincial bariatric centre of excellence. All patients will undergo objective prehabilitation with 6-minute walk test (6MWT) and peak expiratory flow (PEF) that will be measured before and after surgery. Patients will be randomized on a 1:1 basis to either an intervention or placebo group. At the end of the surgery, patients in the intervention arm will receive a total of 60 mL 0.25% Ropivacaine, divided into 4 injections: 2 injections of 20 mL each for TAP and 2 injections of 10 mL each for RS block under laparoscopic visualization. The placebo arm will receive normal saline in the same manner. Standardized surgical and anesthetic protocol will be followed, with careful adherence to established Enhanced Recovery after Bariatric Surgery (ERABS) protocols.Demographic information and relevant medical, surgical and anesthetic data will be collected. Our primary efficacy end point is cumulative postoperative narcotic use. Secondary outcomes are postoperative pain scores, change in PEF and 6MWT with assessment for return to baseline after discharge. Quality of recovery will be also assessed using a validated questionnaire (QoR-40). Statistical analysis will be conducted to assess differences within and between the 2 groups. The repeated measures will be analyzed using a mixed model approach. While this study evaluates the impact of TAP and RS blocks on postoperative pain control and analgesic consumption, it will further confirm the role of objective prehabilitation and protocol standardization in ERABS. If the results show improvement, this study will make a significant contribution to the evidence for laparoscopically guided pain control methods on patient-centric outcomes in ERABS.

10

Marginal ulcer perforation into the pericardium following Roux-en-Y gastric bypass. ***M. Rashid, P. Engels.* From McMaster University, Hamilton, Ont.**

Gastric perforation into the pericardium is a rare complication of benign gastric ulcers. Only a few cases of pneumopericardium due to gastric perforation have been described in the literature. There have been no reported cases of perforated marginal ulcer into the pericardium in post-bariatric surgery patients. We will present a case of marginal ulcer perforation into the pericardium with associated pneumopericardium. A 55-year-old male patient with history of Roux-en-Y gastric bypass 3 years earlier presented with chest pain. Past medical history was noncontributory. The patient had acute-onset severe retrosternal chest pain associated with dyspnea. The patient was tachycardic and hypotensive on vasopressor support. Cardiovascular and respiratory exams revealed faint heart sounds and good air entry bilaterally. No abdominal guarding or peritonitis was identified on abdominal exam. Bloodwork revealed an elevated white blood cell count and mildly elevated high-sensitivity troponins. EKG showed sinus rhythm with ischemic changes and Q waves in inferior leads (Fig. 14). Coronary angiography was performed, revealing normal coronaries. There was concern about pneumopericardium during angiography prompting a CT angiogram of the chest and abdomen demonstrating pneumopericardium from a possible perforated ulcer in the abdomen that tracked up into the pericardium (Figs. 15 and 16). The patient subsequently underwent a diagnostic laparoscopy converted to laparotomy with primary suture repair and omental patch of a perforated gastrojejunal marginal ulcer, pericardial window with evacuation of pyopericardium, diaphragm repair and a pericardial drain placement and placement of roux limb feeding jejunostomy

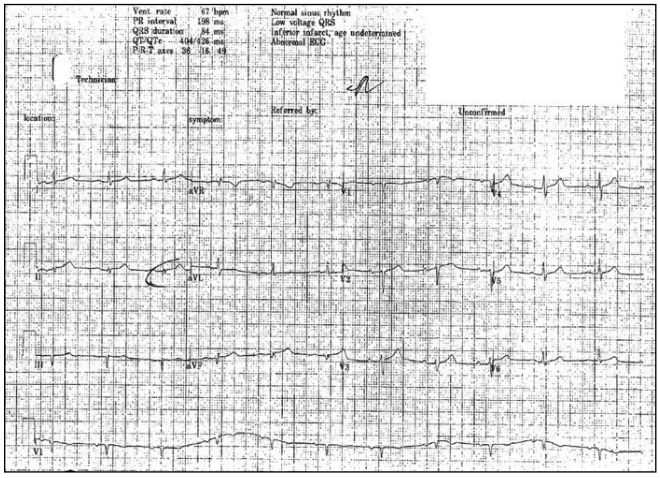


Fig. 14. EKG revealing Q waves and ischemic changes in inferior leads.

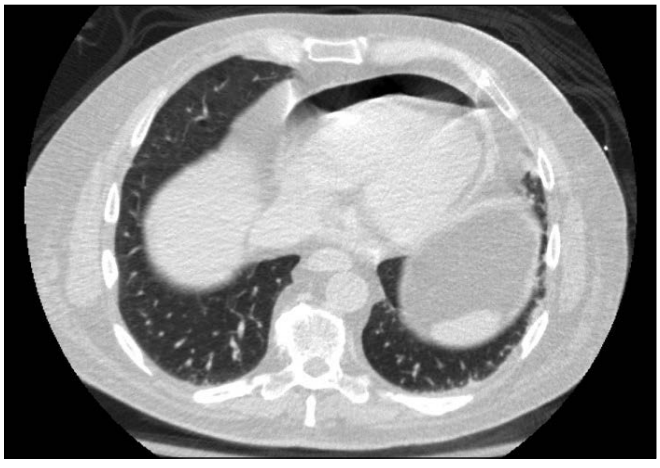


Fig. 15. Axial CT scan of the chest with lung window showing pneumopericardium.

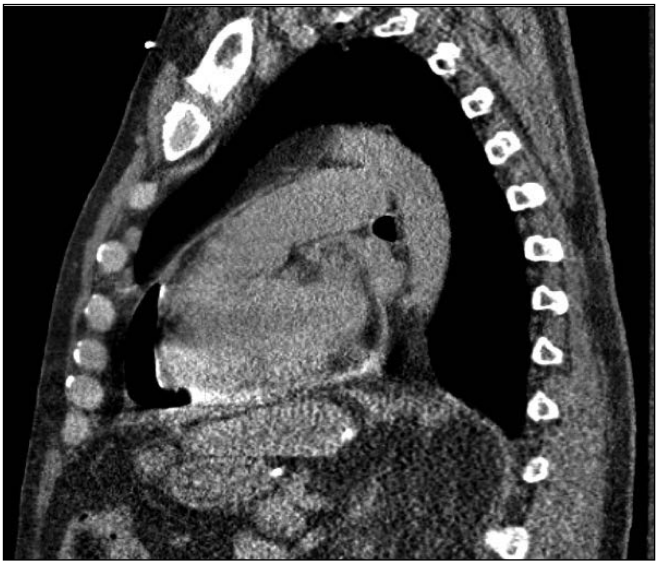


Fig. 16. Sagittal CT scan of the chest with abdominal window showing pneumopericardium.

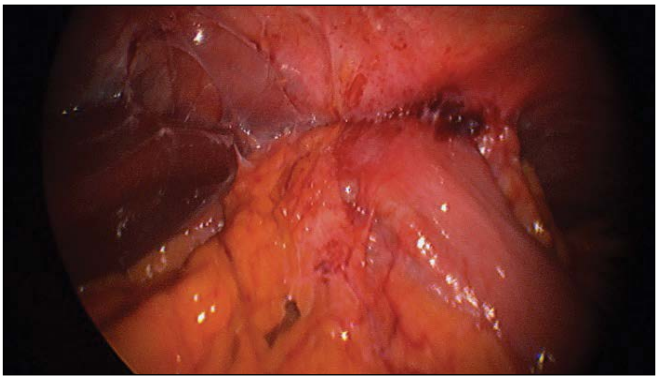


Fig. 17. Laparoscopic view of a fistula between gastrojejunal anastomosis and pericardial cavity.

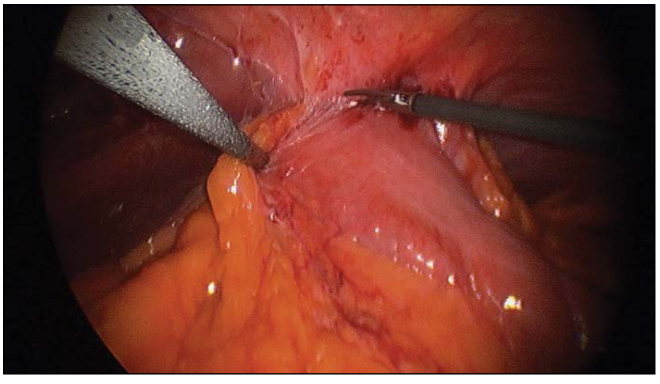


Fig. 18. Laparoscopic view of an attempt of adhesiolysis and takedown of fistula.

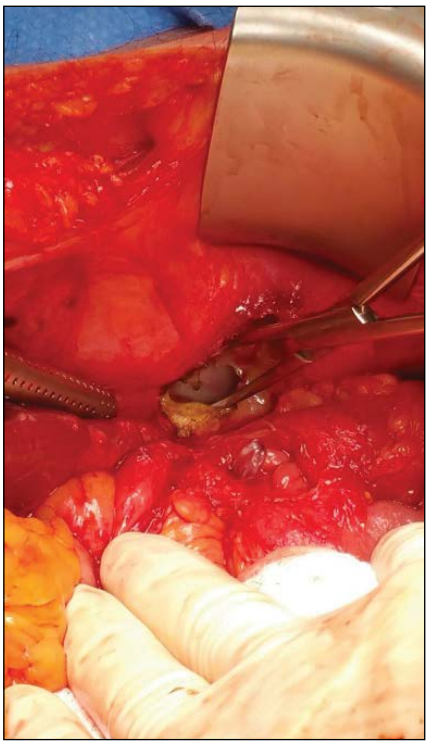


Fig. 19. Takedown of fistula traversing diaphragm into pericardium.

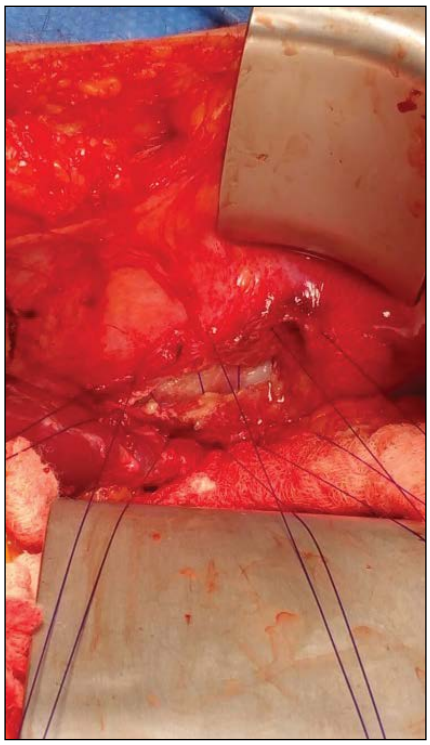


Fig. 20. Placement of 2-0 PDS sutures to primarily close diaphragmatic defect.

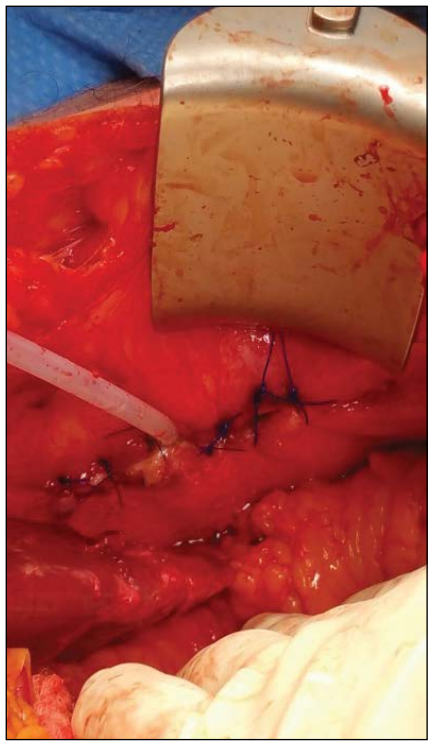


Fig. 21. Closure of diaphragmatic defect and placement of pericardial drain.

tube (Figs. 17–21). Postoperatively, the patient did well and was discharged home on supplemental enteral feeds and intravenous antimicrobial therapy with a plan for esophagogastroduodenoscopy. Pneumopericardium from gastric perforation is extremely rare and yet to be documented in the bariatric surgery population. Coronary and vascular etiologies are primarily considered; however, in the post-bariatric surgery population, we recommend that diagnosis of fistulas between the gastrointestinal tract and pericardium from perforated marginal ulcers be considered.

11
Withdrawn