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ABSTRACTS

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Abstracts

CANADIAN ASSOCIATION OF GENERAL SURGEONS

01

The future of general surgery training: a Canadian resident nationwide Delphi consensus statement. *C. Huynh, N. Wong-Chong, P. Vourtzoumis, S. Lim, W. Marini, G. Johal, M. Strickland, A. Madani.* From the University of British Columbia, Vancouver, B.C. (Huynh, Johal); McGill University, Montreal, Que. (Wong-Chong, Vourtzoumis); the University of Manitoba, Winnipeg, Man. (Lim); the University of Toronto, Toronto, Ont. (Marini, Strickland); and the Columbia University College of Physicians and Surgeons, New York, N.Y. (Madani).

Various pedagogical models have been introduced in an attempt to improve and restructure surgical training, but significant obstacles remain. Before implementing national guidelines, it is critical to explore residents' opinions to ensure a successful transition that meets their needs and addresses the challenges of reformatting surgical residency. This study aimed to establish a nationwide Delphi consensus statement on the opinions and perceptions of Canadian residents regarding the future of general surgery training. Canadian general surgery resident representatives participated in a moderated semistructured focus group using the nominal group technique to discuss issues related to general surgery training across 3 domains: early subspecialization, competency-based medical education (CBME) and a transition-to-practice (TTP) period. Qualitative verbal data were transcribed, grouped into themes and synthesized into a list of recommendation statements. During an iterative Delphi survey, residents ranked each statement on a 5-point Likert scale in terms of agreement. The survey was terminated once consensus was achieved (≥ 2 survey rounds and internal consistency Cronbach's $\alpha \geq 0.80$). Sixty-six statements were synthesized by 16 members of the Canadian Association of General Surgeons Resident Committee. Forty-nine residents participated in the Delphi consensus achieved after 2 voting rounds (Cronbach's $\alpha = 0.93$). Participants agreed that (a) residency should be remodelled to focus on achieving standardized competencies and milestones, based on residents' ability to meet specific measurable metrics; (b) early streaming should be offered after "core" milestones and competencies have been achieved; and (c) an explicit period should allow transition to independent practice with tailored rotations, greater autonomy, patient ownership and resident-run clinics. Ten barriers to CBME implementation were also identified. A nationwide consensus regarding the future of surgical training was established among current residents. These findings can help in the implementation of guidelines and new national curricula that meet trainees' needs and address the many challenges they face in their training.

02

Traumatized: Can mindfulness lead to improved mental health outcomes after multisystem trauma? *E. Clement, A. Lee, A. Ericson, C. Gratton, J. Ryan, T. Clements, M. Kim, C. Ball, S. Widder.* From the University of Alberta, Edmonton, Alta. (Clement, Lee, Ericson, Ryan, Kim, Widder); and the University of Calgary, Calgary, Alta. (Gratton, Clements, Ball).

The incidence of mental health consequences such as depression, anxiety and post-traumatic stress disorders is reported to be as high as 50% in trauma patients. Recently, mindfulness has been used in the

treatment of patients with post-traumatic mental health conditions, and there is mounting evidence for its use in this population. This study sets out to evaluate the utility of a mindfulness-based online tool in patients admitted after traumatic injury. In this prospective cohort study, all adult trauma patients admitted to 2 tertiary care hospitals were screened for inclusion. Eligible patients were enrolled within 48 hours of admission using validated questionnaires for anxiety, depression and resiliency. Patients in the intervention group were introduced to the online tool Stop, Breathe & Think, which they were asked to use daily for 28 days, while patients in the control group had no intervention. After 4 weeks, all participants were contacted, and the questionnaires were repeated. Those in the intervention group also completed a survey about patient experience. One hundred and twenty-three patients were recruited, and 81 completed follow-up. Decreased anxiety scores were seen in both control and experimental groups. Resiliency scores improved in both control and experimental groups but did not reach significance. Of those in the experimental group, 72% used the tool consistently, and 52% said they felt better after use. Fifty-three percent intended to continue using the app, and 77% stated they would recommend it to a friend. Mindfulness-based activities may have a role in improved mental health outcomes in trauma patients. Further studies are warranted to determine which subgroups are likely to achieve the most benefit.

03

Operating room availability for general surgery in 2007 versus 2017 at a regional hospital in BC. *D. DeGirolamo, D. Hwang.* From the University of British Columbia, Vancouver, B.C.

Access to surgical care in Canada is a complex issue. The population is aging, but elective operative time is often cut back. Here we examine all general surgery operations done in the operating room (OR) comparing 2007 with 2017 at a single community hospital focusing on case mix, age of patients, percentage of after-hours OR utilization and cancer diagnosis. All general surgery operations performed in 2007 and 2017 at Vernon Jubilee Hospital (VJH) were collected using Medical Services Plan billing data. VJH is a 165-bed regional hospital located in Vernon, British Columbia. Case mix, after-hours OR utilization, cancer diagnosis and patient ages were analyzed. The data were analyzed in Microsoft Excel for Mac 2011. We used *t* tests to compare patient ages. In 2007 a total of 1925 cases were performed, with 264 elective OR slates and 383 of these occurring after hours (19.9%). A total of 209 of the cases were for a cancer diagnosis. The average age of patients was 56.1 years. The top 3 types of cases were hernias (all types; $n = 453$), cholecystectomies ($n = 233$) and carpal tunnel releases ($n = 213$). In 2017 a total of 1532 cases were performed, with 222 elective OR slates and 386 of these occurring after hours (25.2%). A total of 217 cases were performed for a cancer diagnosis. The average age of patients significantly increased to 57.3 years ($p = 0.09$). The top 3 types of cases were hernias (all types) ($n = 553$), cholecystectomy ($n = 279$) and appendectomies ($n = 115$). Access to OR substantially decreased in a 10-year period, resulting in a 23% reduction in overall surgical cases, predominately because of a 15.9% reduction in the number of elective OR slates. As a result, after-hours cases increased to 25.2% from 19.9% and the proportion of cancer cases on elective slates increased from 13% to 18.1%. Anticipating an aging population with a growing demand for cancer operations, more OR time will need to be allocated to general surgery to meet the demand.

04

Perceptions and barriers to Gastrografin protocol implementation. *A. Kleiman, B. Mador, S. Widder.* From the University of Alberta, Edmonton, Alta.

Adhesive small bowel obstruction (SBO) is one of the most common reasons for general surgery admission. Oral administration of a water-soluble contrast agent, such as Gastrografin, may play both a diagnostic and a therapeutic role in the management of adhesive SBO. Gastrografin use has been shown to be safe and to decrease time to resolution of SBO, need for surgery and length of hospital stay. Despite evidence suggesting that Gastrografin protocols improve patient outcomes and reduce health care costs, they have not gained widespread acceptance. The objective of this study is to gain a better understanding about what barriers to change are limiting Gastrografin protocol implementation. This is a mixed-methods study that gathered information from a survey distributed to multiple stakeholders including nurses, radiologists, surgeons and residents. The survey tool utilized Likert scales and narrative comments with data reported using descriptive statistics. Qualitative analysis was performed on the free-text comments. Eighty-eight responses were received from 4 local hospitals. Survey results were analyzed on the basis of respondent category. All respondent categories were in favour of protocol implementation. Staff radiologists and radiology residents as a group were more likely to have concerns regarding the safety of Gastrografin administration. Staff surgeons and surgical residents believed that compliance with the protocol was the major barrier. Despite these differences, all groups believed that Gastrografin protocols were beneficial to patient care and that protocol implementation would have greater success if more education were provided. This study highlights multiple perceptions including potential barriers to the use of Gastrografin protocols in the management of uncomplicated SBO. These results will allow us to provide tailored quality improvement change cycles, including education, to accomplish our goal of improving patient care via the implementation of a city-wide Gastrografin protocol.

05

Resident opinions and educational experience of a mixed night-float system for general surgery resident call. *R. Ralph-Edwards, B. Greenberg, M. Ott.* From Western University, London, Ont. (Ralph-Edwards, Ott); and the University of Limerick, Limerick, Ireland (Greenberg).

With debate regarding the educational value of duty-hour restrictions among surgical programs in Canada, the optimal approach to call coverage is unknown. General surgery (GS) programs have avoided a night-float approach. There is no consensus in the literature on the effects of night float on quality of life (QOL), educational experience or operative exposure. We propose a mixed short segment night-float (MSSNF) call schedule as an optimal approach. Our objective was to prospectively assess implementation of the MSSNF framework compared with a traditional call model for residents rotating through GS. We hypothesized MSSNF would improve residents' subjective educational experience and satisfaction and increase their ability to attend academic teaching compared with traditional call. Rotating residents in post-graduate year 1 were surveyed at completion of their GS block on their satisfaction with their educational experience, their subjective

assessment of workload and their ability to attend teaching. Surveys were completed before and after implementation of MSSNF. Traditional call (7 in-house 24-hour shifts/month) was compared with MSSNF (5 consecutive 5 pm–7 am in-house shifts with 7 am–5 pm allotted for recovery postcall). Two nonconsecutive 24-hour weekend shifts/month were also completed with SSNF. Of the 44 surveyed, 41% were surgical residents. Residents ranked overnight consults as the greatest source of learning on GS. More residents in MSSNF felt overnight workload was less compared with other rotations (41% v. 5%), and 36% more felt call was less with MSSNF. More found overnight work a useful educational experience with MSSNF (91% v. 41%), and 91% were able to attend teaching (v. 86% with traditional call). This first trial of MSSNF on GS has shown that mixed night-float coverage is feasible and well received, congruent with findings of improved QOL and educational experience seen in other studies. A mixed model provides subjective decreased workload and improved opinion of educational experience on call. Future studies may evaluate operative exposure and resident fatigue with this mixed model.

06

A scoping review of best management for hepato-pancreato-biliary trauma. *L. Streith, J. Silverberg, A. Kirkpatrick, C. Ball.* From the University of Calgary, Calgary, Alta.

Hepato-pancreato-biliary (HPB) traumas are among the most challenging injuries to manage within acute care surgery. The primary aim of this scoping review was to categorize the literature on HPB injuries, identify the best treatments and examine the content and evidence upon which they are based. We searched Medline, Embase, PubMed, Scopus, Web of Science and the Cochrane Library (1950 to 2019) and the grey literature for original and non-original citations reporting HPB injuries and their treatments in civilian and military trauma patients. Among 8438 citations identified, we included 1566 peer-reviewed articles in the scoping review. Of these, 183 (11.6%) unique manuscripts focused on HPB trauma. This included publications outlining liver (109), pancreas (102), duodenum (25) and biliary (5) injuries. The majority (86.3%) were retrospective injury series with a median of 107 included patients. Only 9.3% were prospective studies. While most studies described a mixture of blunt and penetrating mechanisms (41.5%), some publications were limited to blunt (32.2%) or penetrating (11.5%) trauma. The articles were most commonly American (50.8%) or South African (11.5%) in origin. Among hepatic injuries, selective nonoperative management remained the standard of care, as influenced by the advance of angiographic therapies. Outcomes associated with high-grade pancreatic injuries are improved with the involvement of a formally trained HPB surgeon. Computed tomography remains insufficient to define many pancreatic ductal injuries because of inadequate test performance. Therapies include pancreatoduodenectomy for complex pancreato-duodenal injuries. The management of extrahepatic biliary injuries (gallbladder and/or common bile duct) remains primarily operative. Magnetic resonance cholangiopancreatography and endoscopic retrograde cholangiopancreatography continue to be very helpful. Damage control strategies have improved outcomes for both operative and nonoperative HPB scenarios. HPB injuries define complex, multidisciplinary trauma care. Involvement of an HPB expert is widely helpful. Damage control resuscitation has led to improved outcomes in patients with HPB injuries.

07

Simultaneous versus staged resection for synchronous colorectal liver metastases: a population-based cohort study. *J. Bogach, J. Wang, C. Griffiths, S. Parpia, R. Saskin, J. Hallet, L. Ruo, M. Simunovic, P. Serrano.* From McMaster University, Hamilton, Ont. (Bogach, Wang, Griffiths, Parpia, Saskin, Ruo, Simunovic, Serrano); and the University of Toronto, Toronto, Ont. (Hallet).

Simultaneous resection of colorectal cancer primary and liver metastases is not performed routinely because of concerns about safety. We hypothesized that simultaneous resection has steadily increased over time and that the outcomes are similar. We conducted a population-based cohort study of patients undergoing resection for synchronous (resection of the primary colorectal cancer and liver metastases within 6 months) liver metastases from 2006 to 2015 by linking administrative data sets. Outcomes included postoperative complications, length of hospital stay and overall survival. Survival for the staged group was measured from the last surgical resection to death and estimated using Kaplan-Meier methods and compared with the log-rank test. Cox proportional hazard models were used to calculate risks for death. We aimed to identify practice patterns and outcomes of simultaneous versus staged resections for these patients. Of 2738 patients undergoing colorectal and liver resection for colorectal cancer, 1168 had synchronous disease, of whom 442 underwent simultaneous resection. The rate of synchronous disease increased on average by 3% per year ($p = 0.02$). The median length of stay was shorter (8 v. 11 d, $p < 0.001$), the rate of major liver resections was lower (17% v. 65%, $p < 0.001$), and 90-day postoperative mortality was higher (6% v. 1%) for simultaneous resections. Major postoperative complications were higher in the simultaneous group (28% v. 23%, $p = 0.067$), mostly because of a higher reoperation rate (6% v. 3%, $p = 0.034$). Median overall survival was worse with simultaneous resection (40 mo, 95% confidence interval [CI] 35–46, v. 78 mos, 95% CI 59–86). Risk factors for worse survival were comorbidities, rurality, right-sided primary and simultaneous resection. There is selection bias that favours survival in the staged group, as patients must have survived the first operation and have stable disease to undergo the second operation. Simultaneous resection is associated with worse postoperative outcomes. Considering selection bias, randomized studies would be necessary to determine the role of simultaneous resection.

08

Weight loss following hepatopancreatobiliary surgery. How much is too much? *B. Zhang, S. Ghazi Faisal, L. Ruo, M. Simunovic, M. Pinto Sanchez, P. Serrano.* From McMaster University, Hamilton, Ont. (Zhang, Ruo, Simunovic, Pinto Sanchez, Serrano); and the Royal College of Surgeons in Ireland, Dublin, Ireland (Ghazi Faisal).

There is some controversy regarding the extent of weight loss commonly seen after hepato-pancreato-biliary (HPB) surgery. We assessed the percentage of weight loss and rates of postoperative complications in these patients. We conducted a retrospective cohort study of consecutive patients undergoing HPB surgery from 2011 to 2016 at a single institution (50% pancreaticoduodenectomies, 40% hepatectomies and 10% other biliary

surgery). Outcomes included percent change in postoperative weight, incidence of postoperative complications and nutritional clinical marker correlates at 1, 3 and 6 months postoperatively compared with baseline. Clinically significant weight loss was defined as weight loss greater than 10%. Kruskal-Wallis and Wilcoxon tests and logistic regression were used for statistical analysis, when appropriate. Among 262 patients, there was a significant decrease in percent weight loss at 3 months compared with baseline (median 76 kg v. 72 kg, $p < 0.001$). Patients who experienced major postoperative complications had a greater median percent weight loss at 3 months (–11%, interquartile range [IQR] –17% to –7%, v. –4%, IQR –10% to –1%, respectively, $p < 0.001$). These patients also had a significantly higher percent change in albumin at 1 month (–28% v. –9%, $p = 0.003$) and at 3 months (–26.0% v. 0%, $p < 0.001$) and did not tend to recover their weight as much (6-mo median percent weight loss 9% v. 3%, $p < 0.001$). Predictors of clinically relevant weight loss at 3 months were pancreaticoduodenectomy (odds ratio [OR] 4.7, 95% confidence interval [CI] 4.4–5.1, $p = 0.008$), major complications (OR 3.39, 95% CI 1.4–8.3, $p = 0.008$) and minor complications (OR 2.53, 95% CI 1.2–5.3, $p = 0.014$). Patients undergoing HPB surgery experience substantial weight loss at 3 months, and the weight is not recovered at 6 months. Patients with major complications have increased risk of weight loss at 3 and 6 months, which highlights the importance of nutritional assessment and follow-up in these populations.

09

Uptake and patient outcomes of laparoscopic liver resection for colon cancer liver metastases: a population-based analysis. *J. Wang, C. Griffiths, M. Simunovic, S. Parpia, L. Ruo, S. Cleary, P. Serrano.* From McMaster University, Hamilton, Ont. (Wang, Griffiths, Simunovic, Parpia, Ruo, Serrano); and the Mayo Clinic, Rochester, Minn. (Cleary).

Uptake of minimally invasive liver resection (MILR) for colorectal cancer is unclear. We used a population-based cohort to measure uptake and short- and long-term outcomes. We linked hospital administrative data sets (2006–2015) to create a population-based cohort study. Three region-based hospital groups were categorized by their relative rate of MILR (e.g., low rate, medium rate and high rate) and compared by uptake, readmissions, postoperative complications and length of hospital stay (LOS). Multivariable analysis clustered by hospital region was performed using logistic regression to determine risk factors associated with LOS and complications. Costs were analyzed and compared using t tests. Of the 2991 liver resections performed on 2675 patients, 443 (15%) were MILR. This proportion varied significantly among region-based hospital groups: 4% (37/1008) in the low-rate group ($n = 891$), 14% (133/1075) in the medium-rate group ($n = 965$) and 28% (233/912) in the high-rate group ($n = 819$). The rate of MILR increased by 1.1% per year (from 10% to 19%, $p = 0.02$). There was no change over time in the low-rate group, whereas in the medium- and high-rate groups, it increased an average of 1.6% and 1.4% annually, respectively. For all groups, the postoperative complication rate was 18% and 90-day mortality was 3%. By multivariate analysis, Charlson comorbidity score of 2 or more was associated with major postoperative complications (odds ratio 4.79, 95% confidence interval 2.29–10.0). High-rate and medium-rate centres had a shorter

median LOS compared with the low-rate group (6 v. 7, $p = 0.001$). Costs for hospital admission for the initial operation for the low-rate group were significantly higher than for the medium- and high-rate groups by \$2844 ($p = 0.007$) and \$1890 ($p = 0.047$), respectively. The proportion of MILR is low, and the uptake over time is increasing slowly among medium- and high-rate hospital groups. The relatively similar LOS and postoperative outcomes may be the reason for the reluctant enthusiasm seen among surgeons.

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Simultaneous resection of colorectal cancer with synchronous liver metastases: a survey-based analysis. *C. Griffiths, J. Bogach, M. Simunovic, L. Ruo, J. Hallet, P. Serrano.* From McMaster University, Hamilton, Ont. (Griffiths, Bogach, Simunovic, Ruo, Serrano); and the University of Toronto, Toronto, Ont. (Hallet).

The decision to proceed with simultaneous or staged resection in synchronous colorectal cancer liver metastases varies greatly and is usually left to the involved surgeon. We examined practice intentions and determined barriers to performing simultaneous resection. We developed and pilot tested a tailored questionnaire. Members of the Society of Surgical Oncology and the College of Physicians and Surgeons in different provinces who provide colorectal cancer care were surveyed electronically. Four clinical scenarios of synchronous disease with gradually increased complexity determined practice intentions. Perceived outcomes and barriers were assessed on a 7-point Likert scale and compared between general and hepatobiliary surgeons using the Mann-Whitney U test for continuous variables and χ^2 test for categorical variables. There were 184/1335 surgeons (14% response rate), including 50 general and 134 hepatobiliary surgeons. A high likelihood score for simultaneous resection (i.e., Likert score $\geq 5-7$) varied among the 4 scenarios. The score for general and hepatobiliary surgeons, respectively, included the following: for minor liver and low-complexity colon resection, 83% and 98% ($p < 0.001$); for minor liver and rectal resection, 57% and 73% ($p = 0.042$); for complex liver resection and low-complexity colon resection, 26% and 24% ($p = 0.858$); and for complex liver and rectal resection, 11% and 7.0% ($p = 0.436$). Hepatobiliary surgeons were more likely to perform simultaneous resections in their centres. All perceived that simultaneous resection increases postoperative morbidity (63%) but not mortality (69%). Among hepatobiliary surgeons, the most common barriers for simultaneous resections were patient comorbidities and extrahepatic disease, whereas general surgeons were more concerned about transfer to another facility. Surgeon support for simultaneous resection increased with less complex surgery and was higher among hepatobiliary versus general surgeons. Surgeons' perceived practice patterns and barriers to simultaneous resection will identify knowledge gaps, guide future clinical trials and help establish disease care pathways.

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When is it safe to start VTE prophylaxis after blunt solid organ injury? A prospective study from a level I trauma centre. *M. Schellenberg, K. Inaba, P. Heindel, S. Biswas, E. Benjamin, A. Strumwasser, K. Matsushima, L. Lam, D. Demetriades.* From LAC+USC Medical Center, Los Angeles, Calif.

The optimal timing of venous thromboembolism (VTE) prophylaxis initiation after blunt solid organ injury is controversial. Retrospective studies suggest initiation within 48 hours is safe. This prospective study examined the timing of VTE prophylaxis initiation among patients managed nonoperatively after blunt solid organ injury to determine the optimal window for initiation of VTE prophylaxis. All patients presenting to our American College of Surgeons verified level I trauma centre after blunt trauma (Dec. 1, 2016 to Nov. 30, 2017) were prospectively screened. Patients were included if solid organ injury (liver, spleen and/or kidney) was diagnosed on admission computed tomography scan and nonoperative management was planned. Exclusion criteria were death in the emergency department, transfer, preexisting bleeding disorder or home antiplatelet/anticoagulant medication. Demographics, injury/clinical data, type/timing of VTE prophylaxis initiation and outcomes were collected. Patients were dichotomized into study groups: those who underwent VTE prophylaxis initiation within 48 hours versus longer than 48 hours after hospital admission. Outcomes were compared using multivariate analysis. After exclusions (13%), 158 patients were identified. Liver injuries were most common ($n = 80$, 51%), followed by spleen ($n = 58$, 37%) and kidney ($n = 40$, 25%) injuries. Median American Association for the Surgery of Trauma grade of injury was 2 (interquartile range [IQR] 2–3) for liver, 2 (IQR 1–3) for spleen and 3 (IQR 1–3) for kidney. Compared with patients initiated on VTE prophylaxis more than 48 hours after admission ($n = 97$, 61%), patients initiated within 48 hours ($n = 61$, 39%) had significantly fewer VTEs (adjusted odds ratio 0.140, 95% confidence interval 0.014–0.858, $p = 0.0498$). No patient in either group required delayed intervention for bleeding. There was no difference between groups in the volume of postprophylaxis blood transfusion. In this prospective study of patients with blunt solid organ injuries managed nonoperatively, early (≤ 48 h) initiation of VTE prophylaxis resulted in a lower incidence of VTE without an associated increase in bleeding or need for intervention. Early initiation of VTE prophylaxis is likely to be beneficial for patients with blunt solid organ injury.

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Undertriaged trauma patients: Who are we missing? *M. Schellenberg, E. Benjamin, J. Bardes, K. Inaba, D. Demetriades.* From the LAC+USC Medical Center, Los Angeles, Calif.

Trauma team activation (TTA) criteria, set by the American College of Surgeons (ACS) Committee on Trauma (COT), are used to identify patients prehospital who are at highest risk for severe injury and mobilize the optimal resources. Patients are undertriaged if they are severely injured (Injury Severity Score [ISS] ≥ 16) but do not meet standard trauma team activation (TTA) criteria. The study objectives were to examine the epidemiology and injury patterns of undertriaged patients and the potential clinical effects of undertriage. All patients presenting to our level I trauma centre (June 2, 2017, to May 31, 2018) were screened for inclusion using ACS COT TTA criteria. Demographics, injury/clinical data and outcomes of undertriaged patients were analyzed. Undertriaged patients were further subcategorized as "high risk" if they expired or required emergent intervention. A total of 233 undertriaged patients were identified from 1423 routine trauma consults (16%).

Median ISS was 19 (interquartile range [IQR] 17–22). Most undertriage occurred following blunt trauma ($n = 225$, 97%), most commonly after motor vehicle collisions ($n = 66$, 28%) and auto versus pedestrian collisions ($n = 52$, 22%). Thirty-two patients (14%) were identified as high-risk undertriaged patients: 16 (50%) required emergency surgery (mainly craniectomy; $n = 10$, 63%), 7 (22%) required procedural intervention and 14 patients (44%) died. In this high-risk group, the cause of death was almost exclusively traumatic brain injury (TBI) ($n = 13$, 93%). Of the patients who died of TBI, the majority had a depressed Glasgow Coma Scale (GCS) on presentation to the emergency department (< 11) ($n = 10$, 77%) despite not meeting field criteria for TTA. In conclusion, undertriage rates are relatively low, particularly after penetrating trauma. However, there is a high-risk population that is not captured, among whom mortality and need for emergent intervention are high. Most undertriage deaths are secondary to severe TBI. Despite not qualifying for the highest level activation, patients with head trauma and GCS less than 11 on admission are at high risk for adverse outcomes and additional resource mobilization should be considered.

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Trauma team activation at a level I trauma centre: time of day matters. *M. Schellenberg, K. Inaba, B. Love, Z. Warriner, M. Forestiere, E. Benjamin, L. Lam, D. Demetriades.* From the LAC+USC Medical Center, Los Angeles, Calif.

The American College of Surgeons (ACS) Committee on Trauma specifies prehospital criteria that trigger trauma team activation (TTA). The study objectives were to define the relationship between TTA and time of day, mechanism of injury and need for operative intervention. All trauma patients presenting to our ACS-verified level I trauma centre (January 2008 to July 2018) after triggering TTA were screened. Patients were excluded if time of emergency department arrival was undocumented. Demographics, injury data and outcomes were analyzed. After exclusions ($< 1\%$), 54 826 patients were enrolled. Median age was 35 years (interquartile range 23–53). Median Injury Severity Score was 4 (IQR 1–10). The most common mechanisms of injury were falls ($n = 14 166$; 31%), auto versus pedestrian collisions (AVPs; $n = 11 921$; 26%) and motor vehicle collisions (MVCs; $n = 11 024$; 24%). Penetrating trauma comprised 16% ($n = 8686$). Mechanism of injury varied with time of day, with penetrating trauma most commonly occurring from 2300 to 0100, falls occurring during the afternoon; MVCs from 02:00 to 0400 and AVPs occurring from both 0800 to 0900 and from 1800 to 1900. The busiest hour for TTAs was 1900–2000 and the quietest hour for TTAs was 0500–0600. Emergent surgical intervention in absolute numbers was most frequent between 2000 and 0100. As a proportion of the number of TTAs per hour, emergent operative intervention was most frequent between 2300 and 0600. In conclusion, the volume of TTAs and the triggering mechanism of injury vary significantly by time of day. The association between injury mechanism and time of day may indicate potential targets for injury prevention programs. The need for operative intervention is highest overnight, a time at which operating room staffing is frequently reduced. These data can be used to help increase hospital preparedness and allocate resources accordingly.

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The diagnostic dilemma of shotgun injuries. *M. Schellenberg, K. Inaba, P. Heindel, M. Forestiere, D. Clark, K. Matsushima, L. Lam, D. Demetriades.* From the LAC+USC Medical Center, Los Angeles, Calif.

Shotgun wounds pose diagnostic challenges because of variable depth of penetration and degradation of computed tomography (CT) images. The study objectives were to compare the epidemiology and outcomes between shotgun wounds and gunshot wounds (GSWs) and defined the diagnostic capabilities of CT scan after shotgun wounds. All patients presenting to our American College of Surgeons verified level I trauma centre after ballistic injury (January 2008 to March 2017) were included. Demographics, clinical data and outcomes were collected. Study groups were defined as patients injured by shotgun versus patients with GSWs. The diagnostic yield of CT scan after shotgun wounds was calculated. Of 3177 patients with ballistic injury, 3126 (98%) were injured by GSWs and 51 (2%) by shotgun wounds. Compared with patients injured by GSWs, those injured by shotgun wounds had a similar Injury Severity Score (10 v. 11, $p = 0.586$) and mortality (12% v. 13%, $p = 1.000$). Patients injured by shotgun required fewer cavitory explorations (25% v. 59%, $p = 0.006$) but more soft tissue (21% v. 8%, $p = 0.013$) and extremity vascular (86% v. 9%, $p < 0.001$) surgeries. Of the patients injured by shotgun, 5 (10%) had superficial wounds, 8 (16%) were brought emergently to the operating room (OR) and 38 (74%) underwent CT. Of those undergoing CT scan, 10 (26%) were then brought to OR and 28 (74%) underwent a trial of nonoperative management. One of these patients required delayed laparotomy for missed hollow viscus injury. One of 3 (33%) cavitory explorations and 1 of 6 (17%) extremity vascular explorations were nontherapeutic. The sensitivity, specificity, positive predictive value and negative predictive value of CT scan for injury after shotgun wounds were 0.93, 0.96, 0.93, and 0.97. In conclusion, shotgun injuries are infrequent. Patients injured by shotguns have considerable rates of nontherapeutic and delayed operations as well as false-positive and -negative CT scans. A high index of suspicion for injury and a period of observation after negative CT scan may therefore be prudent after shotgun injury.

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Evaluating the efficacy of self-study videos for the surgery clerkship rotation: an innovative project in undergraduate surgical education. *N. Mookerji, J. El Haddad, P. Thin Vo, B. Lam, C. Seabrook, R. Feibel, S. Bennett.* From the University of Ottawa, Ottawa, Ont.

As a large portion of surgical clerkship learning occurs in the clinical environment, standardization of the curriculum is a challenge. In recent years, computer-based educational videos have become valuable resources in medical education and may address some of the pitfalls of traditional learning. To ensure clerkship students have adequate exposure to the required objectives, a series of objective-aligned self-directed learning videos were developed covering core urology concepts alongside general surgery and orthopedics. The objective of the study was to test the efficacy of objective-aligned video podcasts in the surgery clerkship rotation. Nineteen video podcasts were created: 10 in general surgery, 5 in urology and 4 in orthopedic surgery. The videos

were made by medical students and edited by senior surgical residents. For each video, a 10-question multiple choice quiz was developed and administered before and after the video. A participant satisfaction survey was also completed after viewing. Paired *t* test analysis was conducted to test the efficacy of these videos comparing pre and post-test results. The clerkship class was provided with a generic username and password to access the videos. A total of 302 paired pre- and post-test scores were completed. There was an average increase from pre-test to post-test scores of 2.6 points ($p < 0.0001$). On a Likert scale from 1 to 5, students rated the usefulness of the videos as 4.3 and the quality of the content as 4.3. Ninety-eight percent of students reported they would recommend these videos to their classmates and 81% preferred this modality over more traditional methods. This teaching modality has proven to be an effective adjunct educational tool when comparing pre- and post-test scores and user satisfaction scores for medical students during their surgical clerkship.

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Systematic review and meta-analysis: preoperative anti-TNF therapy does not increase the risk of postoperative complications in patients with inflammatory bowel disease undergoing elective surgery. *L. Yang, A. Istl.* From Western University, London, Ont.

Anti-tumour necrosis factor (TNF) therapy may be interrupted in patients with inflammatory bowel disease (IBD) to avoid the risk of complications following elective surgery. We conducted a systematic review and meta-analysis to quantify the risk of postoperative complications among IBD patients receiving anti-TNF agents before elective surgery. Databases were searched from inception through Jan. 10, 2018, for controlled studies comparing postoperative complication rates in IBD patients undergoing elective IBD or non-IBD related surgery who received preoperative anti-TNF therapy versus those who did not. The primary outcome was the proportion of patients who developed infectious complications. Secondary outcomes included the incidence of any complication and specific infection types. Pooled incident rates, risk differences (RDs), risk ratios (RRs) and 95% confidence intervals (CIs) were calculated. Fourteen retrospective cohort studies were eligible. The pooled postoperative infection rate was 20.4% and 16.4% in the preoperative anti-TNF therapy and control groups, respectively (RD 2.4%, 95% CI 3.6%–8.5%, $p = 0.44$; RR 1.13, 95% CI 0.96–1.34). No statistically significant differences in complication rates, including the incidence of anastomotic leak, wound infection, intra-abdominal abscess, pneumonia, urinary tract infection and *Clostridium difficile* infection, were observed when cessation and continuation of preoperative anti-TNF therapy were compared. The overall quality of evidence for all outcomes was low to very low. Preoperative anti-TNF therapy was not associated with an increased risk of complications in IBD patients undergoing elective surgery. Additional data are needed, especially for agents with differing modes of action and extra-intestinal surgeries.

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Simulation platforms to assess laparoscopic suturing skills: a scoping review. *E. Bilgic, M. Alyafi, T. Hada, T. Landry, G. Fried, M. Vassiliou.* From McGill University, Montreal, Que.

Laparoscopic suturing (LS) has become a common technique used in a variety of advanced laparoscopic procedures. However, LS is a challenging skill to master, and many trainees may not be competent in performing LS at the end of their training. The purpose of this review is to identify simulation platforms available for assessment of LS skills and determine the characteristics of the platforms and the LS skills that are targeted. A scoping review was conducted between January 1997 and October 2018 for full-text articles. The search was done in various databases. Only articles written in English or French were included. Additional studies were identified through reference lists. The search terms included “laparoscopic suturing” and “clinical competence.” Sixty-two studies were selected. The majority of the simulation platforms were box trainers with inanimate tissue and targeted basic suturing and intracorporeal knot-tying techniques. Most of the validation came from internal structure (rater reliability) and relationship to other variables (compare training levels/case experience, various metrics). Consequences were not addressed in any of the studies. We identified many types of simulation platforms that were used for assessing LS skills, with most being for assessment of basic skills. Platforms assessing the competence of trainees for advanced LS skills were limited. Therefore, future research should focus on the development of LS tasks that better reflect the needs of the trainees.

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Cost analysis of simultaneous versus staged resection of colorectal cancer liver metastases: a population-based study. *J. Wang, S. Parpia, C. Gu, A. Gafni, P. Serrano.* From McMaster University, Hamilton, Ont.

Simultaneous resection of synchronous colorectal cancer liver metastases is considered safe. We aimed to determine whether performing simultaneous (v. staged) resection is cost-saving at the population level. We conducted a population-based cohort study by linking provincial administrative health care data sets from 2006 to 2015. Resection of colorectal cancer and liver metastases within 6 months was considered synchronous. Cost analysis compared simultaneous (same hospital admission) and staged resections from the perspective of a third-party payer. Median costs with range were estimated using the log-normal distribution of cost using *t* tests with a 1-year time horizon. The estimated median cost per patient in the 559 patients undergoing staged resection was \$64 807 (range \$15 686 to \$635 166) and in the 442 patients undergoing simultaneous resection it was \$51 888 (range \$3024 to \$596 943); the median difference was \$12 919 ($p < 0.001$). Overall costs for the staged group were greater despite a higher cost for readmission to hospital for the simultaneous approach (median difference \$6700, $p < 0.001$), which was probably related to a substantially higher postoperative complication rate (28% v. 23%, $p = 0.067$). The primary cost driver was all costs related to the hospital admission for liver and colon resection, which were higher for the staged approach (median difference \$16 121, $p < 0.001$), mainly because of a longer length of hospital stay (11 v. 8 d, $p < 0.001$). The cost of staged resection of synchronous colorectal cancer liver metastases is significantly higher compared with the simultaneous approach, mostly driven by a shorter length of hospital stay, which was not offset by the higher cost of caring for postoperative complications.

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Complementary and alternative medicine use among general surgery patients in Nova Scotia. E. Roach, L. Helyer. From Dalhousie University, Halifax, N.S.

Use of complementary and alternative medicines (CAM) among the general Canadian population is reported to be high. Health care providers have a responsibility to identify CAM use among their patients, partly out of a duty to provide patient-centred care but also because of an emerging understanding of the potential risks associated with some types of CAM. We sought to identify trends in the pattern of CAM usage among general surgery patients in Nova Scotia. We conducted a survey of patients attending general surgery clinics in Halifax, Nova Scotia, from October to December 2017. These clinics include patients with both benign and malignant conditions. Demographic data were collected including medical history and details of CAM use. We used χ^2 analyses to test for relationships between independent variables and CAM use. A total of 195 patients completed the survey; 128 (65.6%) reported using 1 or more CAM practice. Vitamins (78.1%), massage (21.1%) and chiropractic (19.5%) were the most commonly reported practices. Age, gender and income were not correlated with CAM use. Patients with only a high school diploma were significantly less likely to use CAM than patients with higher levels of formal education (χ^2 [2, $n = 194$] = 0.9.5, $p = 0.009$). Patients with a cancer diagnosis were not more likely to use CAM (χ^2 [1, $n = 195$] = 0.104, $p = 0.75$). Improving nutrition, immune system and energy level were the most commonly cited reasons for using CAM. Fewer than 15% of patients reported disclosing CAM use to their surgeons. CAM use is highly prevalent among general surgery patients in NS in patients with both benign and malignant disease. Most patients do not disclose this information to their surgeon and some of these practices have described risks relevant to the perioperative period. Surgeons should make an effort to initiate discussions about CAM use with their patients.

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General surgery in Canada: current scope of practice and future needs. T. Schroeder, C. Sheppard, D. Wilson, C. Champion, S. DiMillo, R. Kirkpatrick, S. Hiscock, R. Friesen, L. Smithson, P. Miles. From McMaster University, Hamilton, Ont. (Schroeder); the University of Calgary, Calgary, Alta. (Sheppard); the Canadian Association of General Surgeons, Ottawa, Ont. (Wilson); the University of Ottawa, Ottawa, Ont. (Champion); the Royal College of Physicians and Surgeons of Canada, Ottawa, Ont. (DiMillo); the Northern Ontario School of Medicine, Sudbury, Ont. (Kirkpatrick); the University of British Columbia, Vancouver, B.C. (Hiscock); the University of Saskatchewan, Saskatoon, Sask. (Friesen); Memorial University, St. John's, Nfld. (Smithson); and the University of Alberta, Edmonton, Alta. (Miles).

The scope of practice of general surgeons in Canada is highly variable. The objective of this study was to examine the demographics of general surgeons in Canada and compare surgical procedures performed across community sizes and specialties. The National Physician Database (NPDB) of the Canadian Institute for Health Information was used to analyze fee-for-service

(FFS) care provided by general surgeons and other providers across Canada from 2015 to 2016. Across 8 Canadian provinces, 1669 general surgeons provided FFS care. The majority of surgeons worked in communities with over 100 000 citizens (71%), were male (78%), were between the age of 35 and 54 years (56%) and were Canadian medical graduates (76%). Only 7% of general surgeons practised in rural areas and 14% in communities with between 10 000 and 50 000 citizens. Rural communities were significantly more likely to have surgeons who were international medical graduates or older than 65 years of age. The most common surgical procedures performed were hernia repairs, gallbladder and biliary tree surgery, excision of skin tumours, colon and intestine resections and breast surgery. Many general surgeons performed procedures not listed in their Royal College of Physicians and Surgeons of Canada training objectives. Canadian general surgeons provide a wide array of surgical services. Practice patterns vary by community size. Surgeons practising in rural and small communities require proficiency in skills not routinely taught in general surgery residency. Opportunities to acquire these skills should be available in training to prepare surgeons for their career and to meet the care needs of Canadians.

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Impact of dedicated operating time on access to surgical care in an acute care surgery model. A. Albarrak, C. Chiu, O. Panton, A. Meneghetti, M. Meloche, A. Liu, L. Chen. From the Vancouver General Hospital, Vancouver, B.C. (Albarrak, Chiu, Panton, Meneghetti, Meloche); and the University of British Columbia, Vancouver, B.C. (Liu, Chen).

Acute care surgery (ACS) has gained momentum and become the preferred care model for acutely ill general surgical patients. One of the key components to enhance this model is immediate access to the operating room (OR). In many institutions with an ACS model, a block of OR time is allocated to the service to facilitate the large volume of cases, reduce overall wait time and decrease nighttime operations. In our institution, this block of daytime OR is referred to as the protected time (PT). OR wait times for common ACS diagnoses such as appendicitis and cholecystitis are routinely used as an indicator to reflect the adequacy of accessibility to surgical care. This study is a retrospective review to determine the impact of PT on wait times for common ACS diagnoses including appendix and biliary disease. In 2017 when the PT was initiated, a total of 1558 cases were done. Seventy-three percent of the cases were performed in the PT period. The most common cases in PT included oncology (33%), biliary disease (17%), appendix (15%), hernia (8%) and benign colorectal disease (7%). However, an additional 50% of the appendix and 22% of the biliary disease cases were still done outside of the PT, occupying significant nighttime OR. Comparing accessibility to OR, from emergency department registration to OR start time, before and after the implementation of PT in our institution, no significant improvement was found for appendix and biliary disease ($p = 0.94$ for appendicitis, $p = 0.65$ for acute cholecystitis, $p = 0.19$ for nonacute biliary disease). In conclusion, despite implementation of PT, the OR wait time for common ACS diseases remains unchanged. Institutional review for OR utilization of ACS PT is crucial in quality improvement of the ACS model to address adequate OR access.

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Adolescent appendicitis management and outcomes: comparison study between adult and pediatric institutions. *J. Schendel, N. Yanchar.* From the University of Calgary, Calgary, Alta.

Adolescents with appendicitis represent a unique population where patients may be managed in either pediatric or adult health centres in many regions. We compared the differences in diagnosis, treatment and outcomes between adult-focused centres and pediatric centres for adolescents with appendicitis within a defined region. A retrospective cohort of all patients aged 15–17 years undergoing an appendectomy at 1 of 4 adult hospitals or the regional pediatric hospital between January 2016 and December 2017 was performed. Timing of emergency department (ED) presentation, ED workup (laboratory values and imaging), timing and details of operative intervention, final pathology and postoperative outcomes (length of stay and complications) were examined. χ^2 and Wilcoxon 2-sample tests were used to evaluate the data. Outcomes of interest included imaging modality, ED length of stay, time to operation, pathology, use of antibiotics, postoperative length of stay and early postoperative complications. Unadjusted and adjusted associations of outcomes of interest (imaging modality, ED and hospital length of stay, complications) with site of management were derived using χ^2 and Wilcoxon 2-sample tests and logistic regression. Of 215 patients, 120 were managed at the pediatric centre. The mean age at the pediatric centre (16 yr) was significantly lower than at the adult centres (17 yr, $p < 0.0005$). Use of computed tomography (CT) (v. ultrasound) for preoperative imaging was almost 4-fold higher in the adult centres (23%) versus the pediatric hospital (5.9%, $p < 0.0003$). There were no significant differences in any other outcome variables. Utilization of CT to diagnose appendicitis in adolescents in adult centres confers no difference in outcomes relative to management in the pediatric paradigm. In view of the risk of latent malignancies from ionizing radiation in these “older children,” consideration should be given to increasing the use of ultrasound for affirmation of diagnoses of appendicitis in adolescents when they present to adult-focused hospitals.

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A systematic review of behavioural interventions to improve opioid prescribing after surgery. *D. Zhang, J. Sussman, F. Dossa, N. Jivraj, B. Speller, A. Ruco, K. Ladha, S. Brar, D. Urbach, D. Wijeyesundera, A. Tricco, H. Clarke, N. Baxter.* From the University of Toronto, Toronto, Ont. (Zhang, Dossa, Jivraj, Ruco, Ladha, Brar, Urbach, Wijeyesundera, Tricco, Clarke, Baxter); the University of Guelph, Guelph, Ont. (Sussman); and St. Michael's Hospital, Toronto, Ont. (Speller).

Current practices for the prescription of opioids at discharge after surgery are highly variable and often excessive. In recent years, several institutions in North America have developed strategies in an effort to change surgeon behaviour when prescribing opioids. To facilitate dissemination, we conducted a systematic review of behavioural interventions designed to improve these practices. We systematically reviewed the literature to identify studies of behavioural interventions designed to

improve opioid prescribing at discharge among adults undergoing any type of surgery. Behavioural interventions were defined according to the Cochrane Effective Practice and Organisation of Care taxonomy. Our outcomes consisted of the amount of opioid prescribed at discharge and postdischarge pain control. Screening, data extraction and risk of bias assessment were performed by 2 reviewers. A narrative synthesis of identified interventions and their effectiveness was performed. A total of 8048 citations were screened, and 24 studies were included in our review. The majority of studies were published in the past 3 years from academic medical centres in the United States. Only 1 randomized controlled trial was identified, and most of the remaining studies used an uncontrolled pre–post design. Six types of behavioural interventions were identified: local consensus processes, patient-mediated interventions, clinical practice guidelines, educational meetings, interprofessional education and reminders. Almost all interventions were associated with a statistically significant decrease in the amount of opioid prescribed at discharge after surgery, and few were associated with worsened pain control. All studies were found to have at least an overall medium risk of bias. We identified 6 types of behavioural strategies to improve opioid prescription at discharge after surgery. Despite a significant risk of bias, almost all types of intervention appeared effective in reducing opioid overprescription at discharge after surgery without affecting pain control.

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Resuscitative Endovascular Balloon Occlusion of the Aorta (REBOA) in trauma: a gap analysis of the Edmonton Zone Trauma Registry. *A. Eksteen, D. O'Dochartaigh, J. Odenbach, M. Douma, S. Widder, R. Anantha.* From the University of Alberta, Edmonton, Alta.

Trauma leading to uncontrolled hemorrhage of the torso in the critically injured patient carries significant morbidity and mortality. Resuscitative endovascular balloon occlusion of the aorta (REBOA) is a rapidly administered intervention that allows transient source control of subdiaphragmatic hemorrhage while arranging definitive surgical management. REBOA is not used in our zone, and the purpose of this study is to retrospectively review the trauma registry to identify the number of patients that might be candidates for REBOA. Our zone's trauma registry was retrospectively reviewed for the years 2015–2017. Potential candidates were identified using the following criteria: patients with blunt or penetrating trauma to the torso or pelvis AND death before discharge OR taken to the operating theatre/interventional radiology suite within 4 hours of arrival. Included candidates' charts were assessed against predetermined criteria similar to that used in centres using REBOA. There were a total of 3415 patients in the trauma registry, of which 237 patients were identified on the basis of the inclusion criteria. Sixty-six were screened positive for full chart review. After full chart review, a total of 38 patients were identified as REBOA candidates (1.1% of the patients in the registry). A small but significant number of trauma patients in our zone were identified as potential candidates for REBOA. Discussions are required to assess the local utility of this procedure in the overall context of the trauma service. Specific logistics such as indications and training for staff would have to be considered.

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Learning by holographic anatomic models for surgical education. *R. Leung.* From Queen's University, Kingston, Ont.

Learning anatomy is a fundamental cornerstone in medical/surgical education. Currently, cadaveric laboratory learning is the gold standard for anatomic learning. However, the increasing scope and costs of medical education have resulted in decreased laboratory time and anatomic teaching time in undergraduate medical programs. This has resulted in a greater dependence on less effective self-directed learning methods and increased demand for more effective methods. We propose to create a new form of self-directed learning using augmented-reality holographic models using the Microsoft HoloLens for learning inner ear anatomy that can mimic the gold standard cadaveric experience. Using the HoloLens, we can project custom virtual anatomic objects into the learner's physical space, allowing them to view/manipulate/interact with such objects and their environment whenever and wherever is convenient to them. A proof-of-concept study was completed to evaluate the feasibility and effectiveness of learning inner ear anatomy by holographic models in comparison with traditional two-dimensional approaches (i.e., didactic and web-based modules). A proof-of-concept study was completed with 26 second-year medical students at Queen's University at the same level of training and anatomy knowledge. Each participant was given time to find a comfortable fit with the HoloLens. They were then shown the holographic model of the inner ear and allowed as much time as needed to explore and learn. Upon completion, participants were asked to fill out a questionnaire on the effectiveness of learning anatomy from the holographic model. When asked if they could use the model to learn the anatomy of the inner ear, the majority of participants (25/26) strongly agreed while only 1 participant somewhat agreed. When asked if they thought learning by holographic model was an effective method to learn anatomy, the majority of participants again strongly agreed (24/26) while only 2 of the participants somewhat agreed.

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The nature of learning from trauma team simulation. *F. Shariff, G. Regehr, R. Hatala.* From the University of British Columbia, Vancouver, B.C.

Ongoing learning in complex clinical environments requires health professionals to assess their own performance, manage their learning and modify practices on the basis of self-monitored progress. Self-regulated learning (SRL) theory suggests that while learners may be capable of such learning, they often need guidance to enact it effectively. Debriefings in simulation may be an ideal time to prepare learners for SRL in targeted areas but may not be optimally fostering these practices. The goal of this study was to explore and characterize the nature of learning by participants after team-based simulation training. A qualitative study informed by grounded theory methodology was conducted in the context of 3 interprofessional in situ trauma simulations at our level 1 trauma centre. Eighteen participants were interviewed immediately and in follow-up 4–6 weeks after the simulation experience. Transcripts were analyzed in an iterative constant comparative

approach to explore emergent concepts and themes surrounding our research question. There were many examples of acquired content knowledge and straightforward practice change plans during initial interviews; however, more sophisticated examples of SRL were lacking early on. Some participants appeared to have evolved more specific learning goals and rudimentary plans for self-regulated implementation and improvement by the follow-up interviews but often suggested this was prompted by the study interview questions rather than the simulation debriefing itself. Overall, participants did not engage in fulsome development of SRL plans on the basis of the simulation and debriefing; however, elements of SRL were present, particularly in follow-up discussions after participants were given time to reflect on the interview questions and their own goals. This is an encouraging sign that simulation training can support development of this skill. However, debriefing approaches would need to be better optimized to take full advantage of the opportunity to encourage and foster SRL in practice after the simulation is over.

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Comparing reversing half-hitch alternating postsurgical knots and square knots for closure of enterotomy in a simulated deep body cavity: a randomized controlled trial. *M. Lemke, E. Sykes, D. Potter, T. Li, E. Khong, S. Tung, Z. Mir, G. Sheahan, V. Wu, B. Zevin.* From Queen's University, Kingston, Ont. (Lemke, Sykes, Potter, Li, Khong, Tung, Mir, Sheahan, Zevin); and the University of Toronto, Toronto, Ont. (Wu).

Square knots are the standard for hand-tied surgical knots; however, they are difficult to reproduce in a deep body cavity, which can result in slipped knots. The reversing half-hitch alternating post (RHAP) surgical knot is a noninferior alternative to the square surgical knot on the basis of its tensile strength and performance in limited working spaces. The objective of this study was to compare RHAP knots and square knots for closure of bowel enterotomies on a flat surface and in a deep body cavity. We conducted a prospective randomized controlled trial with novice medical students ($n = 20$) allocated to either the RHAP knot ($n = 10$, intervention) or square knot ($n = 10$, control) group. Participants were trained to proficiency in knot tying. Participants were then asked to repair a small bowel enterotomy on cadaveric porcine small bowel positioned on a flat surface and in a deep cavity. Integrity of the repair was assessed with a burst pressure. Time to achieve proficiency in knot tying was similar between the RHAP and square knot groups (23 ± 3 v. 21 ± 2 min; $p = 0.33$). On a flat surface, time to repair an enterotomy (19 ± 2 and 19 ± 2 min; $p = 0.45$) and mean burst pressure (101 ± 35 v. 128 ± 40 mm Hg; $p = 0.31$) were similar between the RHAP and square knot groups. However, in a simulated deep cavity, time to repair an enterotomy was less (16 ± 2 v. 21 ± 1 min; $p = 0.04$) and mean burst pressure (105 ± 39 v. 35 ± 14 mm Hg; $p = 0.05$) was greater in the RHAP group. Duration of training to achieve proficiency in RHAP and square knots is similar; however, RHAP knots are superior to square knots when used in a simulated deep body cavity for repair of bowel enterotomy. The RHAP knot should be taught to surgery trainees as a potential alternative to a square knot for use in deep body cavities.

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Propagating the “SEAD”: exploring the value of an overnight call shift in the Surgical Exploration and Discovery Program. *T. Ziegler, A. Adibfar, A. Abbasian, S. Jiang, J. Rutka, N. Gawad.* From the University of Toronto, Toronto, Ont. (Ziegler, Adibfar, Abbasian, Jiang, Rutka); and the University of Ottawa, Ottawa, Ont. (Gawad).

Attrition of general surgery residents highlights a need to support well-informed specialty selection. The objective of this study was to evaluate the role of overnight call shifts as a platform for surgical career exploration for preclerkship medical students. A mixed-methods design was used, involving entry and postcall shift surveys and focus groups. Survey data characterized the population and call shift, guided focus group segmentation by baseline interest in surgery and provided context for interpretation of qualitative data. Focus groups were transcribed and analyzed with a phenomenological approach using thematic analysis. Twenty-five first-year medical students took part in a call shift at 2 level 1 trauma centres. Sixty-four percent ($n = 16$) of the participants were male. Students in the high-interest group ($n = 9$) had more prior operating room exposure than students in the moderate-interest group ($n = 12$) and the low-interest group ($n = 4$) ($p = 0.039$). Most students valued participating in a call shift; 80% ($n = 20$) rated the experience “positive” or “very positive.” Thematic analysis yielded 2 categories of themes: (a) valuable aspects of the experience, including being part of a team, mentorship, understanding the clerk’s role, dispelling misconceptions, trial of working overnight and influencing interest in a surgical career; and (b) determinants of an enjoyable experience, including resident engagement and number of traumas. An overnight call shift experience was valuable to preclerkship medical students regardless of baseline interest in surgery. Although it only influenced a few students’ specialty preferences, exposure facilitated a better understanding of a unique component of surgical careers and provided valuable mentorship. These findings support implementing call shifts in other curricular or extracurricular programs to make the experience more widely available and enable earlier, informed career decision-making.

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Comparing 2 approaches to residency application file review. *J. Younan, N. Gawad, C. Towaij, I. Raiche.* From the University of Ottawa, Ottawa, Ont.

The residency selection process has become increasingly competitive, making selection more challenging. This study’s objective was to compare 2 approaches to file review: 1 focusing on applicant traits (leadership, communication, etc.) and the other on file elements (curriculum vitae, reference letters, etc.). Ten members of the General Surgery Program file review committee were randomly assigned to 2 groups, and they evaluated 7 randomly selected Canadian applicant files. The first group scored files on the basis of their elements, and the second group scored files on the basis of applicant traits. Feedback was collected regarding each scoring tool, the discrimination capacity of the tool was measured using variation in scores and interrater reliability

(IRR) was calculated for each tool using intraclass correlation (ICC) in a 2-way random-effects model. Both tools identified the same top- and bottom-ranked applicants; however, discrepancies were noted for middle-ranked applicants. The score range for the 3 middle-ranked applicants was greater with the trait-based tool (6.43 v. 3.80). The IRR for trait-based scoring was superior to element-based scoring (ICC 0.82 v. ICC 0.55). The trait-based tool required only 2 raters to achieve an ICC greater than or equal to 0.70. The main criticisms of the trait-based tool were difficulty finding certain traits within the file and longer review time. Using a trait-based file review strategy can facilitate file review with good reliability compared with an element-based strategy. Improved identification of traits within the file can be facilitated by making their role in the review process explicit to applicants and referees.

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A Canadian experience with posterior retroperitoneoscopic adrenalectomy. *K. Garber, A. Melck.* From the University of British Columbia, Vancouver, B.C.

Minimally invasive adrenalectomy is the standard of care for the surgical management of benign adrenal disease. The transperitoneal laparoscopic approach (TLA) is the most common approach worldwide; however, many centres have adopted a posterior retroperitoneoscopic approach (PRA) over the past decade as it offers several advantages over TLA. The objective of this study is to provide the first description of a Canadian experience with PRA and compare these patients with patients who undergo a TLA in terms of preoperative characteristics and surgical outcomes. A retrospective chart review was performed of all patients who underwent a minimally invasive adrenalectomy by a single surgeon between March 2011 and March 2019. Patient and tumour characteristics, operative times and postoperative outcomes were compared between patients who underwent a PRA and a TLA. The Student t test was used to compare continuous variables between groups. During the study period 46 and 38 patients underwent a PRA and a TLA, respectively. The mean American Society of Anesthesiologists (ASA) classification was higher in the TLA group than in the PRA group (3 v. 2.6, $p = 0.01$). Body mass index was similar in the 2 groups (27.6 v. 26.9 kg/m², $p = 0.589$). TLA glands were larger and heavier than PRA glands (6.2 v. 5.2 cm, $p = 0.04$ and 60 v. 18.3 g, $p < 0.001$, respectively). Anesthesia preparation time and operative times were shorter in the PRA than in the TLA group (52.2 v. 65.1 min, $p < 0.001$, and 81.9 v. 120 min, $p < 0.001$, respectively). Finally, the PRA group had less use of analgesia and a shorter hospital length of stay (3.1 v. 12.8 doses, $p < 0.001$, and 2.7 v. 4.4 d, $p < 0.001$, respectively). Patients chosen for the TLA approach tended to have bigger glands and higher ASA class. The PRA approach affords quicker operative times, less postoperative pain and a shorter hospital length of stay.

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A cost-efficient, realistic breast phantom for oncologic breast surgery training. *G. Aldosary, T. Tse, A. Arnaout, J. Caudrelier, C. Footit, E. Vandervoort, J. Belec.* From the Ottawa, Hospital, Ottawa, Ont.

The objective of this study was to create a customizable, cost-efficient and realistic breast phantom for use as a surgical training and educational tool. A silicone-based breast phantom (~800 mL) was constructed using an in-house method. It contained materials emulating breast parenchyma, epidermis, areola/nipple, chest wall and lateral chest fat (used in real patient surgeries). Seven replicas were created with tumours (diameter 2.0 cm) placed at different depths/breast quadrants. Variable oncologic breast surgery (OBS) approaches were applied to excise the tumours (e.g., racquet and reduction mammoplasty with various pedicle options). The phantom's performance was assessed by 2 experienced surgeons in terms of breast tissue similarity, surgical incision and dissection and by withstanding suturing approaches. The phantom's multiple components accommodated realistic OBS approaches. Surgeons confirmed that its palpated density resembled a fibroglandular breast's, usually attributed to a younger patient who is most eligible for OBS. The phantom was amendable to rotations and reapproximation and allowed practice of a wide range of OBS techniques including reduction mammoplasty (levels 1 to 3). Although the skin layer was easily closed with Vicryl/Prolene/nylon sutures, it was not amendable to subcuticular closure. The parenchyma was not amendable to traditional suture material but was easily sutured with cotton yarn. Because the phantom was solely a breast shape, some larger closures (mammoplasty + Wise pattern skin incision) caused too much tension for proper skin closure. A customizable, cost-efficient (\$60/phantom) and realistic breast phantom was developed. The surgical limitations found with larger closures can be overcome by changing the breast phantom shape to capture more anatomy surrounding a breast. The phantom can aid in hands-on resident/fellow teaching of OBS techniques and for mass production for workshops and low-resource areas. It can be adapted for multidisciplinary preop planning with general surgeons and plastic surgeons and to facilitate communication of postop surgical clip placement with radiation oncologists.

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Impact of patient frailty on morbidity and mortality after common emergency general surgery operations. *P. Murphy, S. Savage, B. Zarzaur.* From Indiana University, Bloomington, Ind.

Frailty has been increasingly recognized as a modifiable risk factor before elective general surgery. There is limited evidence regarding the association of frailty with perioperative outcomes after specific emergency general surgery procedures. Our objective was to determine the association between patient frailty and 30-day morbidity, mortality and discharge destination in adult patients undergoing emergency general surgery. We conducted a retrospective cohort study of patients older than 40 years of age from the 2010–2014 American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP) data set who underwent appendectomy, cholecystectomy, large bowel resection, small bowel resection or lysis of adhesions on an emergent basis. The modified frailty index (mFI), a composite of 11 NSQIP variables, was used to stratify patients by low (≤ 0.18), intermediate (0.18–0.35) and high (≥ 0.36) frailty. Multivariable regression modelling included age, sex, mFI, renal failure, steroid use, preoperative

sepsis and transfer status. A total of 57 173 patients underwent appendectomy ($n = 26\ 067$), cholecystectomy ($n = 8138$), large bowel resection ($n = 12\ 107$), small bowel resection ($n = 6503$) or lysis of adhesions ($n = 4358$) on an emergent basis. Of these patients, 25.0% experienced a complication, 3.2% died in hospital and 5.1% died within 30 days. On univariate analysis, frailty was related to complication rate (low mFI, 17.5%; intermediate, 31.5%; and high, 55.5%) and inversely related to discharge destination (70.5%, 62.3% and 29.7% discharged home, respectively). On multivariable regression, regardless of procedure, intermediate and high mFI were independent predictors of any complication, serious complication, death within 30 days and discharge to a destination other than home. Frailty is associated with worse outcomes after common emergency surgeries independent of age, comorbidities and preoperative sepsis. Assessment of frailty before emergency surgery can inform patients and surgeons on expected postoperative outcomes, including discharge disposition, and may affect decision-making to proceed with intervention.

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Preventing opioid prescription after major surgery: a scoping review of the literature on opioid-free analgesia. *G. Olleik, B. Verdolin, A. Kouyoumdjian, C. El Kefraoui, A. Alldrit, A. Figueiredo, S. Valanci, J. Velasco, M. Schulz, D. Mouldoveanu, P. Nguyen-Powanda, G. Best, A. Banks, T. Landry, N. Pecorelli, G. Baldini, L. Feldman, J. Fiore Jr.* From McGill University, Montreal, Que.

North America is facing an opioid epidemic fueled by increased prescriptions by surgeons. The answer to this issue may be found upstream by preventing postoperative opioid prescriptions. Conducting a scoping review to map the literature on opioid-free analgesia is an essential first step to inform sustainable changes in prescription practices. This review aimed to assess the extent, range and nature of the literature addressing opioid-free analgesia after major surgery. Eight major bibliographic databases were searched for studies addressing opioid-free analgesia in youth and adult patients (aged > 15 yr) undergoing major surgery. We extracted study characteristics including design, country, year, surgical procedure(s) and interventions. Results were organized thematically according to surgical specialty and targeted phase of recovery: in hospital (early recovery, < 24 h postoperatively; intermediate recovery, > 24 h) and postdischarge (late recovery). We identified 392 studies addressing postoperative opioid-free analgesia. The number of studies conducted in countries where the opioid epidemic is primarily focused was remarkably low (9 [2%] in the United States and 5 [1%] in Canada). Studies were predominantly focused on procedures in orthopedic, general and gynecologic/obstetric surgery. Many randomized controlled trials compared opioid versus opioid-free analgesia during hospital stay ($n = 115$), but few targeted analgesia after discharge ($n = 8$). We did not identify knowledge synthesis studies (i.e., systematic reviews, meta-analyses) focused on the comparative effectiveness of opioid-free analgesia. Limited attention has been directed toward nonpharmacological pain interventions. The literature on opioid-free analgesia is vast but largely limited to in-hospital interventions. This scoping review indicates numerous opportunities for future research aiming to mitigate the negative downstream effects of postoperative opioid overprescription.

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Correct usage of propensity score methodology in contemporary high-impact surgical literature. *E. Grose, S. Wilson, J. Barkun, K. Bertens, G. Martel, F. Balaa, J. Abou Khalil, E. Grose.* From the University of Ottawa, Ottawa, Ont. (Grose, Wilson, Grose); the McGill University Health Centre, Montreal, Que. (Barkun); and The Ottawa Hospital, Ottawa, Ont. (Bertens, Martel, Balaa, Abou Khalil).

Propensity score (PS) analysis is commonly used in observational trials to account for confounding when estimating the effects of interventions. Improper use and reporting of PS analysis can introduce bias and alter the conclusions that are made. The aim of this study is to review the appropriate use and adequate reporting of PS methods in observational studies published in high-impact surgical journals. We searched the 10 surgical journals with the highest impact factors to identify studies using PS analysis from Jan. 1, 2016, to Dec. 14, 2018. We selected criteria for the proper conduct of PS analysis and systematically appraised the quality of reporting. PS analysis was employed in 305 surgical studies published in high-impact journals within the study period. PS matching was used in 83% ($n = 254$) of studies, with a minority employing other techniques including PS weighting, PS stratification and covariate adjustment using the PS. Among the articles assessed, 94% ($n = 286$) of the studies included the variables used to generate the PS and 90% ($n = 273$) included the type of regression model used to generate the PS. However, 78% ($n = 237$) did not measure the predictive ability of their PS. In those studies using PS matching ($n = 254$), 57% ($n = 146$) included less than half of their total sample size in their matched analysis. Furthermore, 21% ($n = 53$) did not include the matching algorithm used to generate the matched sample, 60% ($n = 152$) used inappropriate statistical methods for a matched cohort and 39% ($n = 99$) failed to perform analyses of covariate balance between groups. This study demonstrates that even in research published in high-quality surgical journals, several studies using PS analysis reported their methods inadequately. Our work identifies the need for more rigorous reporting of PS analyses to allow appropriate interpretation of results.

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Responsible blood compatibility testing for appendectomy: practice assessment at a single Canadian academic centre. *S. Godzisz, S. Lethbridge, R. Nenshi.* From McMaster University, Hamilton, Ont.

Maximum surgical blood ordering schedule (MSBOS) is a tool that guides responsible preoperative blood compatibility or group and screen (G&S) testing and blood product ordering. The MSBOS at our centre does not provide G&S recommendations; however, most MSBOS recommend forgoing testing for low-risk procedures such as appendectomy. This study evaluated the variability in G&S ordering practices for appendectomy at our academic hospital and the risk of transfusion related to appendectomy and aimed to identify risk factors associated with increased transfusion requirements necessitating preoperative G&S. Data from consecutive patients undergoing appendectomy at our centre between

Jan. 1 and Dec. 31, 2017, were assessed. Demographic and perioperative data were collected from electronic medical records. Descriptive and univariate statistical analyses were completed. A total of 203 patients underwent appendectomy, primarily laparoscopic ($n = 202$, 99.5%) and emergent priority ($n = 192$, 94.6%). One hundred and seventy patients (83.7%) had G&S done preoperatively, most often ordered by the surgical team ($n = 132$, 77.7%). Overall, no blood transfusions were required at any perioperative time point for any patient undergoing appendectomy. The citywide G&S cost for all appendectomies in 2017 is estimated to be over \$8700. Unnecessary G&S ordering for appendectomies is common and may occur secondary to lack of knowledge or misunderstanding of risk in the setting of an academic hospital with learners. A larger study population and study sample may help identify associations between risk factors and transfusion requirements. Data from our centre align with the literature, suggesting that preoperative G&S may be safely omitted for appendectomy given low bleeding risk. Current ordering practices show room for improvement and potential health care savings. No conclusion can be drawn from this study regarding the association between risk factors and transfusion requirements.

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What patient factors are associated with participation in a provincial colorectal cancer screening program? *L. Findlay-Shirras, K. Decker, H. Singh, N. Biswanger, J. Park.* From the University of Manitoba, Winnipeg, Man.

Fecal-based colorectal cancer (CRC) screening programs reduce CRC mortality in clinical trials. In practice, however, participation in these programs can be quite variable. This study assessed participation rates and patient factors associated with participation in a population-based, organized CRC screening program. This retrospective cohort study included all people 50–74 years of age who were eligible to participate in our provincial CRC screening program (ColonCheck) using a high-sensitivity guaiac-based fecal occult blood test (FOBT) from 2011 to 2014 ($n = 482\ 701$). Patient factors assessed included age, sex, area of residence (urban, rural-south, rural-north), and Deprivation Index (a measure of living in areas with material deprivation, expressed as quintiles [Q]). Multivariable logistic regression was performed. Time period of participation (2011–2012 v. 2013–2014) was also included in the model. Overall, 97 916 people successfully completed FOBTs (participation rate 20.3%). The effect of age on participation was nonlinear. Age 55 was associated with a dip in participation. In the multivariable analysis, being male gender (odds ratio [OR] 0.72, 95% confidence interval [CI] 0.71–0.74), living in a rural-north residence compared with an urban area (OR 0.78, 95% CI 0.74–0.83) and increased deprivation (OR Q5 v. Q1 0.58, 95% CI 0.56–0.60) were associated with decreased odds of participation. Participation rates in our provincial CRC screening program remain below our targeted benchmark ($\geq 60\%$). More northern rural or materially deprived populations appear especially at risk of decreased participation. There is a clear need to develop initiatives to improve participation rates, especially among the groups with the lowest participation rates.

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Missed appendix tumours owing to nonoperative management for appendicitis. *S. Seidl, H. Cheab, K. Wong.* From the Central Coast Local Health District, Gosford, Australia.

Recent studies have proposed that uncomplicated acute appendicitis should be routinely managed with intravenous antibiotics alone. However, nonoperative management of appendicitis may lead to missed appendiceal tumours. Appendix tumours are a rare presentation and mostly found incidentally during appendectomy. The aim of this study is to identify clinical and radiologic features of patients with appendix tumours to improve diagnostic accuracy. Data of 1130 patients who underwent appendectomy in 2 major teaching hospitals were prospectively collected. Patient demographics, clinical symptoms and signs, pathology, histology and radiology results were further analyzed. Appendix tumour was confirmed on histopathology in 14 out of the 1130 cases analyzed (9 carcinoid tumours, 4 adenocarcinomas, 1 adenoma). The average age of the patients with confirmed appendix tumour was 38 years (all 14 patients were older than age 15 yr). Most of the patients ($n = 12/14$) were afebrile on presentation. Half of the patients ($n = 7/14$) presented with elevated white cell count. Eight of the 14 patients underwent computed tomography (CT) or ultrasound scans suggesting appendicitis and 1 patient had a CT scan suggesting appendix mucocele. No patient was definitively diagnosed with appendix malignancy preoperatively. There are no clinical, pathologic or radiologic features to differentiate uncomplicated appendicitis from appendix tumour. Managing uncomplicated appendicitis on clinical and radiologic findings with antibiotics alone will lead to missed appendix tumours. Hence, we recommend appendectomy as the first line of treatment for all patients with suspected appendicitis.

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Operative delay increases morbidity and mortality in emergency general surgery patients: a study of multiple EGS services within a single city. *M. Meschino, A. Giles, T. Rice, R. Nenshi, P. Engels.* From McMaster University, Hamilton, Ont.

Despite the implementation of an acute care surgery (ACS) model, limited access to operating room time represents a barrier to the optimal delivery of emergency general surgery (EGS) care. The objective of this study was to describe the effects of time to operation on outcomes in EGS at our institution. We conducted a retrospective review of all EGS operations performed at 3 academic teaching hospitals within a single city during a 1-year period (2014). Operative timing was categorized as daytime (0800–1700), after hours (1700–2300) or overnight (2300–0700). Time to operation was calculated as the interval from admission to operating room start time and categorized as less than 24 hours, 24–48 hours, 48–72 hours and more than 72 hours. A total of 1735 EGS cases were included. Biliary and appendiceal disease represented 50% of cases. Operative timing was as follows: daytime 39%, after hours 46% and overnight 15%. Time to operation

was as follows: less than 24 hours in 46%, 24–48 hours in 21%, 48–72 hours in 8% and more than 72 hours in 25%. The overall rate of complications was 25% (429 patients) and the mortality rate was 5% (93 patients). Time to operation more than 72 hours was associated with increased complications (43%) and mortality (11%) compared with baseline ($p < 0.001$). After multivariable analysis, operative delay was independently associated with increased odds of morbidity (odds ratio [OR] 2.47, 95% confidence interval [CI] 1.8–3.4) and mortality (OR 1.92, 95% CI 1.1–3.5). Increasing length of time between admission and operation was associated with greater morbidity and mortality for EGS patients. Optimizing care of EGS patients in an ACS model should include strategies to provide timely access to the operating room.

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Withdrawn

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Improved disease-free survival after prehabilitation for colorectal cancer surgery. *M. Trepanier, E. Minnella, T. Paradis, R. Awasthi, P. Kaneva, K. Schwartzman, F. Carli, G. Fried, L. Feldman, L. Lee.* From the McGill University Health Centre, Montreal, Que.

Preoperative multimodal exercise and nutritional programs (multimodal prehabilitation) improve functional capacity and recovery following colorectal surgery. Exercise may also affect cancer outcomes by mediating the systemic inflammatory response. The effect of prehabilitation on cancer outcomes is unknown. The objective of this study was to investigate the effect of prehabilitation on survival after colorectal cancer surgery. Pooled data from 3 prehabilitation trials (2 randomized controlled trials, 1 cohort study) in patients undergoing elective, biopsy-proven, primary nonmetastatic colorectal cancer surgery from 2009 to 2014 within an enhanced recovery program were analyzed. Patients were grouped into +prehab or –prehab. The primary outcomes were 5-year disease-free (DFS) and overall survival (OS). DFS and OS were analyzed using Kaplan–Meier survival curves. Multiple regression analyses were performed using Cox proportional hazard models to identify independent predictors of survival. A total of 202 patients were included (+prehab 104, –prehab 98) in this study. Median prehabilitation duration was 29 days (interquartile range 20–40). Patient and tumour characteristics were well balanced (33% stage III disease). Postoperative complications and time to adjuvant chemotherapy were similar. Mean duration of follow-up was 60.3 months (SD 26.2). DFS was similar for the combined group of patients with stage I–III disease ($p = 0.244$). For patients with stage III disease, prehabilitation was associated with improved DFS (73.4% v. 50.9%, $p = 0.044$). There were no differences in OS ($p = 0.226$). Prehabilitation independently predicted improved DFS (hazard ratio 0.45, 95% confidence interval 0.21–0.93), adjusting for TNM stage and other confounders. Prehabilitation did not independently predict OS. In this report, prehabilitation is associated with improved 5-year DFS in stage III colorectal cancer. This finding should be confirmed in future trials.

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Development of a conceptual framework of recovery after abdominal surgery. *R. Alam, J. Montanez, S. Law, L. Lee, N. Pecorelli, Y. Watanabe, L. Chiavegato, M. Falconi, H. Satoshi, N. Mayo, L. Feldman, J. Fiore Jr.* From the McGill University Health Centre, Montreal, Que. (Alam, Lee, Feldman, Fiore Jr.); St. Mary's Hospital, Montreal, Que. (Montanez, Law); the San Raffaele Scientific Institute, Milan, Italy (Pecorelli, Falconi); Hokkaido University Graduate School of Medicine, Sapporo, Japan (Watanabe); the Federal University of Sao Paulo, Sao Paulo, Brazil (Chiavegato, Satoshi); and McGill University, Montreal, Que. (Mayo).

The evidence underpinning the measurement properties of patient-reported outcome measures (PROMs) currently in use to measure recovery after abdominal surgery is weak. To bridge this knowledge gap, we initiated a research program to develop a conceptually relevant and psychometrically sound recovery-specific PROM. In compliance with best-practice recommendations for PROM development, this project aimed to develop a conceptual framework representing the health domains relevant to the process of recovery after abdominal surgery. Patients from 4 international sites (Canada, Italy, Brazil and Japan) who underwent abdominal surgery participated in qualitative interviews focusing on their lived experiences of recovery after abdominal surgery. Interviews were guided by a previously developed hypothesized conceptual framework. Interviews were analyzed according to a modified grounded theory approach and transcripts were coded according to health domains covered by the International Classification of Functioning, Disability and Health (ICF). Codes for which thematic saturation was reached were classified into domains of health that are relevant to the process of recovery after abdominal surgery. Thirty patients with diverse demographics and surgical characteristics were interviewed (50% male, age 57 ± 18 yr; 66% major or major extended surgery). Thirty-nine unique domains of recovery emerged from the interviews, all falling under the ICF categories of "Body Functions" and "Activities and Participation." The results from this study provide comprehensive insight into the process of recovery from the patient's perspective. The conceptual framework of recovery after abdominal surgery will support content validity and underpin the generation of items for the future recovery-specific PROM. This framework is also a pivotal first step leading to a novel measure to be used in research informing patient-centred decision-making as well as quality improvement initiatives in abdominal surgery.

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Comparison of Dor and Nissen fundoplication following laparoscopic paraesophageal hernia repair. *M. Trepanier, T. Dumitra, R. Sorial, A. Siblino, M. Vassiliou, G. Fried, L. Feldman, L. Ferri, L. Lee, C. Mueller.* From the McGill University Health Centre, Montreal, Que.

Fundoplication is routinely performed during laparoscopic paraesophageal hernia (PEH) repair, but the degree of fundoplication remains controversial in this patient population. The purpose of this study is to assess postoperative dysphagia and reflux following Dor versus Nissen fundoplication in patients undergoing laparoscopic repair of giant PEH. A retrospective cohort study of all patients

undergoing laparoscopic repair of giant PEH with Nissen or Dor fundoplication between January 2012 and December 2017 at a high-volume centre was performed. Revisional and emergency cases were excluded. Primary outcomes were reflux and dysphagia at 1 and 6 months postoperatively. Dysphagia was measured using a Likert severity scale (0–4) and severe dysphagia was defined as intolerance to liquids. Balanced cohorts were created using coarsened exact matching. Groups were compared using the χ^2 test and Fisher exact test for categorical variables and 2-sample t tests for continuous variables. A total of 106 cases were included and 87 matched (Dor 48, Nissen 58). Baseline characteristics were well balanced between matched groups. Mean follow-up duration was 13.4 months (SD 13.6). Incidence of severe dysphagia at 1 month was significantly lower in the Dor group (0 v. 8 [19.5%], $p = 0.02$) with similar reflux symptoms. There were no differences in severe dysphagia and reflux symptoms at 6 months. Recurrence rate was also similar between the groups (4 [11.8%] v. 13 [27.1%], $p = 0.09$). In this study, Dor fundoplication was associated with less severe early postoperative dysphagia. Future studies assessing the relative importance of dysphagia and reflux on quality of life should be conducted to tailor surgical technique and optimize patient satisfaction.

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A systematic review and summary of clinical practice guidelines on the periprocedural management of patients on anti-thrombotic medications undergoing gastroenterological endoscopy. *H. Abn, L. Baker, S. Khair, E. Saidenberg, E. Kelly.* From the University of Ottawa, Ottawa, Ont.

One in 6 patients requiring endoscopy is on hemostasis-altering medication. Uniform consensus on the management of these medications is lacking. The objective of this review is to evaluate the quality of and summarize available clinical practice guideline (CPG) recommendations on this topic. Multiple databases and guideline clearinghouses were searched from inception to January 2019. The Appraisal of Guidelines for Research & Evaluation (AGREE) II instrument was used to assess the quality of included guidelines. Of the 3502 unique citations, 9 pertained to endoscopy and were included. Among the 9 guidelines, the mean overall guideline assessment score was 40% (range 58, SD 18.6). Clarity of presentation (68.1%) and scope and purpose (60.1%) had the highest mean AGREE II scores while applicability (6.4%) and stakeholder involvement (36.9%) had the lowest. In endoscopic procedures with a low bleeding risk, there was consensus among CPGs to continue antiplatelets and anticoagulants but disagreement regarding continuation of direct oral anticoagulants (DOACs). In procedures with a high bleeding risk, 2 guidelines evaluated acetylsalicylic acid use and recommended either continuation or discontinuation if high thromboembolism (TE) risk. Among the 3 CPGs evaluating other antiplatelets in procedures with a high bleeding risk, there was consensus to discontinue antiplatelets and bridge if there was high TE risk. There was no consensus regarding the management of warfarin or DOACs in this group. No studies recommended the use of blood products or specific reversal agents. This review reveals that among endoscopic procedures with low risk of bleeding, there is consensus between guidelines on the management of most antithrombotic drugs except DOACs. There is less uniformity in recommendations for procedures with a high risk of bleeding. The overall quality of the guidelines is also quite variable, which may contribute to variability in practice.

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Impact of socioeconomic status on postoperative complications following Whipple procedure for pancreatic ductal adenocarcinoma. *L. Glass, L. Qu, C. Garcia Ochoa, L. Allen, K. Leslie.* From Western University, London, Ont.

The literature surrounding the impact of socioeconomic status (SES) on outcomes following the Whipple procedure for pancreatic ductal adenocarcinoma (PDAC) is conflicting. Previous studies conducted in universal health care systems have shown that patient outcomes following surgery are not altered by SES. Similar studies in nonuniversal systems conflict with these results. In this study, we aimed to examine the effect of patient SES on rates of complications following the Whipple procedure in a universal health care system. We examined all patients undergoing a Whipple procedure for PDAC, using a retrospective database from a single centre between 2007 and 2017. This database includes information on patient demographics and comorbidities, as well as outcomes including complications, recurrence and mortality. SES was established using the Ontario marginalization (ON-Marg) index and rurality by the provincial rurality index, both of which are based on patient postal codes. Marginalization scores were stratified into quintiles, and patients were also divided into urban and rural categories. Descriptive and univariate analysis was completed, and logistic regression was used to compare the association between SES (ON-Marg deprivation and instability domains), rurality and postoperative complications, controlling for age, sex, higher grade tumour and Charlson Comorbidity Index. In total, 204 patients were included and 124 (61%) experienced a complication. There was no statistically significant difference in the rate of postoperative complications between groups of lower and higher economic status on logistic regression analysis for either of the ON-Marg domains studied (all quintiles $p > 0.05$). There was no difference in complication rates between urban and rural patients (odds ratio 1.55, $p = 0.34$). Secondary outcomes, including overall survival, 1-year mortality and positive resection margins, were not affected by SES in univariate analysis. Our data continue to support a growing body of literature that suggests that SES may not affect postoperative outcomes in patients who undergo surgery for PDAC in a universal health care system.

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Clinical outcomes of high-risk breast lesions and breast cancer patients treated with total mastectomy and immediate reconstruction. *V. Pravong, P. Dubé, G. Leblanc, L. Sideris, D. Borsuk, M. Tardif, C. Guertin, A. Chollet, M. Gervais, A. Boulay.* From the University of Montreal, Montreal, Que.

Breast cancer is the most common cause of cancer among Canadian women, and 1 of the mainstays of treatment remains surgery. Surgical interventions include breast-conserving surgery and total mastectomy. For patients requiring a total mastectomy, a multidisciplinary approach allows the clinician to offer, when the oncologic context allows it, a skin- or nipple-sparing mastectomy with immediate breast reconstruction. This single-hospital retrospective study included patients from 2010 to 2018 who had pathologically confirmed breast cancer (invasive and in situ) or atypical hyperplasia or who presented with a BRCA mutation, who underwent total mastectomy with immediate reconstruction. Clinical and demographic data were collected, including pathologic and radiologic findings and treatments received. The primary outcome was postoperative

complications. Secondary outcomes were overall survival (OS) and disease-free survival (DFS) of the invasive/in situ subgroups. Kaplan–Meier survival analysis was calculated using SPSS software. A total of 60 patients with a median age of 53 years were included: 12 patients underwent autologous tissue reconstruction and 49 had an implant reconstruction (23 with expander before the permanent implant). Overall postoperative complications occurred in 31.7% of patients: 30.6% in patients with implant reconstruction and 33% in patients with tissue reconstruction. The most common postoperative complication was cellulitis (11.7%), followed by hematoma (5%) and abscess (5%). Among the 60 patients, 10% underwent a second surgery under general anesthesia for prosthesis resection, skin necrosis débridement or abscess drainage. Median follow-up was 24 months. The invasive/in situ group had a mean DFS and OS of 85 and 96 months, respectively. Our study results showed that patients who underwent tissue and implant reconstruction had similar complication rates. Most patients with tissue reconstruction did not need additional surgery for symmetry or correction, which is known to improve patients' quality of life following immediate breast reconstruction.

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My On Call (MOC) Pager App: practising and assessing safe clinical decision-making. *N. Gawad, H. McDonald, F. Rubens, I. Raiche.* From the University of Ottawa, Ottawa, Ont. (Gawad, Rubens, Raiche); and Western University, London, Ont. (McDonald).

During the steep learning curve when students transition to residents they are particularly susceptible to increased medical errors, thus compromising patient safety. Clinical decision-making (CDM) skills are a major contributor to residency preparedness, and educators agree they should be purposefully taught and tested. Despite this, little structured assessment of decision-making exists. This project presents the development and preliminary results of an innovative CDM assessment tool. My On Call (MOC) Pager App is a simulated pager program designed as a learning and assessment tool for senior medical students and junior residents to practise safe CDM as they transition between these roles. Learners are randomly “paged” by the app about a list of virtual patients and must integrate pertinent information efficiently to answer. Learners then receive a page-management question that further probes their CDM skills by asking them to consider the urgency and their level of confidence. The pilot app was successfully α -tested in 2016 and 2017 with 20 fourth-year medical students. A mixed-effects model of 1329 pages revealed a significant increase in the proportion of correctly answered pages over a 1-week elective ($p = 0.04$). Subjectively, students felt more comfortable managing patients and answering pages and greatly enjoyed using the app, citing it as “an excellent learning tool” and an “innovative method of assessment.” The app was then adapted for the National Cardiac Surgery Bootcamp for use by first-year residents and recently rebuilt to support widespread national dissemination. The MOC Pager App provides an innovative approach to CDM assessment, with a unique real-time approach that integrates prioritization, time management and efficiency with no risk to real patients. Preliminary results demonstrate feasible integration of the app into medical training and positive user feedback. The rebuilt app will allow customizable and simultaneous use by multidisciplinary learners anywhere in the world.

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Comprehensive complication index for major abdominal surgeries: an external validation using the American College of Surgeons' National Surgical Quality Improvement Program (ACS NSQIP). C. Garcia-Ochoa, E. McArthur, A. Skaro, K. Leslie. From the London Health Sciences Centre, London, Ont. (Garcia-Ochoa, Skaro, Leslie); and ICES, Toronto, Ont. (McArthur).

When postoperative complications are assessed in studies, patients are often classified with the most severe complication rather than quantifying all complications. The Comprehensive Complication Index (CCI) incorporates all postoperative complications using the Clavien–Dindo classification and assigns a score between 0 and 100. The purpose of this study was to externally validate the use of the CCI as a quantitative measure on major abdominal surgeries in the ACS NSQIP registry. We used the ACS NSQIP registry from 2014 to 2017 and included all pancreas, colon and liver surgeries. We classified postoperative complications using the CCI and assessed its association with length of stay (LOS), prolonged length of stay (> 75th percentile) and 30-day readmission, using negative binomial and modified Poisson regression models. From 168 232 patients included (78% colon, 13% pancreas, 9% liver), 37% experienced at least 1 complication. In patients with CCI greater than 0, the median number of complications was 1 (interquartile range [IQR] 1–2) and the maximum was 10. The median LOS was 6 (IQR 4–9) days, 20% had prolonged length of stay and 10% of patients had a 30-day readmission. A 10-unit increase in the CCI was associated with a 20% increase in expected LOS (95% confidence interval [CI] 1.19%–1.20%), 24% increased risk of prolonged length of stay (95% CI 1.23%–1.24%) and 22% increased risk of readmission (95% CI 1.22%–1.23%). The CCI quantifies all postoperative complications and is associated with different clinical outcomes. This index can easily be implemented within the ACS NSQIP registry and exemplifies a broader representation of a patient's morbidity after major abdominal surgeries.

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The impact of surgeon experience on script concordance test scoring. N. Gawad, A. Malvea, T. Wood, L. Cowley. From the University of Ottawa, Ottawa, Ont.

The script concordance test (SCT) is a test of clinical decision-making that relies on an expert panel to create its scoring key. Existing literature demonstrates the value of specialty-specific experts, but the effect of experience among the expert panel is unknown. The purpose of this study was to determine if surgeon experience affects SCT scoring. An SCT was administered to 29 general surgery residents and 14 staff surgeons. Staff surgeons were stratified as either junior or senior experts on the basis of years since completing residency training (< 15 yr v. > 25 yr). The SCT was scored using the full expert panel, the junior panel and the senior panel. A one-way analysis of variance was used to compare the scores of first-year (R1) and fifth-year (R5) residents using each scoring scheme. There was no statistically significant difference between the average score of R1s and R5s using the full expert panel (R1 69.08 v. R5 67.06, $F_{1,9} = 0.10$, $p = 0.76$) or the junior faculty panel (R1 66.73 v. R5 62.50, $F_{1,9} = 0.35$, $p = 0.57$). However, the average score of R1s was significantly lower

than that of R5s when using the senior faculty panel (R1 52.04 v. R5 63.26, $F_{1,9} = 26.90$, $p = 0.001$). SCT scores are significantly affected by the responses of the expert panel. Expected differences between first- and fifth-year residents were only demonstrated when using an expert panel consisting of senior faculty members. When constructing an SCT expert panel, consideration must be given to the years of experience of panel members.

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Decay of competence with extended research absences during postgraduate residency training: a scoping review. N. Gawad, M. Allen, A. Fowler. From the University of Ottawa, Ottawa, Ont. (Gawad, Allen); and Memorial University of Newfoundland, St. John's, Nfld. (Fowler).

A significant number of residents in postgraduate training programs pursue dedicated research training. Currently, no formal curricula exist to transition residents back into clinical roles following dedicated research leave. This scoping review aims to determine what literature exists on the challenges faced by trainees who interrupt their clinical training for extended periods of time for research leave. The PubMed and Medline databases were searched for all study designs related to postgraduate trainees taking academic or research leave. A 3-step selection process was employed to identify articles that mentioned decay of knowledge, skill or competence. A narrative review of the literature was generated to present key themes identified within the studies. The search yielded 174 articles of which 5 investigated resident skill decay during research leave. The 5 studies included for analysis were cohort studies that used general surgery residents' self-perception and faculty members' perception of residents' skill decay as a measure. Residents and faculty perceived decay of residents' technical skills, leadership skills and knowledge following dedicated research leave. The greatest decay perceived was in technical skills, specifically with more complex tasks and longer periods of nonuse. Residents and faculty perceive a decay of resident skills following dedicated research training. To provide the necessary support to limit this potential decay, as well as to assist in the transition back into clinical training, the needs of and challenges faced by research residents and postgraduate programs must be better understood.

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Long-term outcomes of elderly patients managed nonoperatively for choledocholithiasis. K. Edwards, R. Visser, J. Bednarz, A. Tago, A. Baergan, A. Beaumont, K. Kroeker, R. Dale, A. McKay. From the University of Manitoba, Winnipeg, Man. (Edwards, Bednarz, Tago, Baergan, Beaumont, Dale, McKay); the University of Toronto, Toronto, Ont. (Visser); and the George & Fay Yee Centre for Healthcare Innovation, Winnipeg, Man. (Kroeker).

Prompt cholecystectomy (< 6 wk) following endoscopic retrograde cholangiopancreatography (ERCP) remains the gold standard management of choledocholithiasis. Although evidence increasingly supports cholecystectomy in elderly populations despite higher perioperative risk, clinical practice varies. We sought to determine the long-term effectiveness and safety of nonoperative management of choledocholithiasis in the elderly. A retrospective chart review was performed, identifying all patients

aged 70 years and older who underwent ERCP from 2004 to 2014. A provincial database was linked to capture visits at other centres. Primary outcomes included cholecystectomy, ERCP, complications, and mortality. Univariate analysis was undertaken including χ^2 tests and Kaplan–Meier analysis. Of 252 patients identified, 10.3% underwent prompt cholecystectomy and 89.7% were managed nonoperatively. Those managed operatively had lower Charlson Comorbidity Index (CCI) scores (1.0 v. 1.7, $p = 0.038$). Average follow-up was 2.9 years (SD 2.4). The average number of ERCPs per patient was 1.8 (SD 1.4). A substantial number of patients managed nonoperatively (46.9%) did not experience further choledocholithiasis. A minority of those managed nonoperatively eventually underwent cholecystectomy (13.3%). This cohort demonstrated higher CCI scores (1.8 v. 1.1, $p = 0.02$) despite younger average age (77.7 v. 82.9 yr, $p < 0.001$). Following cholecystectomy, 12.5% of patients experienced repeated choledocholithiasis. Of those managed nonoperatively, 7.1% experienced post-ERCP complications requiring intervention or hospital admission. Operative complications occurred in 10.7% although the majority were minor (average Clavien–Dindo score 2.2). Mortality was significantly lower in those managed operatively in as-treated (33.9% v. 66.8%, $p < 0.0001$) and intention-to-treat analysis (44.4% v. 62.8%, $p = 0.0032$). Kaplan–Meier survival probability at 2.5, 5 and 10 years was significantly lower in those managed nonoperatively in as-treated ($p < 0.0001$) and intention-to-treat analysis ($p = 0.0089$). Despite many patients experiencing sustained relief from choledocholithiasis, serious complications and mortality were higher among those managed nonoperatively. Higher CCI score was associated with failure of nonoperative treatment. These findings support prompt cholecystectomy for choledocholithiasis in the elderly.

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Predictors of mortality and cost among surgical patients admitted to hospital and requiring rapid response team activation. *A. Tran, S. Fernando, D. McIsaac, B. Rochweg, G. Mok, A. Seely, D. Kubelik, K. Inaba, D. Kim, P. Reardon, J. Shen, P. Tanuseputro, K. Thavorn, K. Kyeremanteng.* From the Ottawa Hospital, Ottawa, Ont. (Tran, Fernando, McIsaac, Mok, Seely, Kubelik, Reardon); McMaster University, Hamilton, Ont. (Rochweg); the University of Southern California, Los Angeles, Calif. (Inaba); the University of California Los Angeles, Los Angeles, Calif. (Kim); and the Ottawa Hospital Research Institute, Ottawa, Ont. (Shen, Tanuseputro, Thavorn, Kyeremanteng).

Prior studies of rapid response team (RRT) implementation for surgical patients have demonstrated mixed results with regard to reduction of critical events such as cardiac arrests, intensive care unit (ICU) admissions and in-hospital mortality. The objective of this study is to identify the predictors of both in-hospital mortality and hospital costs among surgical inpatients requiring RRT activation. We performed an analysis of prospectively collected data from May 2012 to May 2016. We included patients who were: (a) aged 18 years and older, (b) admitted to hospital ward, (c) either preoperative or postoperative for an elective or emergent operation and (d) requiring RRT activation. To identify predictors of in-hospital mortality, a multivariable logistic regression model was created on the basis of a priori selection of clinically important variables. We used a multivariable generalized

linear model with a γ distribution to describe predictors of hospital costs. We included 1507 patients. The median age was 71 years (interquartile range [IQR] 60–81) and median American Society of Anesthesiologists (ASA) class was 3. In-hospital mortality was 15.9%. Patient-related factors most strongly associated with in-hospital mortality included Elixhauser Comorbidity Index score 1–19 (odds ratio [OR] 1.89, 95% confidence interval [CI] 1.28–2.77), Elixhauser Comorbidity Index score 20 or higher (OR 3.60, 95% CI 1.96–6.60), increasing ASA class (OR 1.39, 95% CI 1.07–1.80) and care designations excluding ICU and cardiopulmonary resuscitation (OR 3.52, 95% CI 2.25–5.52). The strongest surgical-related predictors include neurosurgical admission (OR 2.09, 95% CI 1.17–3.75), emergent surgery (OR 2.04, 95% CI 1.37–3.03) and occurrence of 2 or more operations (OR 1.73, 95% CI 1.21–2.46). Among RRT factors, occurrence of 2 or more RRT assessments (OR 2.01, 95% CI 1.44–2.80) or activation for respiratory distress (OR 1.95, 95% CI 1.24–3.07) conferred the highest odds of mortality. Increased hospital cost was found to be strongly associated with admitting surgical service, multiple surgeries, multiple RRT assessments, ASA class and Elixhauser Comorbidity Index scores. We found that RRT activation among surgical inpatients identifies a population at high risk of in-hospital mortality. We identify several predictors of mortality and hospital costs, which represent opportunities for future quality improvement and patient safety initiatives.

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Sex-based disparities in the hourly earnings of surgeons in Ontario's fee-for-service system. *F. Dossa, A. Simpson, R. Sutradhar, D. Urbach, G. Tomlinson, A. Detsky, N. Baxter.* From the University of Toronto, Toronto, Ont.

Sex-based income disparities are well documented in medicine and most pronounced in surgery. Commonly attributed to differences in hours worked, it is unclear whether a gap persists when earnings are measured on a per hour worked basis. The objective of this study was to determine whether male and female surgeons have similar earnings for each hour spent operating in a fee-for-service system. We conducted a cross-sectional study using population-based administrative databases in Ontario evaluating claims for elective surgical procedures performed between Jan. 1, 2014, and Dec. 31, 2016. We compared earnings per hour of operative time between male and female surgeons overall and within specialties by matched analysis. We explored factors potentially associated with disparities, including differences in procedure duration and type between male and female surgeons and differences in hourly earnings for procedures performed primarily on male versus female patients. We identified 1 508 471 surgical procedures claimed by 3275 surgeons. Female surgeons were most highly represented in gynecology (48.8%). Hourly earnings for female surgeons were 24% lower than for male surgeons (relative rate 0.76; 95% confidence interval 0.74–0.79). This disparity persisted after adjusting for specialty, with the largest differences in cardiothoracic (\$79.30/h) and orthopedic surgery (\$73.73/h). There were no differences in time taken by male and female surgeons to perform common procedures; however, female surgeons more commonly performed procedures with the lowest hourly earnings. Even within a fee-for-service system, male and female surgeons do not have equal earnings for equal hours spent working, suggesting that the opportunity to perform

the most lucrative surgical procedures is greater for men than for women. These findings call for a comprehensive analysis of drivers of sex-based earning disparities, including referral patterns, and highlight the need for systems-level solutions.

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Outcomes of intestinal ischemia among patients undergoing cardiac surgery. *J. Holden, I. Grant, A. Warraich, L. Hashem, D. Tran, F. Rubens, H. Moloo, I. Raiche, R. Musselman, L. Williams.* From the University of Ottawa Ottawa, Ont. (Holden, Grant, Hashem, Rubens); The Ottawa Hospital, Ottawa, Ont. (Warraich, Moloo, Raiche, Musselman, Williams); and the University of Ottawa Heart Institute, Ottawa, Ont. (Tran).

Intestinal ischemia is a rare but devastating complication associated with cardiac surgery. The aim of this study was to describe the long-term outcomes among patients who develop bowel ischemia after a cardiac procedure, to better guide surgical decision-making and discussions with patients and their families. Retrospective data over a 10 year period were extracted from a cardiac anesthesia perioperative database to identify patients with a diagnosis of intestinal ischemia after undergoing elective or emergent cardiac surgery. Patients who underwent general surgery intervention were compared with patients who did not with respect to the following variables: in-hospital mortality, length of stay and disposition at discharge. Of the 15 086 patients who underwent cardiac surgery during the study period, 54 cases of intestinal ischemia were identified, which represents an incidence of 0.36%. In-hospital mortality among these patients was 70%. Surgical intervention was undertaken in 24 patients and mortality in this group was 54%, compared with a mortality rate of 83% in those who did not have surgery. Among patients who had surgery, the rate of stoma creation was 50%. The mean length of stay in hospital was 84 days after the initial cardiac surgery for patients who survived to discharge and 30 days for patients who died. In the group of patients who survived to discharge after a general surgery intervention, 55% required convalescence in another hospital or rehabilitation facility. For those patients who did not have surgery and survived to discharge, 60% required convalescence in another hospital or rehabilitation facility. Results from this study provide important prognostic information for health care providers as well as patients and families who are faced with a serious diagnosis. A better understanding of the expected outcomes may change the discussion and treatment plan selected for patients with intestinal ischemia after cardiac procedures.

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Factors influencing resident teaching evaluations: the relationship between resident interest in teaching, career plan, training level and their performance in teaching junior learners. *G. Pang, J. Van Koughnett.* From Western University, London, Ont.

Residents play an important role in the education of medical students. Numerous studies have focused on teaching programs and evaluation of resident teaching. Few studies have addressed motivational factors and their influences on teaching performance. The aim of this study was to examine factors that may affect the quality of teaching provided by surgical residents, as

assessed by medical students. Surgical residents at a Canadian university were invited to complete a survey assessing factors that may influence their interest and performance in teaching. Teaching performance was evaluated by third-year medical students using a modified Copeland's Clinical Teaching Effectiveness Instrument (CTEI). Demographic and survey data were described. Teaching performances between groups were compared for statistical significance using the Mann-Whitney *U* test. Open-ended responses were analyzed for themes. Ninety-three of 137 (68%) surgical residents responded to the survey. A total of 134 residents (98%) were evaluated by 136 of 141 (96%) medical students, for a total of 1089 teaching evaluations (mean 8 per resident). Resident teaching performance was not significantly different between academic versus nonacademic career interest ($p = 0.484$), enjoyment versus nonenjoyment of teaching ($p = 0.057$), clinical duty interference versus noninterference ($p = 0.330$), high versus low self-rated performance ($p = 0.811$) and junior versus senior level of training ($p = 0.492$). However, residents interested in teaching were evaluated significantly better than those who reported low interest ($p = 0.013$). Resident teaching interest may play an important role in resident teaching performance, as assessed by medical students. Resident teaching curricula should include strategies to cultivate and nurture resident interest in teaching.

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

The Hinchey classification system for acute colonic diverticulitis is a well-known grading system used frequently in patient management, but it has been criticized for being based purely on operative findings. Therefore, in 2015, a uniform scale grading acute colonic diverticulitis on the basis of clinical, imaging, operative and pathologic criteria was published by the American Association for the Surgery of Trauma (AAST). We undertook the current study to validate this grading system with respect to disease severity and outcomes within a Canadian population. A prospective cohort study was conducted at a single Canadian centre. All patients admitted to the acute care surgery (ACS) team with a diagnosis of acute colonic diverticulitis were identified daily over the study period from September 2015 to January 2019. AAST grading was assigned by 2 independent reviewers, and agreement was calculated using a κ coefficient. Regression analysis, adjusted for age and comorbidities, was performed to correlate AAST grade to patients' length of stay (LOS), risk of complications and readmission rates. A total of 250 patients were included. Patients were assigned the following grades: 10 grade I, 94 grade II, 120 grade III and 26 grade IV. There was a 95% concordance between reviewers (κ coefficient 0.903). The majority (80%) of patients were treated non-operatively, and the overall mortality rate was 2%. Higher AAST grades were correlated with longer LOS, complication rates and readmission rates. In summary, the AAST grading system can be reliably applied to formally qualify disease severity. Higher grades are associated with increased LOS, higher readmission and complication rates. The clinical applicability of the AAST grading system in affecting real-time patient care requires further study.

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Active negative pressure peritoneal therapy and C-reactive protein (CRP) levels after abbreviated laparotomy for abdominal trauma or intraabdominal sepsis: the validity of serum and peritoneal CRP in measuring outcomes in critically ill patients. *A. Kirkpatrick, C. Doig, C. Ball, F. Al Hinai.* From the University of Calgary, Calgary, Alta.

Temporary abdominal closure (TAC) methods that utilize active negative pressure wound therapy (NPWT) are currently recommended in the management of open abdomens (OA). It has been suggested that such application of NPWT increases survival in critical illness/injury potentially by mitigating the reduction of systematic inflammatory response produced by inflammatory mediators in the peritoneal cavity. A prior randomized controlled trial (RCT) found a survival advantage but the mechanism was not apparent in the selected biomarkers analyzed. C-reactive protein (CRP) is a biomarker that has traditionally been used to evaluate the extent of inflammation and infection in critical illness that was not previously analyzed. This analysis sought to investigate the clinical utility of serum and peritoneal CRP measurement as a means of explaining a potential mechanism for increased survival, and to explore the patterns of CRP elaboration in critical illness/injury. This is an original analysis of CRP samples from a prior RCT that enrolled critically ill patients after abbreviated laparotomy. A total of 45 patients were randomly assigned to groups that received either the ABThera or Barker's vacuum pack as a TAC method. Study samples were obtained from peritoneal fluid and serum to determine CRP values at baseline, 24 hours, 48 hours, 72 hours, day 7 and day 30 of admission. Analysis revealed an association between serum CRP (S-CRP) and peritoneal CRP (P-CRP) ($p < 0.001$) at baseline. For predicting sepsis incidence, analysis revealed that a unit increase in S-CRP and P-CRP doubled the chance for sepsis and the area under the curve (ROC) was 0.8636 and 0.8802, respectively. The analysis revealed a statistically significant difference in P-CRP between survivors and nonsurvivors at day 7. There was a significant association between mortality and patients with high P-CRP levels on day 7 regardless of the TAC therapy. In addition, the analysis showed an association between high S-CRP and P-CRP levels and sepsis occurrence, suggesting that CRP values may indicate a clinical pattern.

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Intraoperative use of indocyanine green fluorescence in emergency general surgery: a systematic review. *S. Alqabani.* From Western University, London, Ont.

Indocyanine green (ICG) fluorescence has been used in elective general surgery procedures to elucidate anatomy and assess tissue perfusion. This systematic review aims to determine the potential use/benefit of ICG in the emergency general surgery (EGS) setting. A literature search was conducted using PubMed, Medline, the Cochrane Library of Systematic Reviews and CINAHL for studies evaluating the use of ICG in EGS. We included prospective and retrospective cohort studies, clinical trials, case series and case reports. Systematic reviews identified during the search were checked for additional references. Two independent reviewers screened study

titles and abstracts for inclusion criteria. Full texts of relevant studies were reviewed and conflicts were resolved by consensus with the lead author. Our search generated 206 unique citations after eliminating duplicates, of which 68 studies were selected for full-text review. Fourteen papers reported the use of ICG during EGS in a total of 311 patients: 3 prospective and 2 retrospective cohort studies, 1 case series and 8 case reports. Reported indications for ICG use included anatomic delineation during laparoscopic cholecystectomy (44% of cases), tissue perfusion assessment in bowel ischemia (21% of cases) and identification of bowel resection margins and surrounding lymph nodes in colon cancer (16% of cases). Interestingly, ICG use in emergency bowel resection resulted in a change of operative strategy in more than one-third of reported cases. Laparoscopic cholecystectomy and bowel resection were the 2 main circumstances where ICG was used as a fluorescence agent in EGS. ICG in the emergency setting appears to enhance assessment of anatomy and tissue perfusion. Further research is needed to determine the appropriate techniques and patient selection for the use of fluorescent imaging in the context of EGS.

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Is it safe? Nonoperative management of blunt splenic injuries in geriatric trauma patients. *M. Trust, P. Teixeira, L. Brown, S. Ali, B. Coopwood, J. Aydelotte, C. Brown.* From the University of Texas at Austin Dell Medical School, Austin, Tex.

Owing to increased failure rates of nonoperative management (NOM) of blunt splenic injuries (BSI) in the geriatric population, dogma dictated that this management was unacceptable. Recently, there has been an increased use of this treatment strategy in the geriatric population. However, published data assessing the safety of NOM of BSI in this population are conflicting and well-powered multicentre data are lacking. We performed a retrospective analysis of data from the National Trauma Data Bank (NTDB) from 2014 and identified young (age < 65 yr) and geriatric (age ≥ 65 yr) patients with a BSI. Patients who underwent splenectomy within 6 hours of admission were excluded from the analysis. Outcomes were failure of NOM and mortality. We identified 18 917 total patients with a BSI: 2240 (12%) geriatric patients and 16 677 (88%) young patients. Geriatric patients failed NOM more often than younger patients (6% v. 4%, $p < 0.0001$). On logistic regression analysis, an Injury Severity Score (ISS) of 16 or above was the only independent risk factor associated with failure of NOM in geriatric patients (odds ratio [OR] 2.778, 95% confidence interval [CI] 1.769–4.363, $p < 0.0001$). There was no difference in mortality in geriatric patients who had successful versus failed NOM (11% v. 15%, $p = 0.22$). Independent risk factors for mortality in geriatric patients included admission hypotension, an ISS of 16 or above, a Glasgow Coma Scale score less than 9 and cardiac disease. However, failure of NOM was not independently associated with mortality (OR 1.429, 95% CI 0.776–2.625, $p = 0.25$). Compared with younger patients, geriatric patients had a higher but comparable rate of failed NOM of BSI, and failure rates were lower than previously reported. Failure of NOM in geriatric patients is not an independent risk factor for mortality. On the basis of our results, NOM of BSI in geriatric patients is safe.

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Bladder injury from laparoscopic appendectomy: a multi-centre experience over 5 years. *H. Cheab, K. Wong, S. DiLernia.* From the Central Coast Local Health District, Gosford, Australia.

Laparoscopic appendectomy is often the first unsupervised laparoscopic procedure performed by trainees. Iatrogenic bladder injury during suprapubic port insertions has been described. We present a series of iatrogenic bladder injuries managed with minimally invasive interventions. Analysis of all bladder injuries arising from laparoscopic appendectomy in 2 large regional teaching hospitals over 5 years was undertaken. In our series, 2 bladder injuries were identified. Both patients were female, 13 and 20 years of age, with ultrasound scan suggestive of appendicitis, and they underwent laparoscopic appendectomy by remotely supervised surgical trainees. A 10-mm infraumbilical port and 2 5-mm ports in the left iliac fossa and suprapubic regions were used. Operations were described as uneventful. On the first postoperative day, both patients reported significant abdominal pain, anuria and serum creatinine of over 300 $\mu\text{mol/L}$. Computed tomography intravenous pyelogram showed bladder perforation with contrast leakage into the peritoneal cavity. Both patients underwent a diagnostic laparoscopy and cystoscopy, which demonstrated areas of perforation. Methylene blue dye injected into the bladder was seen tracking extraperitoneally. One patient underwent a laparoscopic bladder repair. Both patients had a urinary catheter for 10 days. A subsequent cystogram did not demonstrate any further urine leak. Iatrogenic bladder injury should be suspected in patients with abdominal pain and anuria after laparoscopic appendectomy. Bladder injuries can be managed with a minimally invasive approach either with laparoscopic repair of the bladder perforation or urinary catheter.

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Perioperative cardiac investigations for chest pain after parathyroidectomy rarely yield a cardiac diagnosis. *D. Lustig, A. Melck.* From the University of British Columbia, Vancouver, B.C.

The incidence of adverse perioperative cardiac complications following parathyroidectomy has not been well described. The purpose of this study was to evaluate the incidence of perioperative chest pain and cardiac complications following parathyroidectomy and to evaluate risk factors that may identify patients more likely to benefit from a cardiac workup. A retrospective review of patients undergoing parathyroidectomy for sporadic primary hyperparathyroidism by an endocrine surgeon over a 4-year period was performed. Patient demographics, clinicopathologic variables, operative and postoperative details (complaint of chest pain, performance of a cardiac workup and new postoperative cardiac diagnosis) were reviewed. Patients with chest pain were compared with those without chest pain using the Fisher exact test and Student *t* test for categorical and continuous variables, respectively. Fourteen of 295 patients (4.7%) complained of chest pain in the immediate postoperative period. Most were investigated with 12-lead electrocardiograms and troponins

(12/14), yet none were diagnosed with a cardiac event. When we compared patients with and without chest pain, there was no significant difference in age, gender, body mass index, presence of cardiovascular risk factors, American Society of Anesthesiologists (ASA) score or length of surgery. There was a trend toward a longer hospital stay (1.1 v. 0.51 d, $p = 0.07$) in the chest pain group. Postoperative chest pain after parathyroidectomy is not an infrequent complaint and leads to a cardiac workup in the majority of cases; however, the risk of significant postoperative cardiac events is minimal. In the “choosing wisely” era, one should evaluate each patient’s pretest probability of such events and avoid extensive workup in low-risk patients to avoid unnecessary costs to the health care system.

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Entero-hepatic axis injury following hemorrhagic shock: a role for uric acid. *F. Kbazoom.* From the University of Montreal, Montreal, Que.

Organ failure following hemorrhagic shock (HS) results in late morbidity among trauma patients. Uric acid (UA), released from tissue damage and ischemia-reperfusion injury, activates inflammatory pathways through the TLR-4/NLRP-3 inflammasome. A role for UA in lung/kidney injury following HS was demonstrated. We hypothesized that UA could contribute to entero-hepatic injury following HS. Male Wistar rats were assigned to 3 groups following general anesthesia and femoral vessel cannulation (7–10/group): (a) sham (cannulation), (b) HS with mean arterial pressure target of 30 mm Hg for 1 h and Ringer lactate (RL) blood resuscitation (HS) and (c) HS with RL-blood plus rasburicase (1.5 mg/kg) resuscitation (HS+R). Rats were sacrificed 72 h after HS. UA was measured in plasma and liver. Liver injury was assessed using caspase-3 and caspase-8 activity, terminal deoxynucleotidyl transferase dUTP nick end labelling (TUNEL) and ICAM-1 protein expression. Intestinal injury was assessed using ex vivo epithelial resistance and in vitro intestinal cell expression of junctional proteins following UA exposure. One-way analysis of variance with post hoc analysis was performed. Rasburicase prevented HS-mediated elevation in plasma UA levels (sham v. HS v. HS+R: 1.9 μM v. 10.2 μM v. 3.7 μM ; $p < 0.05$ for sham v. HS and for sham vs. HS+R). Despite no difference in liver UA between groups, rasburicase prevented liver apoptosis after HS (caspase-3: 100% v. 178% v. 85%; caspase-8: 100% v. 164% v. 111%; TUNEL, % of apoptotic cells: 3.1% v. 19.5% v. 2.9%; $p < 0.05$ in all cases for sham v. HS and for sham v. HS+R). Increased ICAM-1 after HS was prevented by rasburicase (100% v. 178% v. 110%; $p < 0.05$ for sham v. HS and for sham vs. HS+R). Intestinal resistance was decreased in the HS group compared with sham; rasburicase administered in vivo prevented this phenomenon (114 Ω v. 82 Ω v. 112 Ω ; $p < 0.05$ for sham v. HS and for sham vs. HS+R). Intestinal cells exposed to UA showed decreased junctional protein expression (zonula-occludin 1: 100% v. 64%, $p < 0.05$; E-cadherin: 100% v. 70%, $p < 0.05$; claudin-4: 100% v. 78%, $p < 0.05$). After resuscitated HS, UA is involved in liver injury. HS-induced increased small bowel permeability through decreased adhesion proteins could be an indirect mechanism that is UA mediated. Further investigation is needed to better understand this mechanism and ultimately target UA in patients with traumatic HS.

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Loss of functional independence after emergency abdominal surgery in older patients: a prospective cohort study. *T. Wong, S. Chia, N. Nadkarni, D. Seow.* From the Singapore General Hospital, Bukit Merah, Singapore (Wong, Chia, Seow); and the Duke-National University of Singapore, Singapore (Nadkarni).

In our previous prospective cohort study of older patients undergoing emergency abdominal surgery, we found that frailty was associated with an increased risk of all-cause 30-day unplanned readmission. The primary goal of this follow-up study was to examine the association between baseline frailty and loss of functional independence in patients who were functionally independent at baseline. The secondary goal of our study was to examine the change in function over time. Patients aged 65 years and older who underwent emergency gastrointestinal surgery were recruited after examining operating theatre records. Age, gender, ethnicity, Charlson comorbidity score, operation type (laparotomy v. laparoscopic or groin hernia repair without laparotomy) and complications were recorded for patients at recruitment. Modified Fried frailty score (weak grip, weight loss, exhaustion, low physical activity and slowed walking speed) was scored at recruitment; apart from grip strength, which was measured at the recruitment interview, questions for the other 4 factors were phrased to reflect the participants' preop status. Function (Barthel scale) was scored at 1 month, 3 months, 6 months and 1 year postop. Of the 109 patients recruited, 69 completed 1-year follow-up. Only frailty was significantly associated with loss of independence over the course of 1 year, while Charlson comorbidity score, operation type and complications were not significant. Functional independence was worst at the 1-month visit, but it improved over time for the nonfrail group, with mean Barthel scores returning to baseline at 1 year. For frail patients, functional independence deteriorated at the 1-month visit but generally did not deteriorate significantly after that for the patients who remained in our study. Although the patients in our study generally experienced a decline in function within a month of emergency abdominal surgery, nonfrail patients were able to improve over time, and frail patients did not deteriorate further.

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Association between use of nonsteroidal antiinflammatory drugs, diuretics or angiotensin converting enzyme inhibitor/receptor blockers after major surgery and acute kidney injury: a nested, population-based case-control study. *D. Roberts, S. Smith, Z. Tan, E. Dixon, I. Datta, A. Devrome, B. Hemmelgarn, M. Tonelli, N. Pannu, M. James.* From the University of Ottawa, Ottawa, Ont. (Roberts); Dalhousie University, Halifax, N.S. (Smith); the University of Calgary, Calgary, Alta. (Tan, Dixon, Datta, Devrome, Hemmelgarn, Tonelli, James); and the University of Edmonton, Edmonton, Alta. (Pannu).

Acute kidney injury (AKI) is common after surgery and associated with increased mortality, costs and lengths of hospital stay. We sought to examine associations between use of nonsteroidal anti-inflammatory drugs (NSAIDs), diuretics or angiotensin converting enzyme inhibitors (ACEI)/angiotensin receptor blockers (ARB) after major surgery and AKI. We conducted a time-

matched, case-control study nested within a cohort of patients who underwent major cardiac, thoracic, general or vascular surgery between 2005 and 2012. Cases with AKI were matched on age, gender and surgery type with up to 5 controls without AKI within 30 days of surgery. Adjusted odds ratios (ORs) for AKI and median differences were determined using clustered logistic and quantile regression on the basis of postoperative administration of medications that could reduce kidney function, respectively. Among 20 154 patients in the cohort, 3216 cases with AKI were matched to 10 744 controls without AKI. Most patients underwent general (43.3%), cardiac (37.9%) or vascular (14.9%) surgery. Postoperative diuretic, but not NSAID or ACEI/ARB, use was independently associated with an increased odds of stage I (OR 1.73; 95% confidence interval [CI] 1.53–1.95) and stage II/III (OR 1.14; 95% CI 0.93–1.40) AKI. This association was apparent within 1–5 days following diuretic administration. Relationships between postoperative ACEI/ARB use and AKI varied by surgery type (p -interaction = 0.004), with lower odds of AKI observed among ACEI/ARB use after cardiac surgery (OR 0.70; 95% CI 0.57–0.81) but no difference after other major surgical procedures. Development of stage I (OR 2.07; 95% CI 1.76–2.43) and stage II (OR 6.10; 95% CI 4.98–7.47) AKI after major surgery was associated with an increased odds of all-cause mortality and a 5.1–12.2 median day longer hospital stay, respectively. Postoperative use of diuretics, but not NSAIDs or ACEIs/ARBs, was associated with an increased odds of AKI after major surgery. These findings identify common, potentially modifiable medication exposures that could reduce rates of AKI after surgery.

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Timing of CT for adhesive small bowel obstructions (SBO). *M. Nguyen, B. Elsolh, D. Naidu, A. Nadler.* From the University of Toronto, Toronto, Ont. (Nguyen, Elsolh); and the Sunnybrook Health Sciences Centre, Toronto, Ont. (Naidu, Nadler).

Small bowel obstruction management strategies vary widely between practitioners. The aim of this study was to assess the effect of the timing of computed tomography (CT) scan from emergency department (ED) presentation on outcomes for SBO patients to guide the development of an evidence-based clinical pathway. A single-institution retrospective chart review to establish prepathway implementation performance metrics was performed on SBO patients for 2016 and 2018. SBO was confirmed by CT in all patients. Nonadhesive causes were excluded. The calculated median time to CT was used to identify 2 groups: patients undergoing CT in 0–6 hours from ED presentation (early CT) and those undergoing CT after 6 hours (late CT). Groups were compared using χ^2 . A total of 299 SBO patients were identified. The median time to CT from ED presentation was 6.2 hours. A total of 149 patients had adhesive SBOs, of which 68 had an early CT and 81 had a late CT. The median length of stay was 3 days in the early CT group and 4 days in the late CT group. There was no difference in the red flags identified by CT in either group (10% v. 18.5%). In the early CT group, 5% required surgery after failure of conservative management versus 12% in the late CT group ($p = 0.072$). Of the patients who required immediate surgery, 4.4% of the early CT group required a bowel resection while 9.9% of the late CT group did ($p = 0.056$). These data suggest that early CT may result in improved care by reducing bowel resections in patients with adhesive SBO.

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The ABDO (Acute Biliary Disease Optimization) Study: improving the management of biliary diseases in emergency general surgery. *K. D'Souza, C. Huynh, D. Ko, K. Martyn, V. Zou, P. Dawe, M. Hameed.* From the University of British Columbia, Vancouver, B.C.

Emergency general surgery (EGS) conditions, including biliary diseases, are often considered to be too acute for the development of standardized processes of care. A proposed strategy to reduce practice variation while providing timely, effective and safe surgical care has been the development of integrated practice units (IPUs). These are multidisciplinary teams dedicated to providing the full cycle of care for a specific health condition. However, part of the process of developing an IPU, and the aim of this study, involves understanding the current institutional environment, setting quality of care benchmarks and engaging the perspectives of all stakeholders. A tertiary care academic centre prospectively identified 100 patients between January and April 2019 with diagnoses of acute biliary disease. Hospital databases were used to map the flux of patients by stratifying their length of stay in the hospital into granular units of time. The American College of Surgeons National Surgical Quality Improvement Program was used to gather data on postoperative complications and readmissions. Lastly, to gather feedback about the quality of inpatient care, patients completed the validated Canadian Patient Experiences Survey. A significant number of patients with acute cholecystitis did not have their operative intervention within the accepted 48–72 hours since admission. Processes displaying increased variability included time to ultrasound imaging (6.12 ± 4.55 h), time to gastrointestinal intervention (e.g., endoscopic retrograde cholangiopancreatography) (75.18 ± 43.18 h) and time to surgery (18.5 ± 13.15 h). Lastly, patients had decreased satisfaction when provided with insufficient information about the expected care plan and potential delays in management. Prospective identification of process variability identifies potential areas for improvement within the EGS model. Further steps include adopting standardized practice guidelines to improve efficiency within these processes.

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Rates and predictors of advanced biliary imaging and interventions in acute care surgery: a quality improvement study. *C. Way, K. Leslie, K. Vogt, A. Ferguson, L. Allen, B. Moffat.* From Western University, London, Ont.

Gallstone disease is a common problem encountered by the acute care surgery (ACS) team. The number and type of advanced biliary studies has been associated with increased time to surgical intervention and overall hospital stay. The goal of this observational prospective study was to identify care delays associated with additional testing for gallstone disease experienced by the ACS team at our centre. Patients who were admitted to the ACS team between Dec. 1, 2018, and Feb. 28, 2019, with evidence of gallstone disease on routine imaging were included. Time of initial plan made, time from plan to cholecystectomy and time from test result to cholecystectomy were all recorded by the ACS team. Patient demographics were recorded from our institute's electronic medical

record. Statistical differences between groups were calculated using the Mann–Whitney *U* test. A total of 121 patients were included from our 2 campuses. Of these, 63% required advanced biliary imaging/interventions, comprised of magnetic resonance cholangiopancreatography (MRCP), endoscopic retrograde cholangiopancreatography (ERCP), percutaneous transhepatic cholangiography (PTC) or cholecystostomy drain before possible cholecystectomy. There was a significantly longer time from admission to cholecystectomy when advanced biliary imaging/interventions were required (19 v. 57 h, $p < 0.01$). The length of stay in hospital was also significantly longer with additional tests (1.4 v. 4.2 d, $p < 0.01$). When we compared MRCP versus ERCP, there was no significant difference in the time the plan was made until cholecystectomy was performed (67 v. 48 h, $p = 0.479$). At our institution, use of advanced biliary imaging/interventions is associated with increased time to surgical cholecystectomy and overall length of stay in hospital. MRCP was also associated with a substantial delay to cholecystectomy, approaching an additional 3 days. These delays may represent targets for quality improvement to try to minimize in-hospital delays and length of stay.

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The use of early warning scores in patients undergoing emergency general surgery: a systematic review. *D. Laczko.* From Western University, London, Ont.

Early warning scores (EWS) were developed to provide a bedside scoring system that allows for early identification of patients at risk of deterioration. Early recognition of patient deterioration in the postoperative setting is essential for escalation of care to improve patient outcomes. The use of EWS has been increasingly studied in the surgical field. We conducted a systematic review of the literature to determine the use of EWS in patients undergoing emergency general surgery procedures. A literature search in Ovid Medline, Embase, CINAHL and the Cochrane Library electronic databases was conducted to identify articles using the following keywords: failure to rescue, early warning signs, surgical complications and emergency/acute care general surgery. A total of 693 unique studies were screened after removing duplicates. Seven papers met our inclusion criteria. Four were retrospective and 3 were prospective observational studies. Five studies assessed the use of the modified early warning score (MEWS), 1 used a geriatric rescue after surgery (GRAS) score and 1 used an early warning system screening tool (EWSST) based in Cerner. In the perioperative setting, MEWS can be used to select the appropriate level of care. Patients with higher MEWS scores were found to have longer lengths of stay, a worse prognosis following complications and a higher risk of mortality. Use of the EWSST successfully predicted patients at high risk of 30-day outcomes. Use of GRAS score helped identify patients older than 65 years at high risk of failure to rescue. The use of EWS for emergency general surgery patients pre- and post-operatively can help clinicians better identify patients at high risk of deterioration. Identification of these high-risk patients will allow clinicians to escalate care in the hopes that early intervention will reduce rates of patient mortality.

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Does primary closure versus resection and anastomosis in patients with hollow viscus injury affect 30-day mortality? *J. Beattie-Booth, T. Paradis, C. Frank, A. Beckett, K. Khwaja, P. Fata, D. Deckelbaum, T. Razek, J. Grushka.* From McGill University, Montreal, Que. (Beattie-Booth, Paradis, Frank); and the McGill University Health Centre, Montreal, Que. (Beckett, Khwaja, Fata, Deckelbaum, Razek, Grushka).

Hollow viscus injury (HVI) is uncommon among trauma patients and can be associated with both blunt and penetrating injuries. HVI has been associated with a high degree of mortality if not treated promptly. In many circumstances the decision for primary closure versus resection and anastomosis is up to the surgeon's discretion. Patients with full-thickness HVI undergoing surgical management between 2008 and 2018 were identified from a prospectively maintained institutional trauma database. Patients undergoing primary closure versus resection and anastomosis were compared in terms of length of hospital stay (LOS), postoperative complications and 30-day mortality. Continuous variables are presented as means and categorical variables as frequencies. Univariable logistic regression was performed to assess the effect of primary closure versus resection and anastomosis on 30-day mortality. We identified 65 patients presenting with HVI at our level 1 trauma centre. The majority of patients (35) underwent primary closure, with those remaining undergoing resection and primary anastomosis. A large proportion of patients (71%) suffered from penetrating abdominal injury, while 28% had blunt abdominal trauma. Only 20% of patients had associated solid organ injury. The location of HVI was most commonly within the small bowel, with a smaller proportion within the colon. The majority of repairs (63%) were performed using a gastrointestinal anastomosis stapler, with only 43% being repaired solely with sutures. The average hospital LOS was 20 days, with an average intensive care unit LOS of 6 days. Only 6% of patients were readmitted within 30 days of discharge. Preliminary analysis showed no significant association between primary closure or resection with primary anastomosis and 30-day mortality, with odds ratios 0.141 (95% confidence interval [CI] 0.015–1.35) and 0.231 (95% CI 0.024–2.12), respectively. For traumatic HVI injury, our analysis demonstrates no significant association between method of repair and 30-day mortality.

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Impact of sarcopenia on morbidity and mortality after Whipple procedure for pancreatic ductal adenocarcinoma. *L. Qu, L. Glass, C. Garcia-Ochoa, L. Allen, M. Roth, D. Wiseman, C. Yosby, K. Leslie.* From Western University, London, Ont.

Sarcopenia has been associated with various cancers and shown to have a negative effect on morbidity and mortality. The aim of this study is to investigate the impact of sarcopenia on postoperative complications and survival in Canadian patients with pancreatic ductal adenocarcinoma (PDAC) who underwent a pancreaticoduodenectomy with curative intent. From a single-centre database of 228 patients who underwent a Whipple for PDAC between 2007 and 2017, we analyzed 87 who had recorded height and available preoperative computed tomography (CT) within 6 months. We calculated total skeletal muscle cross-sectional area on CT at the

L3 vertebra and normalized by sex and height. Sarcopenia cut-offs were less than 38.5 cm²/m² for women and less than 52.4 cm²/m² for men. A modified Poisson regression model was performed to look at the association between sarcopenia and morbidity and mortality. Of the 87 patients, 58 (67%) had sarcopenia and 64 (74%) had a postoperative complication. Recurrence at 1 year was present in 54 (62%), and 14 (21%) had mortality at 1 year. There was a significant difference between the presence of sarcopenia in women and men (13 [22%] v. 45 [78%], $p < 0.001$). The incidence of complications in woman (12 [92%]) was more than in men (33 [77%], $p = 0.14$). Sarcopenia did not have an impact on postoperative complications (RR 1.24, 95% confidence interval [CI] 0.88–1.74), recurrence at 1 year (RR 0.92, 95% CI 0.65–1.28) or 1-year mortality (RR 1.36, 95% CI 0.47–3.88). Sarcopenia was more prevalent in men. However, women with sarcopenia had a higher tendency for postoperative complications after a Whipple for PDAC. Owing to the small sample size, our study may be underpowered to reflect smaller effects of sarcopenia on morbidity and mortality.

70

Mind the speaker gap: a cross-specialty analysis of the representation of women at surgical meetings in 5 different geographic regions. *A. Arora, F. Dossa, Y. Kaur, D. Little, N. Baxter.* From the University of Toronto, Toronto, Ont.

Women remain underrepresented at academic medical conferences. We designed a cross-sectional study to evaluate the representation of women as invited speakers at surgical meetings in multiple jurisdictions. We selected 30 scientific conferences held between 2017 and 2018 in 6 surgical specialties (cardiothoracic surgery, colorectal surgery, orthopedic surgery, obstetrics/gynecology, neurosurgery and urology) in 5 geographic regions (Australasia, Canada, Europe, United Kingdom, United States). We determined the gender of speakers giving invited lectures and included in panel sessions from conference programs, and we determined the number of planning committee members who were women. We evaluated the proportion of female speakers and the number of all-male panels (MANELS) at each conference. We compared the proportion of women in each specialty with their representation at respective conferences. We examined the correlation between the planning committee gender balance and the proportion of female speakers. In total there were 1854 sessions including 1227 panels and 627 invited lectures. Women made up 914 speakers (16.1%) of the total 5676 speakers. The gender distribution of speakers for invited lectures (24.7% women, interquartile range [IQR] 18.2%) and panels (15.0% women, IQR 17.5%) was similar. At 6 conferences, women made up less than 10% of speakers. Most panel sessions (61.8%) were MANELS. Only 1 conference had no MANELS. The representation of women at conferences and baseline sex ratios varied by region. In the US, the representation of women at conferences was generally higher than their baseline proportion, while in Europe the representation of women was generally lower. We found a moderate positive correlation between the proportion of women on steering committees and the representation of female speakers at conferences ($r = 0.44$, $p < 0.033$, 95% confidence interval 0.04–0.71). A low representation of female speakers is common at surgical meetings, and most panel sessions include no women. Action to increase the participation of women at surgical meetings and strategies to avoid MANELS should be considered.

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Immediate breast reconstruction in locally advanced breast cancer: Is it safe? *K. Taqi, J. Pao, L. Chen, E. Mckevitt, A. Bazzarelli, C. Dingee, R. Warburton.* From the University of British Columbia, Vancouver, B.C. (Taqi, Chen); and Mount Saint Joseph Hospital, Vancouver, B.C. (Pao, Mckevitt, Bazzarelli, Dingee, Warburton).

Immediate breast reconstruction (IBR) following mastectomy is a safe treatment option for early breast cancer, but its safety for locally advanced disease has been debated owing to concerns about local recurrence, delayed adjuvant therapy and surgical complications. However, IBR is a preferred option for younger populations and has a positive impact on quality of life after surgery. The aim of this study is to compare the surgical outcome and oncological safety of IBR following mastectomy compared with mastectomy alone (MA) for locally advanced breast cancer. Data were collected retrospectively from electronic records and chart review for all patients with primary locally advanced breast cancer who underwent surgery at a single acute care community hospital between January 2012 and December 2017. A total of 360 patients were included in the study (IBR: $n = 150$, MA: $n = 210$). Patients who received IBR and MA had mean ages of 49.39 and 62.04 years, respectively ($p < 0.05$). The median follow-up in the study was 30 months with a maximum of 84 months. Recurrence of disease occurred in 61 patients: 21 in the IBR group and 40 in the MA group ($p = 0.14$); however, only 8 patients had local recurrence (IBR: $n = 1$, MA: $n = 7$). There was no statistically significant difference in the use of neoadjuvant ($p = 0.06$) and adjuvant therapy ($p = 0.488$) between the IBR and MA groups. Disease-specific mortality also did not differ significantly between the groups (IBR: $n = 11$, MA: $n = 18$, $p = 0.56$). Immediate breast reconstruction is a safe option for patients with locally advanced breast cancer and does not increase recurrence or disease-specific mortality.

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An administrative review of the incidence of adverse events involving electrocautery. *B. Giammarioli, H. Queresby, C. Masimo, A. Maeda, T. Jackson, A. Okrainec.* From the University Health Network, Toronto, Ont.

Electrocautery can readily serve as an ignition source and can lead to fires and burns. The purpose of this administrative review is to determine the incidence of surgical fires and burns related to electrocautery use at our institution. A retrospective review of our institutional incident report data between Jan 1, 2007, and Dec 31, 2017, was performed. Adverse events were reviewed for the following level of harm classifications: critical, severe, moderate, minor, near miss, and near miss/potentially severe. Two independent reviewers coded the data using a conventional content analysis method. Our findings revealed a very low total incidence of electrocautery fires and burns over a 10-year period, which constituted 0.01% of total operating room cases performed. A total of 7 electrocautery-related fire events and 19 burns were recorded, with a decreasing trend over time. The majority were classified as moderate (14/26, 53.8%) closely followed by a minor level of harm classification (10/26, 38.4%). For the critical and severe classifications, only 1 severe event was reported, involving a sponge fire. No deaths were reported. The majority of fire incidents were recorded as sponge fires (4/7,

57%) followed by cautery pencil fires. Additionally, both patients and surgeons were susceptible to burns, with 19 of these events taking place over the last 10 years resulting in 2 surgeon burns and 17 patient burns. All incidents caused by electrocautery burns were assigned a minor or moderate level of harm classification. Administrative review of institutional incident report databases should include all level of harm classification as this may reveal a higher incidence of events. These data can be useful to determine needs for continued training in the safe operation of electrocautery through certifications such as the Fundamental Use of Surgical Energy.

73

If you don't document it, did it really happen? A review of the documentation of informed consent in laparoscopic cholecystectomy. *S. Nanji, R. Selvam, E. Williams.* From Queen's University, Kingston, Ont.

Despite improvements in the informed consent (IC) discussion in surgery, its documentation remains inadequate. Laparoscopic cholecystectomy (LC) is a common general surgery procedure that is performed both electively and emergently for which IC discussion is routine. We performed a review of the completeness of IC documentation for LC in our academic institution with a general surgery residency training program. The clinic note, operating room note (OR note) and consent form were evaluated for completeness of documentation of IC, which was defined as details of the procedure, alternatives and potential complications. Differences in completeness between elective and emergent cases were also assessed using t tests for continuous data and the Pearson χ^2 test or Fisher exact test for categorical data. Of 100% (270) of patients undergoing LC from 2015 to 2017, only 1.9% (5) of patients had documentation of all elements of IC. Alternatives to the procedure were documented the least frequently, in only 27.0% (20) of elective cases in contrast to 1.5% (3) of emergent cases ($p < 0.0001$). Details were outlined in only 29.7% (22) of elective cases compared with 3.6% (7) of emergent ($p < 0.0001$). Complications were documented in 91.9% (68) of elective cases compared with 93.9% (184) of emergent cases ($p = 0.560$). Documentation was performed primarily by residents with 74% (200) of identifiable consent forms completed by trainees. Complete documentation of IC for LC at our institution appears inadequate, and it is worse in the emergent setting than in the elective setting. Further research is needed to assess for potential barriers to IC such as time constraints or inadequate IC forms. Improvement strategies should also be explored such as the adaptation of a tailored IC for LC or development of specific training programs in acquiring IC.

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Can an online module help medical students gain confidence and proficiency in writing orders? *T. Wijayanayaka, J. Davidson, A. Butter.* From Western University, London, Ont.

The introduction of computerized physician order entry (CPOE) at our institution has raised concerns about the quality of undergraduate education regarding medical students' ability to learn appropriate patient care and medication orders. A previous study conducted at our institution demonstrated that student satisfaction was very low with regard to learning how to write orders

after implementation of the CPOE. Thus, we created an online module where surgical clerks can practise writing case-based mock orders and assessed its effectiveness at improving students' competence and confidence at writing orders. We conducted a randomized controlled trial that included third-year clerks. Clerks were given a pretest at the start of their surgery rotation assessing both their confidence and competence in writing orders as well as a posttest assessing the same factors at the end of their rotation. They were randomly assigned to either the intervention group, which received access to the online module during their rotation, or the control group, which did not. To date, data have been collected from 30 clerks who have completed all components of the study. There was no significant difference in pretest scores between the intervention and the control groups; however, the median posttest scores (out of 40) were significantly better in the group that received the module (24.5, interquartile range [IQR] 23.0–27.5) than in the group that did not (14.0, IQR 12.0–18.0) ($p = 0.0257$). Despite demonstrating a significant improvement in scores, at this time our data do not show a significant difference in clerks' confidence levels in writing patient care and medication orders between groups. Our study demonstrates that an online module can increase clerks' ability to write accurate orders in the face of challenges posed by CPOE and may help to address some of the educational concerns raised by medical students previously.

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The influence of undergraduate medical education anatomy exposure on choice of surgical specialty: a national survey. *T. McKechnie, J. Springer, A. Doumouras, C. Eskicioglu, S. Reid.* From McMaster University, Hamilton, Ont.

The number of Canadian Resident Matching Service (CaRMS) applicants ranking surgical specialties as their first choice has declined over the past 20 years. During this same time frame, there has been a significant reduction in the number of hours being spent teaching undergraduate medical education (UGME) anatomy, particularly cadaveric dissection-based anatomy. The aim of this study was to determine the most impactful persuasive and dissuasive factors in selecting a surgical specialty and to determine the importance of anatomy teaching to this process. A 21-item, bilingual cross-sectional survey, administered via SurveyMonkey (www.surveymonkey.com), was sent to all current surgical residents in Canada across all specialties. The majority of responses were recorded using a 5-point Likert scale or place ranking. All statistical analyses was carried out using GraphPad Prism 7 statistical software (GraphPad Software Inc.). A 2-sided α value of 0.05 was considered statistically significant. Two hundred and twenty-eight (15.5%) surgical residents responded to the survey. Experiences on core rotations, elective rotations and having a mentor were most commonly cited as the most important factor in decision of specialty. Free time as well as job availability were the top dissuasive factors. Interestingly, the influence of free time, future money, significant others and exposure to anatomy before medical school differed between genders and favoured heavier weighting for males. Otherwise there were no differences between genders. Anatomy training with or without cadaveric dissection was moderately influential in residents' first-choice CaRMS discipline (5-point Likert scores 2.87 and 2.97, respectively), with cadaveric dissection having the

greatest impact on learning (54.9%). UGME anatomy training, with or without cadaveric dissection, has a moderate influence on specialty decision but is not as important as students' experience in the specialty or access to a mentor.

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Association between patient engagement and surgical outcomes: a pilot study. *T. Dumitra, N. Mayo, P. Kaneva, J. Mata, J. Fiore Jr., L. Lee, G. Fried, L. Feldman.* From McGill University, Montreal, Que.

In patients with chronic medical conditions, there is a strong association between patient engagement (PE) and health care outcomes, including resource utilization. The goal of this study was to estimate the extent to which low PE predicts postoperative outcomes and emergency department (ED) visits after colorectal surgery. A secondary analysis of data from a randomized controlled trial including adult patients who underwent scheduled colorectal surgery was performed. PE was measured using the Patient Activation Measure (PAM), classified as high or low. Outcomes included adherence to an enhanced recovery pathway (ERP), 30-day complications, 30-day ED visits and satisfaction. The groups were compared using χ^2 tests, Fisher exact tests, t tests or analysis of variance. A total of 97 patients were included in the study cohort, 14% ($n = 14$) of whom had a low preoperative PE. Patient characteristics were similar between the 2 groups. Patients with high PE had higher ERP adherence on postoperative day 1 (66% v. 47%, $p = 0.004$) and felt more informed and motivated ($p < 0.005$). Patients with high PE were more likely to have early discharge (length of stay ≤ 3 d) (37% v. 7%, $p = 0.021$). There was no difference in the incidence of postoperative complications (47% in the high group v. 43% in the low group) or ED visits (21% high v. 20% low). This pilot study suggests that levels of activation do not predict ED use after discharge in patients undergoing colorectal surgery. However, highly activated patients have a higher adherence to care pathways, tend to be discharged sooner after surgery and feel more informed and motivated in their care. Patient activation levels decreased in the immediate postoperative period. Further studies in a larger cohort of surgical patients are warranted.

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Guidelines on the intraoperative transfusion of red blood cells: a systematic review. *L. Baker, L. Park, R. Gilbert, H. Abn, A. Davis, D. McIsaac, E. Saitenberg, A. Timmouth, D. Fergusson, G. Martel.* From the University of Ottawa, Ottawa, Ont.

A significant proportion of red blood cell (RBC) transfusions are administered intraoperatively, yet there is limited evidence to guide transfusion decisions in this setting. The objective of this systematic review was to explore the availability, quality and content of clinical practice guidelines (CPGs) reporting on the indication for intraoperative allogenic RBC transfusion. Major electronic databases, guideline clearinghouses and Google Scholar were systematically searched from inception to January 2019 for CPGs pertaining to indications for intraoperative allogenic RBC transfusion. The Appraisal of Guidelines for Research & Evaluation (AGREE) II instrument was used to appraise the quality of identified guidelines. Recommendations advising on indications

for intraoperative RBC transfusion were extracted and presented to allow for comparison of similarities and/or discrepancies in the literature. Nine CPGs were identified, published between 1992 and 2018, from 6 North American and 5 European groups. “Clarity of presentation” (85% ± 7%) and “scope and purpose” (81% ± 13%) were the highest scoring domains; “applicability” (19% ± 22%) and “editorial independence” (39 ± 20) were the lowest scoring domains on AGREE II. Specific hemoglobin transfusion triggers (range 7–10 g/dL) or targets (range 7–9 g/dL) are present in 5 of 6 CPGs that recommend measuring hemoglobin. Five guidelines recommend that surgical blood loss should guide transfusion decisions, without quantifying a volume at which a transfusion is indicated. One of 5 CPGs that recommend monitoring for evidence of decreased end-organ perfusion advises on the circumstances under which a transfusion should be administered (ST changes on electrocardiogram). Five CPGs recommend using vital signs, none of which present thresholds in which transfusion is indicated. One guideline, targeted at pediatric patients with heart disease, fails to provide guidance owing to insufficient evidence. With the exception of hemoglobin triggers, founded on limited evidence, specific, practitioner-oriented criteria for administering RBC transfusions in the intraoperative setting are lacking. Review of current research and anticipated further investigation are necessary to guide formulation of CPGs targeted at intraoperative decision rules.

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Cancer is common in missed appendicitis: a retrospective cohort study. *E. Walser, A. Maciver, P. Murphy, K. Leslie.* From Western University, London, Ont.

Missed appendicitis is a common clinical scenario without strong evidence to guide management. Initial nonoperative management has been shown to avoid increased operative morbidity, but subsequent care and the role of interval appendectomy remain controversial. Recent studies have suggested that the rate of malignancy in interval appendectomy specimens is higher than previous estimates. Our goal was to characterize the treatment and outcomes of missed appendicitis in a Canadian population. All cases of appendicitis at a single academic health sciences centre from 2013 to 2018 were screened using hospital diagnostic codes. Demographics, interventions and operative characteristics were recorded. Outcomes included malignancy rate, recurrence and use of follow-up colonoscopy. Over the 5-year study period, 110 patients with missed appendicitis were identified. Length of antibiotic treatment was heterogeneous, ranging a median of 12 days (interquartile range 7). Twelve patients (11%) developed recurrent appendicitis, at a median interval of 322 days. The majority of patients were offered appendectomy (74%) and nearly 25% declined further intervention. Fifty-three (48%) patients underwent interval appendectomy and cancer was diagnosed in 9 (17%). The majority of cancers (78%) were diagnosed in patients over 40 years of age. Five (9.4%) patients undergoing interval appendectomy experienced a significant complication (Clavien–Dindo 3a or higher). Overall follow-up with colonoscopy was lower than expected; only 53 patients (48%) had a follow-up colonoscopy. In a Canadian population, missed appendicitis is frequently associated with an underlying neoplasm. Follow-up colonoscopy and interval appendectomy should be offered to all patients following missed appendicitis.

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Everyone is awesome: analyzing letters of reference in a general surgery residency selection process. *C. Towaij, I. Raiche, J. Younan, N. Gawad.* From the University of Ottawa, Ottawa, Ont.

Resident selection includes reviewing letters of reference (LORs). Given their subjective nature, our ability to rely on LORs is unknown. The purpose of this study was to assess the frequency with which LORs use objective qualifiers to describe applicants and whether these terms are representative of the applicant pool. A retrospective cohort analysis of all LORs submitted by Canadian medical graduates to our institution’s general surgery program in 2018 was conducted. A database was created including demographics of applicants and referees. Objective qualifiers identified a priori were recorded (mentions of level, average, comparisons to residents, and percentages). Descriptive statistics were used to analyze the demographics of applicants and LORs and the frequency of use of objective qualifiers. A total of 343 LORs describing 114 applicants were analyzed. Eighty-two percent ($n = 291$) used objective qualifiers to describe applicants. Of these, 45% of LORs described applicants as functioning at a resident level, 21% as being the “best,” 55% as being above average and only 20% as being average. A global percentage was used in 28% of letters ($n = 97$) and the average score was the ninth percentile. Rankings of applicants called “best” in a LOR ranged from second to 104th in our file review process. Most LORs use objective qualifiers, which are generally positive. It is unclear whether the use of positive qualifiers is inflated or whether the absence of a positive qualifier implies a negative impression of the applicant. As such, objective qualifiers alone should not be relied on when assessing LORs.

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Evaluating the true additional costs of general surgery complications using a propensity score weighted model. *N. AIShabwan, S. Fraser.* From McGill University, Montreal, Que.

Complications after general surgery procedures have been known to increase health care costs; there is no defined value of the added costs of these complications in Quebec. We hypothesize that identifying the true costs of common complications will tempt stakeholders to increase funding in education/prevention bundles. The patients were identified using the American College of Surgeons National Surgical Quality Improvement Program database in a single university-affiliated tertiary care centre. The cost data were derived from Med-GPS, the hospital’s accounting system. The data showed the costs of admission, surgical procedure, medications, laboratory tests, imaging and emergency department/clinic follow-up. We included patients from a 1-year period (April 2013 to March 2014) and the complications examined were deep surgical site infection, urinary tract infection and venous thromboembolism. We used a propensity score weighted module to match patients with complications to those without; this was done to identify the cost increase with different complications. We determined similarity in types of procedures before matching. Treatment costs and length of stay were the primary outcomes measured. The total number of complications identified was 66; the majority were deep surgical site infections. 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. Mortality was significantly higher in the complication group (6%) than in patients who did not have complications (0.9%). This study examines the true added costs of complications after general surgery procedures; there was an increase in mortality, length of stay and costs in treating patients who had a complication. Increasing awareness and implementation of prevention bundles is an effective way of reducing costs and improving outcomes.

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Deriving literature-based benchmarks for surgical complications from national databases in high-income countries: a systematic review on pancreatectomy outcomes. *M. Horkoff, O. Daodu, C. Grabam, D. Urban, M. Brindle.* From the University of Calgary, Calgary, Alta.

Health systems must identify preventable adverse outcomes to improve surgical safety. Benchmarks for postoperative patient outcomes and complication rates are key to establish to set goals for advances in care. Procedures with relatively high complication rates offer targets for quality improvement. In this study, we conducted a systematic review to determine national rates of postoperative complications associated with pancreatectomy in high-income countries (HICs). A comprehensive search for national database studies from 2000 to 2016 from 5 HICs was conducted. Studies on complication rates associated with pancreatectomy were included. Twelve postoperative complications and outcomes, including mortality and length of hospital stay (LOS), were reported. One hundred and seventeen papers met the inclusion criteria. The large majority of studies were from the United States ($n = 115$) with another 2 studies being from the United Kingdom. No studies from Canada, Australia or New Zealand met the inclusion criteria. The American College of Surgeons National Surgical Quality Improvement Program ($n = 72$) and the National Inpatient Sample ($n = 37$) were the most prevalent national databases used in studies. Data on 1 562 474 patients were extracted. The overall mortality was 4.13%. Mean length of stay was 10.8 days and 15.62% of patients required readmission. The most common complications were sepsis/septic shock (7.97%), surgical site infection (14.33%) and requiring a blood transfusion (18.19%). The overall reoperation rate was 5.36%. This systematic review provides benchmark rates of complications and mortality after pancreatectomy by examining a large number of national database studies in HICs. Information on national outcomes is paramount to improving patient care.

82

The impact of distance on postoperative follow-up in pediatric general surgery patients: a retrospective review. *M. Wiebe, A. Shawyer.* From the University of Manitoba, Winnipeg, Man.

Although consolidation of medical services has been shown to decrease overall system health care costs, many Canadians must now travel large distances for care and therefore may attend fewer appointments, resulting in disparate care. We sought to determine whether children who live farther away from a chil-

dren's hospital are offered, and attend, fewer follow-up appointments than those living in closer proximity. All children younger than 17 years of age referred as an outpatient to the pediatric general surgery clinic at our children's hospital between Jan. 1, 2016, and Dec. 31, 2017, who underwent a surgical procedure were reviewed. Demographic, diagnostic, surgical, follow-up and complication variables were extracted. Descriptive statistics and analysis were performed. A total of 723 patients were identified. The majority were male (61%), the median age was 7 years (range 18 d – 16 yr) and 56.3% lived close to the hospital. The median distance travelled to hospital for patients from within the city was 8.9 km (range 0.9–22) and it was 119.5 km (range 20.3–1950) for patients from farther away. Patients from the city were offered significantly more follow-up appointments (72.5% v. 60.8%, $p < 0.05$). There was no significant difference in follow-up attendance for patients from the city (89.1%) compared with those from farther away (89%) ($p = 0.97$). There was no significant difference in postoperative complication rates between patients from nearby (9.8%) and those from outside the city (9.2%) ($p = 0.78$). There were no deaths. Patients living farther away are not offered the same rate of follow-up; however, they attend an equivalent number of follow-up appointments when offered one. Telehealth or remote follow-up are underused approaches to increase follow-up rates, while reducing expenses and employment and school absenteeism for patients and their families. Family and patient input regarding these modalities should be sought out.

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Water-soluble contrast in adhesive small bowel obstruction management: a Canadian centre's experience. *B. Elsolh, M. Nguyen, D. Naidu, A. Nadler.* From the University of Toronto, Toronto, Ont.

Determining whether an adhesive small bowel obstruction (SBO) will resolve nonoperatively is not standardized. Orally administered water-soluble contrast (WSC) can be used diagnostically and therapeutically by tracking transit time to the cecum using x-rays in stable patients with SBO. This more rapidly ascertains need for surgery and reduces length of stay (LOS). We review outcomes of patients following the implementation of a standardized SBO pathway at a tertiary care academic centre. A WSC pathway was created and implemented. Historical control data were gathered from 2016, and the pathway was introduced gradually over 2018 with a PRE group from the first half of 2018 and a POST group from the second half. The primary outcome was hospital LOS. Secondary outcomes included rates of failure of conservative management, readmission rates for SBO, in-hospital complications and mortality. A total of 144 patients with adhesive SBO were reviewed (55 2016 v. 58 2018 PRE v. 31 2018 POST). One patient (1.8%) in 2016 received WSC, compared with 25 (43.1%) in the 2018 PRE group and 22 (71.0%) in the 2018 POST group. The 2016 group had a median LOS of 3 days versus 4 days in the 2018 PRE group and 2 days in the 2018 POST group ($p > 0.05$). Compared with 2016 patients, 2018 POST patients had a higher rate of needing surgery following failure of conservative management (14.9% v. 3.6%, $p < 0.05$) and a lower readmission rate (10.8% v. 34.8%, $p < 0.05$). Complications and mortality did not differ between groups. LOS was not statistically significantly lower with pathway implementation, but the difference may be

clinically significant. The number of patients undergoing surgery for SBO increased, and readmissions for SBO decreased. This may be a result of early operative decision-making as a result of the pathway. Further evaluation is required to increase pathway compliance and assess its impact on outcomes.

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Recognizing predatory journals in general surgery and their common violations. *M. Mohammed, R. Hilsden, T. Ribeiro, A. Siddiqui, N. Alkhamisi.* From Western University, London, Ont. (Mohammed, Hilsden, Ribeiro, Alkhamisi); and Carleton University, Ottawa, Ont. (Siddiqui).

Open access literature has benefited medicine by increasing the availability of published research, reducing the risk of publication bias, and allowing work that would otherwise not be published in print to be available online. At the same time, the willingness of some people to exploit authors for the purpose of profit has led to the rise of predatory journals. Predatory journals trade editorial oversight for the opportunity to profit from authors. We sought to identify the characteristics surgeons can look for to identify whether a particular journal could be predatory. Using the journal blacklist of Cabell's International, we identified predatory journals in general surgery. The journals, their location, their publishers and the types of violations were studied to determine common factors between these journals. A total of 175 predatory journals established by 44 publishing groups were identified. Fifty percent of these were from India. Another 30% claimed to be from North America but lacked a physical address there. Common violations included no copyright policies (75%), inadequate publications (58%), promised expeditious publications (44%), failure to disclose conflicting interests (42%) and lack of peer review policies (41%). None of these journals were indexed in PubMed (0%), and some were never listed in any standard directories or library databases (20%). Predatory journals not only exist but have become common in the field of surgery. Lists that identify predatory journals are never exhaustive. Therefore, researchers must have the skills to recognize predatory practices. Our results demonstrated that the majority of predatory journals were established in India between a much smaller group of publishers. Failure to outline policies surrounding digital preservation and peer review process, promises of rapid publication, and infrequent or missing publications were the most common violations. The presence of any of these practices should signal to a potential author that the journal is exhibiting questionable editorial practices.

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Prophylactic negative pressure wound therapy for closed laparotomy incisions: a meta-analysis of randomized controlled trials. *T. Kuper, P. Murphy, B. Kaur, M. Ott.* From Western University, London, Ont.

Surgical site infections (SSIs) are a common cause of morbidity following open abdominal surgery. Prophylactic negative pressure wound therapy (NPWT) has shown promise for SSI reduction. However, the results of randomized controlled trials conducted among patients undergoing laparotomy have been inconsistent. We aimed to determine whether NPWT applied to primarily closed incisions decreases SSIs following open

abdominal surgery. A meta-analysis of English-language randomized controlled trials comparing the use of prophylactic NPWT to standard dressings on primarily closed laparotomy incisions following open abdominal surgery was performed. The Medline, Embase, Cochrane Library and CINAHL databases were searched from inception to Dec. 31, 2018, for relevant studies. A random-effects model was used for statistical analysis. Within-study biases were assessed using the Cochrane Collaboration's tool. Publication bias was assessed by visual inspection of a funnel plot. Five randomized controlled trials with a total of 792 patients were included in our meta-analysis after application of our exclusion and inclusion criteria. There was no significant difference in the risk of SSIs identified among those patients who had NPWT compared with standard dressings (relative risk 0.56, 95% confidence interval 0.30–1.03, $p = 0.064$). There was significant statistical heterogeneity across studies ($I^2 = 67.4\%$, $p = 0.015$). All trials but 1 reported measures taken to ensure randomization and allocation concealment. Surgeons and patients were not blinded to study interventions in any of the included trials. Outcome assessors were blinded in only 2 of the included studies. Publication bias was detected by visual inspection, with smaller studies estimating a greater risk reduction of SSIs with the application of NPWT in comparison with standard dressings. NPWT for SSI prophylaxis following laparotomy should be adopted with caution outside of randomized controlled trials. Studies have shown conflicting results for this costly intervention, they are prone to bias and our meta-analysis demonstrated no benefit.

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Choosing Wisely Canada: 2019 general surgery recommendations. *L. Abraham, D. Mok, S. Brar, I. Datta, S. Chadi, A. MacNeill, F. Wright.* From the University of Toronto, Toronto, Ont. (Abraham, Brar, Chadi, Wright); the University of Alberta, Edmonton, Alta. (Mok); the University of Calgary, Calgary, Alta. (Datta); and the University of British Columbia, Vancouver, B.C. (MacNeill).

Choosing Wisely Canada is a national program focused on reducing unnecessary tests and treatments in health care as well as providing revised evidence-based recommendations for Canadian physicians. Practising general surgeons in Canada were invited to join this working group. A review of previous recommendations was performed, in addition to identifying new topics through focus group sessions. These were subjected to literature review and those that were not evidence based were excluded. Six surgeons then used the nominal group technique to reach consensus. The top 5 recommendations were put forward. The final recommendations are as follows: (1) Avoid the routine use of ultrasound to evaluate clinically evident inguinal hernias and, where appropriate, consider a watchful waiting approach for up to 2 years in patients with minimally symptomatic inguinal hernias. (2) Avoid the use of computed tomography for the evaluation of suspected appendicitis in pediatric patients until an ultrasound has been considered as an option. (3) Avoid colorectal cancer screening tests in asymptomatic patients with a life expectancy of less than 10 years and with no personal or family history of colorectal neoplasia. (4) In adult patients with complicated intraabdominal infections, avoid prescribing a prolonged course of antimicrobial therapy (> 5 d)

after source control has been adequately obtained. (5) Contralateral prophylactic mastectomy is not recommended for average-risk women with early-stage unilateral breast cancer. The revised Choosing Wisely Canada recommendations offer Canadian surgeons guidance in the diagnostic workup and management of general surgery issues to reduce unnecessary and potentially harmful interventions. These are, however, general recommendations and clinical judgment is paramount in ensuring the safety and appropriateness of proposed treatment plans. The next phase will involve employing knowledge translation strategies to encourage the implementation of these recommendations into surgical practice.

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Content-specific resident teaching can improve medical student learning outcomes on certifying examinations. *N. Zondervan, K. McLaughlin.* From the University of Calgary, Calgary, Alta.

Residents are ideally positioned to teach medical students because their similar level of training creates a safe environment where students are comfortable asking questions and presenting ideas. Many surgical residents receive resident-as-teacher training, but improved teaching skills have not been shown to improve medical student learning. It is unlikely that improving the teaching ability of residents will translate into improved test scores until the content of the teaching matches the examination. This study examined the impact of using residents to deliver a predefined acute care surgery curriculum on medical student performance on certifying examinations. This study used a prospective interventional cohort design with separate 1-year observation and intervention periods. Knowledge acquisition during the rotation was measured using multiple-choice examination scores, while clinical skills were evaluated during the clerkship objective structured clinical examination (OSCE). Secondary analysis focused on student ratings of the rotation and resident teaching effectiveness. Focus groups of medical students and residents were also completed to gain further insight into their experiences as teachers and learners. We found no difference in the performance of medical students on the surgery multiple-choice question examination. However, the proportion of medical students passing the surgery OSCE station increased from 80.6% to 91.0% ($p = 0.01$) following the intervention. There was no change in teaching effectiveness ratings, but ratings of the rotation declined during the intervention. Focus groups described a lack of time for teaching owing to clinical responsibilities as a common barrier to knowledge acquisition, while the clinical skills resources were thought to be valuable teaching tools that could be easily incorporated into everyday patient interactions. The introduction of a resident-led curriculum can improve the performance of medical students on certifying examinations provided that the content of the teaching is aligned with the examination and adequate time is available for teaching activities.

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Transition to practice: preparedness for independent practice in general surgery graduates. *M. Parapini, F. Shariff, T. Scott, A. Karimuddin.* From the University of British Columbia, Vancouver, B.C.

The practice of general surgery has evolved significantly, with increasing complexity in technology and subspecialty treatment approaches. Despite this evolution, there are few studies that assess the readiness of Canadian general surgery graduates for independent practice and whether current training supports this transition effectively. The objective of this study was to examine perceived strengths and weaknesses of our program in preparing graduates for independent surgical practice in both technical and nontechnical domains. A qualitative survey was distributed to our graduates from the last 5 years, exploring issues related to readiness for practice including perceived need for additional fellowship training, comfort with technical procedures, readiness for clinical decision-making and preparedness for the administrative aspects of practice. Descriptive analysis of amalgamated and anonymized responses was performed to summarize key findings. Twenty-one of 33 eligible respondents (64%) completed the survey, with 85% pursuing fellowship training before practice. Top reasons for fellowship training included desire to specialize in an area of interest and the need to be competitive for employment. Trauma, colorectal surgery and surgical oncology were areas of strength for graduates, while they expressed lower confidence in complex head and neck, upper gastrointestinal (UGI) and vascular procedures. Respondents also felt underprepared for the administrative tasks of starting a practice such as employment contract negotiation and promotion/tenure. Overall, the large majority (89%) of graduates felt they were adequately prepared for transition to the surgery attending role. Areas of articulated strengths and weaknesses are in keeping with current practice trends within the field of general surgery and provide guidance for where efforts in curriculum development for Canadian trainees might best be targeted. In the context of the upcoming competence by design framework, these results also help to highlight key directions for educational programming in the final transition-to-practice stage of training.

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CAGS Exam 2.0: maximizing the potential for teaching and learning. *C. Gomez-Garibello, M. Wagner, B. Vair, P. Fata.* From McGill University, Montreal, Que. (Gomez-Garibello, Wagner, Fata); and Dalhousie University, Halifax, N.S. (Vair).

Each year all general surgeon residents in Canada write the Canadian Association of General Surgeons (CAGS) examination. This formative exam assesses the full breadth of core and fundamental knowledge required by trainees in their residency in multiple different domains. The exam has evolved in numerous ways since it was first developed and implemented through a purposeful process of test development and revision (e.g., surgeons and assessment experts working in tandem; test blue-printing). The purpose of the study was to evaluate the potential of the exam for teaching and learning through analyses of trainees' test performance data. Residents' exam performance was analyzed in 3 successive test administrations (2017, 2018, 2019) in which 806 examinees had written the CAGS exam at least once, to determine if the exam reflected their progression of surgical knowledge. We also tracked residents' longitudinal performance across the 3 iterations of the exam for residents who had taken the exam all 3 times ($n = 214$). Qualitative data were also gathered from residents about their perception of the

exam in terms of its relevance, content and feedback provided. The analyses revealed that the test differentiates performance between junior and senior residents. The postexam survey revealed that the majority of residents (> 70%) found that the exam was a fair assessment of their knowledge and the content was relevant. The longitudinal analyses revealed that learners' overall performance improved successively; however, their performance across the different assessment domains (e.g., trauma, breast) varied. These findings reveal that the reenvisioned CAGS exam has a wealth of potential for advancing teaching and learning by: (a) providing specific information to program directors regarding curriculum delivery and supervision; (b) identifying learners who are not advancing as expected; and (c) generating diagnostic information about learners' performance over time and across different content areas.

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Resident attitudes toward the introduction of synoptic operative reporting for appendectomy and cholecystectomy. *M. Lipson, T. Maclean, E. Dixon.* From the University of Calgary, Calgary, Alta.

Synoptic reporting has been used across many areas in medicine in attempts to improve quality by decreasing variation, including operative and radiology reports. Appendectomy and cholecystectomy are 2 of the most common procedures general surgery residents are involved in. This study reports resident attitudes before and after the introduction of a synoptic operative report template for appendectomy and cholecystectomy. A survey assessing resident attitudes toward synoptic appendectomy and cholecystectomy reports was administered to general surgery residents before the introduction, early after the introduction and late after the introduction of synoptic operative reports. Response rates before, early after and late after the introduction of synoptic operative report templates were 44%, 45% and 42%, respectively. Residents were significantly more likely to believe that synoptic operative reports save them time compared with dictating early after introducing the templates compared with their impressions before implementation ($p = 0.049$). There was no difference between early and late assessments after implementation. Similarly, residents' overall impression of synoptic operative reports was more favourable early after implementation as compared with their impression before implementation ($p = 0.01$). Synoptic operative reports for common general surgery procedures are well received by general surgery residents.

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Determining the individual, hospital and environmental cost of unnecessary laboratory investigations for patients admitted to general surgery services at an academic centre. *A. Lalande, K. Spoyalo, L. Chen, D. Schaeffer, P. Dawe, A. MacNeill.* From the University of British Columbia, Vancouver, B.C. (Lalande, Spoyalo); the BC Cancer Agency, Vancouver, B.C. (Chen); and the Vancouver General Hospital, Vancouver, B.C. (Schaeffer, Dawe, MacNeill).

Ancillary tests in the patient admitted to hospital should be used to support clinical judgment and identify actionable

issues for ongoing care. Excessive phlebotomy through unnecessary blood work can lead to iatrogenic anemia, fatigue, prolonged recovery and increased blood transfusion requirements, along with its associated risks. However, there is limited research characterizing the full impact of excessive phlebotomy outside of the intensive care unit population, including factors such as hospital costs and the environmental impact of unnecessary investigations. We retrospectively evaluated patients admitted to the acute care surgery and surgical oncology services between Jan. 1 and Dec. 31, 2018, with 6 specific disease entities: acute uncomplicated appendicitis ($n = 192$), acute uncomplicated cholecystitis ($n = 46$), choledocholithiasis ($n = 8$), gallstone pancreatitis ($n = 6$), adhesive small bowel obstruction treated nonoperatively ($n = 58$) and cancer requiring cytoreductive surgery and hyperthermic intraperitoneal chemotherapy ($n = 27$). An ideal pathway outlining appropriate postoperative laboratory investigations for each disease entity was established with the general surgery division members in consensus. Twenty patients were randomly selected from each disease subset; half were admitted between July and December and half were admitted between January and June. Preliminary results demonstrated that 8 out of 20 patients (40%) with acute uncomplicated appendicitis who had been discharged on postoperative day 1 had blood work drawn postoperatively. Similarly, 13 patients (65%) with acute uncomplicated cholecystitis who had been discharged on postoperative day 1 had blood work done postoperatively. This alone represents 69 blood vials used and an excessive 106 individual laboratory tests ordered. Data collection is currently underway and will include a similar analysis for each disease entity. The associated carbon footprint, amount of waste created and incurred hospital costs will also be calculated.

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Gender-based compensation disparity among general surgeons in British Columbia. *Z. Sagorin, A. Guo, K. D'Souza, A. Karimuddin, T. Scott.* From the University of British Columbia, Vancouver, B.C. (Sagorin, D'Souza, Karimuddin, Scott); and the London School of Economics and Political Science, London, United Kingdom (Guo).

The gender composition of the general surgery workforce is shifting as women now comprise nearly half of new general surgeons in British Columbia. Despite similar or improved outcomes, women in surgery may earn 20% less than their male colleagues. This study aims to identify and analyze gender-based differences in compensation among general surgeons in BC. Medical Services Plan (MSP) payments to practitioners were collected for all BC general surgeons from 2010/11 to 2016/17 fiscal years. Surgery and consult volumes were obtained from General Surgeons of BC. Surgeon data were gathered from public databases. Surgeons from subspecialties that have since become direct-entry programs and years in which general surgeons earned less than \$200 000 were excluded. Data were analyzed by t tests for continuous variables, χ^2 tests for categorical variables and linear regression analysis to adjust for confounding variables. Of 228 general surgeons, women ($n = 53$) received \$133 496 lower mean MSP compensation than men ($n = 175$) (\$368 325 v. \$501 821, $p < 0.001$). In the first 5 years in practice, compensation of male

general surgeons (\$381 291) was not significantly greater than that of female surgeons (\$323 836, $p = 0.162$). After 5 years in practice, female surgeon compensation (\$381 347) was significantly different from male surgeon compensation (\$511 494, $p < 0.001$). Compensation differences persisted across publication and population categories and were greatest between male and female surgeons with 15–39 publications (\$469 854 v. \$312 823, $p = 0.004$) and those serving small population centres (\$562 001 v. \$421 119, $p = 0.025$). After adjusting for surgeries and consults performed, male surgeons earned more than female surgeons. Female general surgeons earned less than male surgeons, especially after 5 years in practice. This difference persists despite publications and locations of practice. This difference is not wholly accounted for by differences in number of surgeries and consultations performed. Improved understanding of the division of surgical and consultation services by gender as well as expert discussion on contributing factors will be necessary to reduce compensation discrepancy and improve equity among general surgeons in BC.

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Transgastric robotic resection for gastrointestinal stromal tumours of the stomach. S. Neri. From the Università degli studi di Padova, Padua, Italy.

Gastrointestinal stromal tumours (GISTs) of the stomach are the most common mesenchymal tumours of the gastrointestinal tract. Their treatment varies from endoscopic resection to total gastrectomy, depending on their size, location and invasion of adjacent organs. Our first patient is a 57-year-old woman with a recent endoscopic finding of a pedunculated gastrointestinal tumour of the gastric fundus measuring 5.8×4.5 cm. Our second patient is a 78-year-old man with a non-pedunculated GIST located in the posterior wall of the stomach measuring 7 cm in diameter. In both cases the computed tomography scan showed no invasion of adjacent organs and no signs of abdominal metastases. Since an endoscopic approach

CANADIAN SOCIETY OF COLORECTAL SURGEONS

01

Predictors and outcomes among patients requiring salvage APR for the treatment of squamous cell carcinoma of the anus: a population-based study. G. Ko, S. Brogly, K. Lajkosz, T. Hanna, M. Kalyvas, M. Raphael, C. Booth, S. Patel. From Queen's University, Kingston, Ont.

Previous studies assessing long-term outcomes after salvage abdominoperineal resection (APR) for squamous cell cancer of the anus (SCCA) have been single-centre studies with patients accrued over a long time period. The objective of this study was to identify contemporary rates of salvage APR and overall survival (OS) with salvage APR in a single-payer, universal health care system. All patients with SCCA who underwent chemoradiotherapy (CRT) with curative intent in Ontario, Canada, between 2007 and 2015 were included in the cohort. Cases were identified using diagnostic codes in the Ontario Cancer Registry and treatment information from administrative data. The risk of salvage APR for persistent or recurrent

was not indicated in either patient owing to the position and size of the tumour we decided to perform a transgastric robotic enucleation. This minimally invasive approach allows the complete resection of the tumour while sparing the patient a more aggressive surgery such as a partial or total gastrectomy. The postoperative observation was uneventful and both patients were discharged a week after surgery.

YouTube video link: <https://youtu.be/8iR7oV4NGic>

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Recurrent gallstone ileus after laparoscopic-assisted enterolithotomy treated with totally laparoscopic enterolithotomy. S. Lo. From the William Osler Health System, Etobicoke, Ont.

Gallstone ileus is an uncommon complication of cholelithiasis with a high morbidity and mortality rate. Laparotomy and enterolithotomy with or without definitive biliary surgery is an established treatment. Laparoscopic enterolithotomy with the enterotomy, stone removal and enterotomy closure done extracorporeally (laparoscopic-assisted enterolithotomy) or intracorporeally (totally laparoscopic enterolithotomy) has also been well described in the literature. Whereas laparoscopic-assisted enterolithotomy allows excellent spillage control and does not require intracorporeal suturing, for gallstone that is impacted in the terminal ileum, totally laparoscopic enterolithotomy avoids the need to mobilize the right colon. This video presents an unusual case of recurrent gallstone ileus shortly after laparoscopic-assisted enterolithotomy, which was subsequently treated with totally laparoscopic enterolithotomy. This case illustrates the importance of considering recurrent gallstone ileus as a differential diagnosis for patients with recurrent/persistent obstructive symptoms after enterolithotomy without definitive biliary surgery. It also reignites the debate about whether cholecystectomy and cholecystoenteric fistula repair should be done concurrently with enterolithotomy for patients with gallstone ileus.

YouTube video link: <https://youtu.be/uwF4pf5KAfY>

disease was calculated. Predictors of salvage APR and OS were determined using multivariate Cox models adjusted for potential confounding variables. During the study period, 1161 patients with SCCA were treated with CRT. A total of 94 (8.1%) patients underwent salvage APR with 24 patients (25.5%) for persistent disease (PD) and 70 patients (74.5%) for recurrent disease (RD). The crude 5-year OS was 71.7% (95% confidence interval [CI] 68.8%–74.6%) among patients who did not require salvage APR compared with 39.1% (95% CI 26.8%–51.3%) for patients with PD and 64.2% (95% CI 45.1%–83.4%) for patients with RD ($p < 0.0001$). Patients who underwent salvage APR had worse survival (hazard ratio [HR] 2.25, 95% CI 1.69–3.01) than those who did not. The adjusted risk of death was higher in patients undergoing salvage APR for PD (HR 2.62, 95% CI 1.89–3.63) and patients undergoing salvage APR for RD (HR 1.57, 95% CI 0.90–2.74) compared with no salvage APR. This study is the largest contemporary report of outcomes following salvage APR for persistent and recurrent SCCA. We found that the risk of APR was lower than in previous studies. Patients requiring salvage APR had higher 5-year mortality.

02

Short-course radiotherapy with perioperative systemic chemotherapy for patients with rectal cancer and synchronous resectable liver metastases: a single-centre Canadian experience. *A. Pang, S. Faria, N. Kopek, T. Hijal, A. Liberman, P. Charlebois, B. Stein, L. Lee.* From the McGill University Health Centre, Montreal, Que.

The incidence of rectal cancer with synchronous liver metastases is approximately 20%. Although a liver-first strategy is widely used, choosing the best sequence of treatment modalities remains a clinical challenge. Short-course radiotherapy with delayed interval to surgery may be effective in this setting as it is a convenient way of delivering radiation to the rectal primary and avoiding interruption in systemic chemotherapy treatment. The aim of this study was to evaluate the clinicopathologic data and survival outcomes of patients with rectal cancer and synchronous liver metastases who received short-course radiotherapy and perioperative chemotherapy as part of their treatment protocol. This is a retrospective cohort study that was conducted at a tertiary hospital. Records of patients with rectal cancer and synchronous liver metastases from 2007 to 2018 were reviewed. All patients underwent a combination of short-course radiotherapy, perioperative chemotherapy, hepatectomy and total mesorectal excision resection of their primary rectal tumour. Clinicopathologic features were collected and analyzed. Overall survival (OS) and recurrence-free survival (RFS) were calculated. A total of 25 patients were included in the study. A liver-first strategy was performed in 64% of patients. Half of the patients had locally advanced midrectal primary tumours where 55% had threatened circumferential resection margins before treatment. With regard to the liver metastases, 71% had more than 1 liver metastasis, 10% of which were bilobar. The median follow-up time was 20 months. Nineteen percent of patients developed local recurrence and 52% developed distant recurrence. The estimated median RFS for local and distant recurrence was 2 and 4 months, respectively. The estimated median OS of the study population was 52 months. The 1-, 3- and 5-year OS values were 90%, 68% and 43%, respectively. This is one of the first North American experiences using short-course radiotherapy for patients with rectal cancer and synchronous liver metastases. Acceptable long-term survival and adequate locoregional control were achieved.

03

Compliance with preoperative elements of the American Society of Colon and Rectal Surgeons rectal cancer surgery checklist improves pathologic and postoperative outcomes. *R. Garfinkle, C. Vasilevsky, G. Ghitulescu, N. Morin, J. Faria, M. Boutros.* From McGill University, Montreal, Que.

The purpose of this study was to assess whether compliance with preoperative elements of the American Society of Colon and Rectal Surgeons (ASCRS) rectal cancer surgery checklist was associated with improved pathologic and 30-day postoperative outcomes after rectal cancer surgery. Patients undergoing elective rectal cancer surgery were identified from the 2016–2017 American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP) proctectomy-targeted

database. Of the 10 preoperative elements listed in the ASCRS checklist, 6 were routinely collected in the ACSNSQIP database: complete colonoscopy, logoregional staging, distant staging, tumour location in the rectum, preoperative stoma marking and appropriate use of neoadjuvant radiotherapy. Modified preoperative checklist compliance (mPCC(+): 6 of 6 elements) was compared with mPCC(-) (0–5 of 6 elements). The outcomes of interest included pathologic (circumferential resection margin [CRM] status and lymph node harvest ≥ 12) and 30-day postoperative (surgical morbidity and length of stay) outcomes. Multivariate regression was used to adjust for patient, tumour and treatment characteristics. In total, 2217 patients met the inclusion criteria. Individual compliance with the 6 checklist items was variable: 86.8% for complete colonoscopy, 76.6% for locoregional staging, 70.8% for distant staging, 91.3% for tumour location in the rectum, 84.0% for preoperative stoma marking and 79.8% for appropriate use of neoadjuvant radiotherapy. Only 836 (37.7%) patients completed all 6 items (mPCC(+)), while 1381 (62.3%) did not (mPCC(-)). mPCC(+) patients were younger than mPCC(-) patients (60.0 v. 63.0 yr, $p < 0.001$), but they were otherwise similar. On multivariate regression, mPCC(+) was associated with lower odds of CRM positivity (odds ratio [OR] 0.47, 95% confidence interval [CI] 0.31 to 0.71), higher odds of lymph node harvest ≥ 12 (OR 1.60, 95% CI 1.29 to 2.00), reduced surgical morbidity (OR 0.79, 95% CI 0.65 to 0.96) and shorter length of stay ($\beta = -0.90$, 95% CI -1.53 to -0.27). Compliance with 6 preoperative elements of the ASCRS rectal cancer surgery checklist was associated with significantly improved pathologic outcomes and reduced postoperative morbidity.

04

Clinical predictors of pathologic complete response following neoadjuvant chemoradiation therapy for rectal cancer: a systematic review and meta-analysis. *N. Wong-Chong, R. Garfinkle, T. Landry, Y. Xiao, C. Vasilevsky, G. Ghitulescu, N. Morin, J. Faria, M. Boutros.* From McGill University, Montreal, Que.

There are limited data to guide patient selection for watch-and-wait/organ preservation following neoadjuvant chemoradiation therapy (NaCRT) for rectal cancer. We performed a systematic review and meta-analysis to identify clinical predictors of pathologic complete response (pCR) in rectal cancer following NaCRT. We searched Medline, PubMed, Embase, Biosis, ClinicalTrials.gov and the Cochrane Library databases from 1995 to 2017 to identify prospective and retrospective comparative studies examining pCR (ypT0N0) in histologically proven rectal cancer treated with long-course NaCRT followed by radical resection. Two reviewers independently extracted data and appraised study quality using the MINORS scale. Odds ratios were pooled using a random-effects meta-analytic model. Fifty-six studies with 76 987 patients met the inclusion criteria. Of these, 17.1% achieved pCR (95% confidence interval [CI] 15.5–18.9). Mucinous tumours (OR 0.11, 95% CI 0.068–0.17, $P = 0.00$), pretreatment T3/4 (v. T1/T2; OR 0.44, 95% CI 0.31–0.62, $P = 0.00$), pre-treatment T4 (v. T3; OR 0.72, 95% CI 0.59–0.89, $P = 0.00$), pretreatment nodal involvement (OR 0.77, 95% CI 0.70–0.86, $P = 0.00$), tumour circumference

greater than 50% (OR 0.49, 95% CI 0.33–0.74, P 11%), tumour size greater than 5 cm (OR 0.37, 95% CI 0.35–0.39, P 0%), interval time between NaCRT and surgery less than 8 weeks (OR 0.82, 95% CI 0.71–0.96, P 65%) and pretreatment carcinoembryonic antigen greater than 5 mg/dL ($v.$ < 5 mg/dL; OR 0.47, 95% CI 0.39–0.56, P 66%) were negative predictors of pCR. Distance from anal verge, pretreatment N1 ($v.$ N2) and tumour differentiation had no association with pCR. Patients with elevated pretreatment CEA, mucinous tumours, clinical T4 or node-positive disease or large rectal cancers should be cautiously enrolled in nonoperative management protocols as they are unlikely to achieve a complete response.

05

Rejected

06

The impact of laparoscopic technique on the rate of perineal hernia after abdominoperineal resection of the rectum. *A. Black, A. Karimuddin, M. Raval, T. Phang, C. Brown.* From St. Paul's Hospital, Vancouver, B.C.

Although the laparoscopic approach to an abdominoperineal resection (LAPR) reduces patient morbidity over open APR (OAPR), case reports suggest a possible association of this technique with postoperative perineal hernia. However, the incidence and risk factors for perineal hernia after APR are poorly characterized. The objective of this study was to determine the impact of surgical technique on the incidence of perineal hernia after APR. A retrospective analysis was performed on patients treated by APR between May 2007 and March 2018 at our institution using a prospectively maintained colorectal cancer database. Demographics, clinical parameters and outcomes were compared between the OAPR and LAPR groups using the Student t test, χ^2 test or the Fisher exact test. Putative risk factors were analyzed using a Cox proportional hazard model with perineal hernia as the outcome. Perineal hernia was diagnosed by clinical and/or radiological criteria. The study included 261 patients (191 OAPR and 70 LAPR). Follow-up was 29 ± 23 months for patients who underwent OAPR and 20 ± 18 months for patients who underwent LAPR ($p = 0.002$). Intraoperative blood loss (596 ± 633 mL $v.$ 307 ± 307 mL, $p < 0.001$), duration of surgery (250 ± 116 min $v.$ 213 ± 75 min, $p = 0.004$) and length of stay (15.6 ± 18.0 d $v.$ 10.4 ± 12.6 d, $p = 0.031$) were all greater for patients who underwent OAPR than for those who underwent LAPR, but short-term wound complications did not differ significantly. Perineal hernia was observed in 2.1% of patients who underwent OAPR and 12.9% of patients who underwent LAPR. In multivariable analysis, significant risk factors for perineal hernia were age, laparoscopic technique and closure of the perineal wound with myocutaneous flap (hazard ratios 1.08, 11.13 and 31.51, respectively, all $p < 0.05$). LAPR, although associated with less blood loss and shorter length of hospital stay than OAPR, was a significant risk factor for perineal hernia. We speculate that fewer intraabdominal adhesions form after LAPR, facilitating the movement of abdominal viscera into the pelvis. Strategies to prevent perineal hernia should be considered when a LAPR is performed.

07

An assessment of the current perioperative practice, barriers and predictors for utilization of enhanced recovery after surgery protocols: a provincial survey. *J. Springer, A. Doumouras, S. Lethbridge, S. Forbes, C. Eskicioglu.* From McMaster University, Hamilton, Ont.

Enhanced recovery after surgery (ERAS) protocols utilize perioperative interventions that decrease morbidity and length of stay and improve patient satisfaction. ERAS uptake following colorectal surgery remains low and significant practice variability exists. This study's purpose was to characterize ERAS practice variation and utilization and identify barriers to ERAS implementation following colorectal surgery. A survey identifying demographics, rates of ERAS utilization and implementation barriers was distributed to 797 general surgeons identified through a provincial college database. A total of 235 (30%) general surgeons representing 84 (56%) hospitals participated. Academic and large hospital community surgeons represented the cohort majority (30.5% and 47.2%, respectively). Nine perioperative ERAS behaviours were analyzed. Use of early diet advancement, intravenous fluid restriction and catheter and line protocols was significantly higher among surgeons who adhere to ERAS protocols than among those who do not (73.5% $v.$ 54%, $p = 0.004$; 92% $v.$ 79.7%, $p = 0.01$; and 91% $v.$ 40.6%, $p < 0.001$ respectively). Interestingly, 4% of surgeons utilize postoperative prophylactic nasogastric tubes. Multivariable linear regression demonstrated that having a colorectal fellowship or ERAS exposure during training did not significantly affect use of ERAS principles (0.32, 95% confidence interval [CI] -0.31 to 0.94, $p = 0.155$; 0.28, 95% CI -0.26 to 0.82, $p = 0.155$, respectively). Surgeon demographics, years in practice and training details had no effect on ERAS protocol utilization. ERAS protocols were used significantly less in small community hospitals than in large/academic hospitals (odds ratio [OR] 0.02, 95% CI 0 to 0.3, $p = 0.005$). Over 50% of respondents did not use formal ERAS protocols; however, they used ERAS principles. Surgeons in academic settings used, on average, 1 more ERAS behaviour than surgeons in small community settings (0.86, 95% CI 0.42 to 1.31, $p < 0.001$). Several ERAS implementation barriers were identified and included patient variability, lack of institutional/nursing support and financial constraints. Despite the evidence supporting ERAS protocols, this unique large-scale provincial study demonstrates that significant variation in perioperative colorectal surgery practice exists and therefore informs ongoing quality improvement efforts in the delivery of colorectal surgery care in Canada.

08

Regional variation in the utilization of laparoscopy for the treatment of rectal cancer: the importance of fellowship training sites. *J. Springer, A. Doumouras, N. Amin, M. Caddeu, C. Eskicioglu, D. Hong.* From McMaster University, Hamilton, Ont.

Laparoscopic rectal surgery is associated with improved perioperative outcomes in specific circumstances. Uptake is variable and probably influenced by factors beyond patient or tumour characteristics, such as local surgeon expertise. The objective of the present study was to determine if the proximity to colorectal fellowship training sites (CFTS) influenced the utilization of

laparoscopy in rectal cancer. This population-based study assessed all patients older than 18 years of age who underwent an elective rectal resection for cancer between April 2008 and March 2015. Data were derived from the Canadian Institute for Health Information Discharge Abstract Database. The main outcome of interest was the use of laparoscopy at the individual level. Predictors of laparoscopy use included patient/disease characteristics, rural status, hospital/surgeon volumes and patient's home distance from a CFTS. Odds of laparoscopy use was evaluated using hierarchical logistic regression models. Overall, 10 994 patients underwent rectal cancer surgery. There was no significant difference in the general characteristics of the laparoscopic and open surgery groups. Overall, laparoscopy rates were 25% and significantly increased from 18% to 40% between 2008 and 2014 ($p < 0.001$). Increasing patient distance from a CFTS was inversely associated with undergoing laparoscopic rectal surgery ($p < 0.001$). High-volume hospitals and surgeons were significantly associated with increased rates of laparoscopy ($p < 0.001$). Patients who lived within 25 km of a CFTS had a 2.5 times higher odds of undergoing a laparoscopic surgery than those who lived within 26–100 km, who had a 1.8 times higher odds of undergoing a laparoscopic surgery (95% confidence interval [CI] 2.14–2.71, $p < 0.001$; 95% CI 1.64–2.07, $p < 0.001$, respectively). After adjustment for patient and system factors, the present study identified that increasing distance of patient's residence to a CFTS was inversely associated with undergoing a laparoscopic rectal resection. These data highlight the regional variation in rectal cancer care in a publicly funded health care system and further demonstrate disparity in Canadian health care delivery.

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Local versus radical surgery for early rectal cancer with or without neoadjuvant or adjuvant therapy: a systematic review and meta-analysis. *A. Motamedi, N. Mak, C. Brown, M. Raval, A. Karimuddin, P. Phang.* From the University of British Columbia, Vancouver, B.C. (Motamedi, Mak, Raval); and St. Paul's Hospital, Providence Health Care, Vancouver, B.C. (Brown, Karimuddin, Phang).

Despite major advances in and increasing enthusiasm for modern endoscopic local excision techniques (LE), radical resection (RR) with total mesorectal excision has remained the standard of care for stage I rectal cancer owing to uncertainty about LE's oncologic safety. We conducted a systematic review to compare these 2 approaches. In collaboration with the Cochrane Colorectal Cancer Group, we searched major electronic databases as well as grey literature for randomized controlled trials (RCTs) comparing LE with RR with or without neoadjuvant chemoradiotherapy in patients with T1–2N0M0 rectal adenocarcinoma, with no restrictions. Disease-free survival (DFS) and sphincter function, as well as overall survival (OS), local recurrence, postoperative complications and 30-day postoperative mortality, were compared. Cochrane methodology was used at all stages and results were pooled using a Mantel–Haenszel random-effects model where appropriate. Until December 2018, 5 RCTs were eligible for inclusion, of which 3 were used to extract data. All included RCTs had at least 1 domain with high risk of bias. There was no statistical difference between LE and RR for DFS (hazard ratio [HR] 1.56, 95% confidence interval [CI] 0.57–4.31, 3 studies, 211

patients), OS (HR 1.26, 95% CI 0.50–3.12, 2 studies, 153 patients) or 1-year local recurrence (Peto-OR 1.90, 95% CI 0.64–5.64; 2 studies, 111 patients). One RCT reported 89% versus 94% cancer-related survival at 10 years for LE and RR, respectively, and another RCT reported an overall survival of 96% at 5 years similarly for both groups. None of the studies reported quantitative results for sphincter function. Substantial heterogeneity was observed regarding postoperative complications because of unstandardized outcome reporting. The overall quality of evidence for primary outcomes was deemed as low. This review suggests an equal role for LE in terms of oncologic and operative outcomes in patients with early-stage rectal cancer. If further supported by future RCTs, LE has the potential to become the preferred approach in these patients.

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The relation between the gut microbiota and anastomotic leak in patients with colorectal cancer: a preliminary feasibility study. *R. Hajar, G. Fragoso, F. Dagbert, É. DeBroux, R. Loungnarath, H. Sebjang, F. Schwenter, R. Ratelle, R. Wassef, A. Calvé, M. Constante, G. Ebead, C. Péthel, M. Santos, C. Richard.* From the Centre hospitalier de l'Université de Montréal, Montreal, Que.

Anastomotic leak (AL) is an unpredictable complication in colorectal cancer (CRC) surgery. It is associated with increased morbidity and worse oncological outcomes. The microbiota was suggested recently as a potential factor in the pathophysiology of AL and CRC. Literature on this relation is very scarce. This is a pilot study that assesses the feasibility of a larger study, which aims at understanding the relationship between perioperative microbiota and the risk of AL and CRC evolution. Pre- and postoperative fecal samples were collected from patients ($n = 5$) undergoing bowel resection for CRC ($n = 5$), postoperative fecal samples were collected from patients with AL ($n = 5$), intraoperative fecal samples were collected from patients with inflammatory bowel disease ($n = 5$) and fecal samples were collected from healthy subjects ($n = 5$). Phyla-level microbial classification revealed a predominance of Firmicutes and Bacteroidetes in all individuals, followed by Proteobacteria, Actinobacteria and Verrucomicrobia, in agreement with published data. At the phylum level, both patients in whom it was possible to compare samples before and after surgery displayed a depletion of Firmicutes at the expense of Bacteroidetes and Proteobacteria expansion, independently of AL occurrence. Postoperatively, a depletion of bacteria considered protective was noted, particularly *Faecalibacterium prausnitzii*, and an expansion of bacteria linked to CRC development. *Akkermansia muciniphila*, which plays a major role in wound healing, expanded after surgery to 24% without AL but only to 12% with AL, while the average found in control subjects was 3%. Another important difference between AL and no-AL postsurgery reports to the abundance of Lachnospiraceae, a family of butyrate-producing Clostridia associated with reduced risk of CRC. The pilot study allowed the implementation of standard operating procedures for sample collection, storage and analysis according to the International Human Microbiome Standards consortium. Larger cohorts are required to validate the potential differences in microbiota composition and their impact on clinical outcomes.

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Optimizing discharge decision-making in colorectal surgery: an audit of discharge practices in a newly implemented enhanced recovery pathway. *N. Caminsky, D. Hamad, B. He, K. Zhao, M. Boutros, L. Feldman, L. Lee, J. Fiore Jr.* From McGill University, Montreal, Que.

Enhanced recovery pathways (ERPs) reduce length of stay (LOS) after colorectal surgery, but challenges to implementation remain. Standardized discharge criteria (DC) have been defined by international consensus and, in a well-established ERP, we found no difference between time to readiness for discharge (TRD) and actual LOS. However, this may not be the case in a newly implemented pathway. We conducted an internal audit of colorectal surgery discharge practices within a newly implemented ERP to (a) compare the TRD to actual LOS and (b) identify reasons for delay in discharge once DC are achieved. We studied a cohort of adult patients undergoing elective colorectal surgery within a recently implemented ERP (< 2 yr). TRD was assessed from the day of surgery until patients fulfilled consensus-based DC (oral intake, flatus, pain control, ability to walk and no complications). TRD and LOS were compared using correlation-adjusted log-rank test. Physicians were interviewed and thematic analysis was used to assess reasons for patients remaining in hospital beyond DC achievement. Seventy-three patients were included (age 67 ± 14 yr, 56% male, 50% laparoscopic, 16% stoma creation). Median LOS was 6 days (interquartile range [IQR] 4–8); median TRD was 5 days (IQR 3–8) ($p < 0.001$). Twenty-eight patients (37%) remained in hospital after DC were achieved. Most of the delayed discharges were medically justified (i.e., pending workup of suspected complication [31%], diarrhea or high stoma output [19%]), but medically unnecessary hospital stays were common (i.e., patient unwilling to be discharged [13%], insufficient postdischarge support or awaiting disposition [13%], surgeon judged insufficient recovery [13%]). Delayed hospital discharges in a newly implemented colorectal surgery ERP are often medically justified, but unnecessary hospital stays are common and represent a target for quality improvement. Efforts should be directed at optimizing patient education regarding discharge expectations, early consultation of the discharge planning team and improving discharge decision-making using standardized DC.

12

Trends in colectomy for colorectal neoplasms in ulcerative colitis (UC) patients over 2 decades: a National Inpatient Sample database analysis. *A. Ni, M. Alqabani, M. Abou Khalil, D. Marinescu, C. Vasilevsky, N. Morin, J. Faria, M. Boutros.* From McGill University, Montreal, Que.

Rates of colectomy for ulcerative colitis (UC) have been decreasing, especially since the introduction of biologics. The impact of reduced colectomy rates on the development of dysplasia/cancer in chronically treated UC colons is unknown. This retrospective study was conducted to determine the trend of colectomy for colorectal neoplasms in adult patients with UC over 2 decades and to identify predictors of colectomy for UC with colorectal neoplasms (UCCRN). Data for adult patients with UC were obtained from the National Inpatient Sample from 1993 to

2015. All total colectomies and/or proctocolectomies were identified using ICD 9/10 codes. The primary outcome was colectomy for UCCRN, defined as a concurrent ICD 9/10 code for colorectal cancer, rectal cancer or dysplasia/benign neoplasm. Time trend linear and multivariable regressions were used. Of 366 286 admissions with a diagnosis of UC, 16 556 (4.5%) were for a total colectomy/proctocolectomy and 2018 (12.2%) had a concurrent diagnosis of colorectal neoplasm. The rates of colectomy for UCCRN significantly increased by 16.3% from 10.3% to 12.3% (p Trend = 0.004), while the overall rates of colectomy for UC significantly decreased by 55.6% from 6.3% to 2.8% (p Trend < 0.001). There were significant increases in colectomies performed for dysplasia/benign neoplasms (37.5% from 3.5% to 5.6%, p Trend < 0.001) and rectal cancer (36.6% from 2.6% to 4.1%, p Trend = 0.028), whereas colectomies for colon cancer remained unchanged (4.5% to 3.9%, p Trend = 0.423). On multivariable regression, after accounting for age, sex, race, chronic illnesses, primary sclerosing cholangitis, universal UC, long-term steroid use and severity of illness, year of colectomy was a significant predictor (odds ratio 1.043, 95% confidence interval 1.024–1.062) of colectomy for UCCRN. Despite decreasing rates of colectomy for UC, more patients require surgery for colorectal neoplasms. Dysplasia/benign neoplasms represent a higher proportion of cases, suggesting that current screening is effective. However, the increased rates of rectal cancer are worrisome and may warrant more frequent surveillance than advocated by current guidelines.

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Spin in minimally invasive transanal total mesorectal excision articles (TaTME): an assessment of the current literature. *L. Zhang, S. Patel, B. Elsolh, D. Yu, A. Chadi.* From Queen's University, Kingston, Ont. (Zhang, Patel, Yu); and the University of Toronto, Toronto, Ont. (Elsolh, Chadi).

Minimally invasive transanal total mesorectal excision (TaTME) is a new approach in treating rectal cancer. Spin can be defined as “reporting strategies to highlight that the experimental treatment is beneficial” despite limitations in study design. The aim of this study was to assess spin within TaTME publications. Embase and Medline (2009–2017) were searched for publications assessing TaTME in rectal cancer. All studies published between 2009 and 2017 were eligible for inclusion. Study titles and abstracts were assessed for evidence of spin, as previously defined. A total of 1202 studies were identified through our search, and 73 were included in the analysis. The majority were case series ($n = 48$, 66%). Fifty-five publications (75%) had evidence of spin within at least 1 domain. The most common type of spin was claiming safety without describing how this was defined or tested (56%). Other strategies included claiming superiority without support (33%) and reporting nonsignificance as equivalence (42%). We did not find that year of publication ($p = 0.61$), study design ($p = 0.60$), number of patients ($p = 0.85$) or declared conflict of interest ($p = 0.43$) were associated with spin. We have shown that spin is common in studies assessing TaTME for rectal cancer. Despite a lack of support from study results, authors concluded that TaTME was safe for use in rectal cancer in the majority of studies. Readers of study abstracts describing new techniques need to be cautious of accepting authors' conclusions, especially in case series and observational studies.

14

Venous thromboembolism (VTE) in colon cancer: a population-based cohort study of VTE rates following surgery and during adjuvant chemotherapy. L. Zhang, S. Patel, S. Wei, S. Merchant, S. Nanji, P. James, C. Booth. From Queen's University, Kingston, Ont.

There is an elevated risk of venous thromboembolism (VTE) in patients treated for colon cancer. Postoperative VTE has been studied previously, but no large study has compared the risks of VTE during different stages of treatment. The objective of this study is to quantify and compare the risks of VTE before surgery, after surgery, during adjuvant chemotherapy (ACT) and up to 365 days after surgery among patients with resected colon cancer. In this population-based retrospective cohort study, patients with stage I–III colon cancer treated with surgical resection between 2002 and 2008 were identified through the Ontario Cancer Registry (OCR) and hospital admission records. The exposures of interest were surgical resection, ACT and stage of treatment, the latter of which was defined as preoperative (90 d before surgery), in-hospital, postoperative, during administration of adjuvant chemotherapy and up to 365 days postoperatively. The primary outcome was the development of VTE. Of the 6806 patients included in this study, 327 (5%) developed a VTE. Patients receiving ACT had a higher risk of VTE than patients who underwent surgery alone (6% v. 4%, $p < 0.001$). Forty-six percent of all diagnosed VTE occurred within 30 days of surgery. Patients receiving ACT were more likely to be diagnosed with a VTE while receiving ACT (53%) than in the 30-day postoperative period (26%). VTE was an independent risk factor for worse 5-year overall survival (hazard ratio [HR] 1.65, 95% confidence interval [CI] 1.43–1.91, $p < 0.001$) and cancer-specific survival (HR 1.84, 95% CI 1.55–2.18, $p < 0.001$). Patients who undergo treatment for early-stage colon cancer are at considerable risk of developing VTE. The risk is elevated in those who require adjuvant chemotherapy, and VTE is associated with worse long-term outcomes. There may be a role of VTE prophylaxis during all phases of treatment, including both after surgery and during adjuvant chemotherapy.

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Robotic-assisted lateral lymph node dissection for rectal neuroendocrine tumor. M. Gagnon-Konamna, F. Dagbert. From the University of Montreal, Montreal, Que.

Lateral lymph node dissection (LLND) is a surgical procedure frequently used in eastern countries for rectal cancer. It is associated with morbidities, affecting sexual and urinary functions. Recent studies in colorectal surgery now encourage the use of LLND for positive lymph nodes. Western countries are now developing their expertise, especially with the use of robotic technologies, which allow better access to lateral compartments. This is a video of robotic-assisted LLND recorded at the Centre hospitalier de l'Université de Montréal in January 2019. A 73-year-old woman presented with recurrent well-differentiated regionally advanced rectal neuroendocrine tumour (NET) and positive left internal iliac lymph nodes on pelvic magnetic resonance imaging and gallium-68 positron emission tomography/computed tomography. After agreement with the tumour

board committee, a robotic-assisted proctectomy with left internal iliac lymph node dissection was offered to the patient for curative intent. She agreed and was scheduled for surgery. Robotic-assisted proctectomy with left LLND and low colorectal anastomosis was performed and was well tolerated by the patient. The procedure time was 324 minutes. She left the hospital on postoperative day 6 without any complications. Two internal iliac compartment lymph nodes were found positive out of 10 retrieved on pathologic analysis. At follow-up, the patient reported no sexual or urinary dysfunctions nor lymphedema. The robotic-assisted approach allows better access to pelvic lateral compartments. Recent studies in colorectal surgery encourage the use of LLND for positive lymph nodes and have demonstrated lower local recurrence for rectal cancer. Further studies are currently pending for different rectal pathologies. Our video is an example of a safe surgical approach for well-differentiated regionally advanced rectal NET. YouTube video link: <https://youtu.be/Jf1DqYuQtM0>

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Loop ileostomy and colonic lavage as an alternative to colectomy for fulminant *Clostridium difficile* colitis. T. McKechnie, Y. Lee, J. Springer, A. Doumouras, D. Hong, C. Eskicioglu. From McMaster University, Hamilton, Ont.

Clostridium difficile infection (CDI) is the most common cause of infectious diarrhea in hospitals in North America. The clinical manifestations of CDI vary from mild diarrhea to septic shock. Overall, approximately 1% of these patients will eventually require surgical intervention for CDI refractory to antibiotics. While loop ileostomy (LI) with colonic lavage has been proposed as a less morbid procedure than total abdominal colectomy, there has been limited use and evaluation of this procedure. The aim of this systematic review is to compare LI with colonic lavage with total abdominal colectomy in terms of overall mortality and morbidity. A search of the Medline, Embase, PubMed and ClinicalTrials.gov databases was performed. The primary outcome was postoperative CDI-related mortality. Secondary outcomes included postoperative length of stay, readmission rates, reoperation rates, overall postoperative complication rates and other specific postoperative complications. The quality of all studies was assessed using the Newcastle–Ottawa Scale (NOS). From 49 relevant citations, 4 studies (3 retrospective cohort and 1 case series) with 120 patients undergoing LI with colonic lavage and 502 patients undergoing total abdominal colectomy were included. Compared with total abdominal colectomy, LI with colonic lavage did not significantly reduce overall mortality (relative risk [RR] 1.29, 95% confidence interval [CI] 0.69–2.39, $p = 0.43$). Furthermore, there was no significant difference in rate of reoperation (RR 1.1, 95% CI 0.58–2.16, $p = 0.75$) or overall postoperative complications (RR 1.13, 95% CI 0.83–1.54, $p = 0.45$). The NOS demonstrated significant risk of bias in outcome reporting in the included studies. Overall, there does not appear to be a survival advantage with the use of LI with colonic lavage compared with total abdominal colectomy for refractory CDI. However, this review is significantly limited by the number of patients undergoing LI with colonic lavage. As such, larger, multicentre prospective studies are required to confirm these results.

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Recurrent diverticulitis: Is it all in the family? *T. Almalki, R. Garfinkle, E. Kmietek, V. Pelsser, P. Bonaffini, C. Reinhold, P. Yousef, N. Morin, C. Vasilevsky, S. Liberman, M. Boutros.* From the Jewish General Hospital, Montreal, Que. (Almalki, Garfinkle, Kmietek, Pelsser, Morin, Vasilevsky, Boutros); and the McGill University Health Centre, Montreal, Que. (Bonaffini, Reinhold, Yousef, Liberman).

The purpose of this study was to evaluate the association between family history (FH) and diverticulitis recurrence after an episode of diverticulitis managed nonoperatively. After institutional review board approval, all patients with left-sided diverticulitis proven with computed tomography (CT) who were managed nonoperatively at 2 McGill-affiliated tertiary care institutions from 2007 to 2017 were identified. All CT scans pertaining to the index episode of diverticulitis were reviewed by a blinded expert gastrointestinal radiologist. A detailed telephone follow-up questionnaire was conducted to assess for the presence of FH of diverticulitis. The primary outcome was diverticulitis recurrence occurring more than 60 days after the index episode. Secondary outcomes included a complicated recurrence and more than 1 recurrence (i.e., re-recurrence). Multiple Cox regression was used to assess for an association between a positive FH and diverticulitis outcomes, adjusting for relevant confounders. Of the 997 patients identified in the database, 476 completed the telephone questionnaire (response rate 47.7%). Among them, 212 (44.5%) had a positive FH of diverticulitis and 264 (55.5%) did not. Compared with patients with no FH, patients with FH had a higher incidence of abscess (27.8% v. 4.5%, $p < 0.001$) and immunosuppression (19.8% v. 7.6%, $p < 0.001$). After a median follow-up of 37.3 (14.7–63.2) months, patients with a positive FH had worse recurrence-free survival (log-rank test: $p < 0.001$). On Cox regression, a positive FH remained associated with diverticulitis recurrence (hazard ratio [HR] 4.07, 95% confidence interval [CI] 2.95–5.63). Among patients with a positive FH, those with more than 1 relative with a history of diverticulitis had a higher hazard of recurrence (HR 2.12, 95% CI 1.50–3.00) compared with patients with only 1 relative. Positive FH was also associated with the development of a complicated recurrence (HR 9.75, 95% CI 4.11–23.10) and more than 1 recurrence (HR 2.07, 95% CI 1.17–3.64). Patients with a positive FH of diverticulitis are at higher risk for recurrent diverticulitis and complicated recurrences.

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Le traitement des fistules entérocutanées complexes : expérience du Centre hospitalier de l'Université de Montréal (CHUM). *M. Gagnon-Konanna, E. De Broux.* From the University of Montreal, Montreal, Que.

Il existe peu de données dans littérature sur la prise en charge des patients aux prises avec une fistule entérocutanée (FEC). La qualité de vie peut être atteinte de façon importante. La procédure chirurgicale est souvent longue et ardue, et les risques associés peuvent être majeurs. C'est pourquoi ces patients sont souvent référés en centre tertiaire. Voici une étude de la qualité de l'acte du traitement chirurgical des FEC, s'étendant sur une période de plus de 10 ans. Il s'agit d'une étude rétrospective. Des données additionnelles ont été recueillies de façon prospective. Cinquante-sept patients ont été enrôlés entre 2004 et 2018. Les critères d'inclusion sont tout patient de plus de 18 ans, ayant une FEC

symptomatique à haut débit. La technique consiste à une résection des anses intestinales impliquées ainsi qu'à une fermeture primaire de l'abdomen. Le taux de succès du traitement chirurgical pour FEC est de 81 %. Le temps moyen entre la consultation pour une FEC et la chirurgie est de 5 mois. Onze patients sur 57 ont eu une récurrence de leur FEC, donnant un taux de récurrence de 19 %. De ces 11 patients, 9 patients ont été ré-opéré. Le taux de succès après la deuxième chirurgie pour FEC est de 94 %. Trois patients ont récidivé à un site différent de la FEC primaire. Ces 3 patients ne sont pas inclus dans les récurrences. Un seul patient est décédé des multiples complications de la chirurgie. L'étude de l'acte du traitement chirurgical des FEC a démontré un haut taux de succès ainsi qu'un faible taux de mortalité associé à la procédure. Ces données confirment la prise en charge de ces patients en centre tertiaire.

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A North American single-blinded pilot randomized controlled trial for outpatient nonantibiotic management of acute uncomplicated diverticulitis (MUD TRIAL): feasibility and lessons learned. *S. Al-Masrouri, E. Salama, S. Lachance, S. Sabboobeh, J. Savard, N. Morin, C. Vasilevsky, J. Faria, G. Ghitulescu, M. Boutros.* From McGill University, Montreal, Que.

Antibiotics remain the mainstay of treatment of uncomplicated diverticulitis in North America despite recent European literature challenging their utility. This pilot study assesses the feasibility of the first North American randomized controlled trial (RCT) for outpatient nonantibiotic management of uncomplicated diverticulitis (clinicaltrials.gov identifier NCT03146091). After institutional review board approval, adults presenting to the emergency department with acute uncomplicated left-sided diverticulitis proven by computed tomography and meeting inclusion/exclusion criteria were offered enrollment. Participants were randomly assigned to receive either oral antibiotics or analgesia alone. Follow-up included daily phone calls for 7 days and clinic visits at 14, 30 and 60 days. Our primary end point was recruitment rate. Secondary outcomes included median visual analogue pain scores (VAS) at 7 days and treatment failure (defined as persistent diverticulitis at 60 d, progression to complicated diverticulitis and hospital admission). We determined a sample size of 40 patients would allow for estimation of the recruitment rate within a 14% margin of error with 95% confidence. Of the 45 patients screened, 29 met the study criteria and 14 consented to participation (31.1% recruitment rate). Patients refusing participation cited their inability to attend clinic follow-ups, preconceived expectations of receiving antibiotics and belief that antibiotics would expedite recovery. Eight patients were randomly assigned to receive antibiotics and 6 to nonantibiotic management. The median age of participants was 54 (30–74) years. Five patients (35.7%) were lost to follow-up at 60 days. There were no treatment failures in either group. Median VAS scores at 7 days were 0 and 0.5 for the antibiotic and nonantibiotic groups, respectively. A large-scale RCT is feasible assuming a 31.1% recruitment rate and 64.3% retention rate. Recruitment rates are likely to improve with a more rigorous electronic screening platform and less stringent follow-up, as the inability to adhere to follow-up was the most frequently cited reason for refusing participation. Further investigation into the nonantibiotic management of acute uncomplicated diverticulitis is warranted.

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Treatment failure after conservative management of acute diverticulitis: a nationwide readmission database analysis. *S. Al-Masroui, F. Alrashed, K. Zhao, N. Morin, C. Vasilevsky, G. Gbitulescu, J. Faria, M. Boutros.* From McGill University, Montreal, Que.

The aim of this study is to describe the rates and predictors of treatment failure within 90 days after conservative management of an index admission with acute diverticulitis. Data were obtained from the Nationwide Readmissions Database (NRD) for 2010–2015. Adult patients (aged ≥ 18 yr) admitted with a primary diagnosis of acute diverticulitis (AD) who were managed conservatively were included. The primary outcome was overall treatment failure defined as unplanned readmission within 90 days. A multivariable logistic regression model was used to identify independent predictors of treatment failure. Of 201 384 patients with AD managed conservatively, 13 261 (6.2%) had treatment failure and 3298 patients (1.6%) underwent emergency surgery. On the index admission, 26 457 patients (13.0%) were admitted with complicated AD. Of these, 7287 (4.2%) had treatment failure with uncomplicated AD and of these, 1190 (16.3%) required emergency surgery; 2659 (1.5%) had a treatment failure with complicated AD and of these, 1235 (46.4%) required subsequent emergency surgery. Among the patients with an index complicated AD, 2225 (8.4%) had treatment failure with complicated AD and of these, 1166 (52.4%) required subsequent emergency surgery. On multivariate regression, significant predictors of treatment failure were an index admission with complicated AD (odds ratio [OR] 2.07, 95% confidence interval [CI] 1.98–2.16), discharge disposition (against medical advice [OR] 1.96, 95% CI 1.70–2.60) and home health care [OR] 1.24, 95% CI 1.16–1.34], longer length of index hospital admission (OR 1.05, 95% CI 1.04–1.06), immunosuppression (OR 1.47, 95% CI 1.32–1.64), rheumatoid arthritis/vasculitis (OR 1.20, 95% CI 1.09–1.33), obesity (OR 1.11, 95% CI 1.06–1.17), drug abuse (OR 1.17, 95% CI 1.04–1.33) and alcohol abuse (OR 1.13, 95% CI 1.02–1.26). The overall rate of treatment failure following conservative management of AD is low; however, those with an index complicated AD are at significantly higher risk of treatment failure and subsequent emergency surgery. Thus, patients at high risk of treatment failure should be followed closely after the index presentation to ensure complete resolution.

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Impact of immunosuppression on mortality and major morbidity following sigmoid colectomy for diverticulitis: a propensity-score weighted analysis of the National Inpatient Sample. *S. Al-Masroui, F. Alrashed, K. Zhao, N. Morin, C. Vasilevsky, G. Gbitulescu, J. Faria, M. Boutros.* From McGill University, Montreal, Que.

The appropriate timing and need for elective colectomy for acute diverticulitis in immunosuppressed patients is increasingly debated. This study aims to assess the impact of immunosuppression on the outcomes of sigmoid colectomy for diverticulitis in emergency and elective settings. Data were obtained from the National Inpatient Sample (NIS) from 2005 to 2015. Adult patients (aged ≥ 18 yr) who underwent open/laparoscopic

left/sigmoid colectomy for acute diverticulitis were included. Immunosuppression was defined as history of long-term steroid use, solid organ transplant, immune deficiency, end-stage renal disease (dialysis dependent) and severe blood disorders (bone marrow failure, pancytopenia or leukopenia). The primary outcome was in-hospital mortality rate. Secondary outcomes included postoperative in-hospital major morbidity, length of stay (LOS) and reintervention rates. Of 109 705 patients, 4626 (4.2%) were immunosuppressed. Immunosuppressed patients were significantly older (64.2 [interquartile range (IQR) 12.6] v. 58.2 (IQR 13.7) yr, $p < 0.01$) and had higher rates of complicated diverticulitis (50.0% v. 39.2%, $p < 0.01$) than immunocompetent patients. Using a propensity-score adjusted multivariable analysis, we found that the odds of mortality and postoperative morbidity were significantly greater among immunosuppressed compared with immunocompetent patients (odds ratio [OR] 2.16, 95% CI 1.70–2.75, and OR 1.26, 95% CI 1.12–1.42, respectively) in the emergency setting. In addition, the median LOS was significantly longer (1.01 d, 95% CI 0.67–1.42) among immunosuppressed compared with immunocompetent patients. In the elective setting, immunosuppression was associated with significantly increased odds of mortality (OR 3.61, 95% CI 1.97–6.64) and postoperative morbidity (OR 1.29, 95% CI 1.09–1.53). Immunosuppressed patients were at significantly increased risk of mortality and major morbidity following emergency and elective colectomy for diverticulitis compared with immunocompetent patients. However, the absolute risk of mortality following elective colectomy for immunosuppressed patients was not prohibitive. Elective colectomy should be offered to immunosuppressed patients who are considered to be at high risk of recurrent complicated diverticulitis as the risks of morbidity and mortality following emergency colectomy remain high.

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Presentation and survival in colorectal cancer under 50 years of age: a systematic review and meta-analysis. *C. Griffiths, T. McKechnie, A. Doumouras, C. Eskicioglu.* From McMaster University, Hamilton, Ont.

The incidence of colorectal cancer (CRC) in North America is rising among patients under 50 years of age. Available data are conflicting regarding patient presentation and outcomes in this population. We aimed to synthesize the existing literature regarding young patients with colorectal cancer with respect to patient demographics, extent of disease and survival compared with those over 50 years of age. A search of the Medline, Embase, Central, PubMed and ClinicalTrials.gov databases was performed. Articles published between 1990 and the present day comparing patients under and over 50 years of age with newly diagnosed CRC were eligible for inclusion. Patient demographics, tumour histology, grade, stage and survival were evaluated. Odds ratios (ORs), hazard ratios (HRs) and 95% confidence intervals (CIs) were calculated. A random-effects model was used. The quality of included studies was assessed using the Newcastle–Ottawa Scale. Eight studies were included, with a total 790 959 patients, of which 81 570 patients were under the age of 50 years. Mean age was 42.6 years in the young group and 69.1 years in the over-50 group. Younger patients were less commonly non-Hispanic

white (74% v. 81%, $p < 0.0001$). Young patients were more likely to present with regional (OR 1.27, 95% CI 1.16–1.40) and distant disease (OR 1.47, 95% CI 1.30–1.67). For patients of all stages, the differences in 5-year overall survival (HR 1.54, 95% CI 0.96–2.47) and cancer-specific survival (HR 1.01, 95% CI 0.91–1.13) were not statistically significant between groups. However, when we controlled for extent of disease, 5-year cancer-specific survival was significantly higher among young patients with regional (HR 1.37, 95% CI 1.16–1.63) and distant disease (HR 1.79, 95% CI 1.45–2.21). North American patients who present with CRC before the age of 50 years are more likely to present with advanced disease. Although overall and cancer-specific survival is not significantly different between these groups, younger patients have improved survival when controlling for cancer stage.

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Genetics of postoperative recurrence of Crohn's disease: a systematic review and meta-analysis. *M. Laffin, J. Dang, T. Dang, T. Chambers, E. Wine, B. Dicken, K. Madsen.* From the University of Alberta, Edmonton, Alta.

Crohn's disease often requires intestinal resection. Surgical intervention is not considered curative, as repeat surgery is required in over half of all patients. Genetic factors have been shown to influence the development of Crohn's disease, although the impact of genetics on postoperative recurrence is not well understood. We conducted a literature search using the Ovid Medline, Embase, EBSCOhost CINAHL and Web of Science databases. Quality assessment and data extraction were performed by 2 authors independently. Study inclusion required the assessment of postoperative recurrence of Crohn's disease defined by a specific genotype. The primary end point was defined as odds of surgical recurrence for distinct genotypes. Our meta-analysis employed a random-effects model to assess the pooled odds ratio (OR) with 95% confidence interval (CI). Heterogeneity was assessed using χ^2 and Cochrane Q tests. A total of 386 studies were identified and 56 were reviewed in full. Twenty-six studies enrolled a total of 6376 subjects. Sixteen studies contained incomplete information regarding genotype and recurrence rate. Over 70 loci were identified as modifying the risk of recurrence following intestinal resection, including CARD8, TIMP-1, TNSF15 and IRGM, although only a single gene, NOD2, was identified as a risk factor by more than a single study. Twelve studies examined NOD2, 8 of which contained the necessary data for meta-analysis, representing 1214 surgical subjects, of whom 401 experienced a surgical recurrence. The cumulative risk of resection was elevated in subjects with a NOD2 risk allele (OR 1.56, 95% CI 1.07–2.28, $p = 0.02$). Heterogeneity of these studies was moderate ($I^2 = 43\%$). The presence of a NOD2 risk allele increased the odds of surgical recurrence following intestinal resection in Crohn's disease.

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Improving the identification and treatment of preoperative anemia in patients undergoing elective bowel resection. *R. Gilbert, J. Greenberg, T. Zwiap, D. Touchie, E. Sainenberg, D. McIsacc, R. Musselman, I. Raiche, L. Williams, H. Moloo.* From the University of Ottawa, Ottawa, Ont.

Evidence demonstrates 40%–47% of surgical patients undergoing elective bowel resection have preoperative anemia, a condition associated with significantly higher rates of postoperative mortality, morbidity and blood transfusion, prolonged length of stay by 1.8 days and hospital costs up to \$3000 per anemic patient. The aim of this project is to create a standardized approach to effectively identify and treat this subset of surgical patients to improve postoperative outcomes and reduce the overall costs of care. A local clinical practice audit and costing analysis were performed by a multidisciplinary team. The root causes of untreated preoperative anemia were targeted for interventions by the team, which included the development and implementation of an evidence-based clinical practice algorithm and a clinical checklist. The primary outcome was the percentage of patients treated appropriately for preoperative anemia. The secondary outcome measure was the percentage of patients screened preoperatively for anemia. Process and balancing measures were also tracked prospectively before and after the intervention. Following implementation of the anemia algorithm, run charts revealed an increase in both the percentage of patients screened preoperatively (11.8% v. 86%, $p < 0.001$) and the percentage of patients receiving treatment for preoperative anemia (12.1% v. 47.6%, $p = 0.023$). Notable trends toward increased surgeon-reported familiarity with guidelines (0% v. 100%), routine screening of patients for preoperative anemia (25% v. 100%) and use of the algorithm (14% v. 95%) were also identified. There was no significant increase in surgeon self-reported time spent managing preoperative anemia. The development of an evidence-based clinical practice algorithm and clinical checklist was effective at improving screening and treatment rates of preoperative anemia in patients undergoing elective bowel resections. This may contribute to improved postoperative outcomes and reduced overall costs of care.

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Impact of postoperative complications on quality of life after colorectal surgery. *T. Dumitra, M. Trepanier, J. Fiore Jr., F. Carli, G. Fried, L. Feldman, L. Lee.* From McGill University, Montreal, Que.

The grading of surgical complications is heterogeneous, but its effect on patient-reported outcomes is not well understood. The objective of this study was to examine the relationship between complication severity and health-related quality of life (HRQoL) in colorectal surgery patients. A secondary analysis of adult patients undergoing elective colorectal surgery from 2009 to 2013 was performed. HRQoL was measured using the 36-item Short Form Survey (SF-36) preoperatively and at 4 and 8 weeks postoperatively. Thirty-day morbidity was classified using Clavien–Dindo grading (grades I, II, III+) and comprehensive complication index (CCI). The main outcomes were change in physical component summary (PCS) and mental component summary (MCS) scores postoperatively. Multiple linear regression was used to determine the effect of complications on HRQoL. A total of 402 patients were included in the study (55% male, 67% malignancy, 57% laparoscopic). Overall morbidity was 46% ($n = 186$). The mean preoperative PCS score was 49.71 (SD 9.70) and the mean MCS score was 48.29 (SD 11.14). Patients with complications had lower PCS and MCS scores at 4 and 8 weeks after surgery than patients without complications ($p < 0.05$). On multivariate

regression, PCS score significantly decreased with Clavien–Dindo grade III+ complications at 4 weeks (-5.20 [-8.88 to -1.53]) and with Clavien–Dindo grade II complications at 8 weeks (-3.84 [-7.0 to -0.73]). MCS score decreased with Clavien–Dindo grade II+ complications at 4 weeks and grade III+ complications at 4 and 8 weeks. Adjusted change in PCS and MCS scores had a more linear correlation with CCI scores. In patients undergoing colorectal surgery, however, the relationship between Clavien–Dindo complication grading and postoperative HRQoL is not linear. The CCI may be a more inclusive morbidity measure when assessing its effects on HRQoL.

26

Colon cancer survival by subsite: a retrospective analysis of the National Cancer Database. *D. Yu, M. Stem, J. Taylor, S. Chen, B. Safar, S. Fang, S. Gearhart, J. Efron.* From Queen's University, Kingston, Ont. (Yu); and the Johns Hopkins Medicine, Baltimore, Md. (Stem, Taylor, Chen, Safar, Fang, Gearhart, Efron).

Recent studies report a shift in the site of origin of colon cancer from the distal to the proximal colon. This study aims to assess subsite-specific differences of colon adenocarcinomas with respect to patient and tumour characteristics, treatment and overall survival (OS). From the National Cancer Database (2004–2015), adult patients older than 18 years of age diagnosed with stage I to IV colon adenocarcinoma were stratified by primary site of cancer (right, transverse, left or sigmoid). The primary outcome was 5-year OS analyzed using Kaplan–Meier survival curves and Cox proportional hazard models. A total of 642 983 cases were included. A small increase in diagnosis from 2004 to 2015 was found in right-sided and transverse colon cancers. Patients with right and transverse colon cancer tended to be female, to be older, to have higher frequencies of poorly differentiated tumours and to have tumours larger than 5 cm. When we stratified by stage, patients with sigmoid cancer were more likely to receive multimodal therapy than those with other subsites across all stages. In the unadjusted analysis, right and transverse colon cancers had the worst 5-year OS. Similar trends persisted when we stratified by stage. In the adjusted Cox analysis, right, transverse and left colon cancers all had significantly increased risk of mortality in comparison to sigmoid cancer when all stages were combined (sigmoid reference, hazard ratio [HR] 1.10, 95% confidence interval [CI] 1.08–1.12; HR 1.16, 95% CI 1.13–1.19; HR 1.12, 95% CI 1.09–1.15; $p < 0.001$ for all). When we stratified by stage, right and transverse colon cancers had the greatest risk of death in stages III and IV (sigmoid reference, stage III: transverse HR 1.21, 95% CI 1.16–1.26, $p < 0.001$; stage IV: right HR 1.28, 95% CI 1.24–1.31, $p < 0.001$). Right-sided and transverse cancers showed an increasing trend over the study period. These patients tended to be female, to be older, to have poor differentiation and to have larger tumours. Five-year OS was worst in transverse cancers for all stages combined.

27

A second opinion for T1 colorectal cancer pathology reports results in frequent changes to clinical management. *M. Dykstra, T. Gimon, W. Buie, A. MacLean.* From the University of Calgary, Calgary, Alta.

There are 3 treatment options for endoscopically resected malignant colorectal polyps (T1N0M0): oncologic resection, repeat endoscopic therapy and surveillance. The College of American Pathologists guidelines list features that are “mandatory” and “optional.” Unfortunately, reports are often incomplete or incorrectly reported, which may result in inaccurate tumour risk stratification. The aim of our study was to determine how often a second pathologist's opinion is requested and how often the second opinion changes the risk category of the tumour. All endoscopically resected T1 colorectal cancers in our province from 2014 to 2016 were identified. We reviewed pathology reports and stratified tumours into high- or low-risk categories for lymph node metastases and recurrence. Tumours were considered high risk if they had any of the following: high-grade tumour budding, high histological grade, positive margin, lymphovascular invasion, sm3 depth, invasive width greater than 4000 μm or invasive depth greater than 2000 μm . We identified reports that had second opinions to determine how often the risk class of the tumour changed. A total of 388 patients were identified, of whom 143 met the inclusion criteria. Twenty-one (14.7%) reports included all of the mandatory reporting characteristics, and 15 (10.5%) reports included all of the mandatory and optional reporting characteristics. Fourteen reports (9.8%) underwent a second review by an expert gastrointestinal (GI) pathologist. Nine (64.3%) tumours remained in the same risk category and 5 (35.7%) switched categories. One high-risk tumour was downgraded to low risk, and 4 low-risk tumours were upgraded to high risk. Our results highlight 2 striking findings. First, clinical decisions for patients with T1 colorectal cancers in our province are frequently based on incomplete information. Second, with a second opinion from a GI pathologist, tumour risk changes in more than one-third of cases. From a surgeon's perspective, these findings highlight the importance of accurate pathologic reporting and involving expert reviews.

28

Effects of the quadratus lumborum block regional anaesthesia on postoperative pain after colorectal resection: a double-blind randomized clinical trial. *M. Boulianne, P. Paquet, R. Veilleux, S. Drolet, D. Simonyan, A. Turgeon.* From Laval University, Québec, Que.

Postoperative pain following colorectal surgery requires significant opioid use. Recently, regional anesthesia has been proposed to improve pain relief and reduce opioid use. In this context, the posterior quadratus lumborum block (QL2) is newly employed but its effectiveness remains controversial. We conducted a randomized controlled trial evaluating the effect of quadratus lumborum block on pain control. In the QL2 group, an injection of 20 mL of ropivacaine 0.375% was performed on each side. A sham injection (superficial cutaneous puncture) was performed in the placebo group. Our primary outcome was opioid administration at 24 hours. Our secondary outcomes were opioid administration, pain (visual analogue scale), delay in resumption of intestinal transit, nausea and vomiting, and hospital length of stay. Sixty-two patients were required to evaluate a 50% reduction in opioid use (alpha 5%, beta 20%) with the QL2. Our population was composed of 63% men and 37% women aged 63 years on average. In the QL2 group, 100.2 mg (95% confidence interval [CI] 68.9–131.5) of PO morphine equivalent were administered

on average compared with 88.7 mg (95% CI 59.3–118.0) in the placebo group ($p = 0.80$). Postoperative pain was better controlled in the placebo group than in the QL2 group (3.8 [95% CI 2.8–4.7] v. 5.7 [95% CI 4.7–6.6], $p = 0.005$). Other outcomes were comparable across groups. In our trial, we did not observe a decrease in opioid administration with the posterior quadratus lumborum block regional anesthesia in a context of colorectal surgery.

29

Safety of a short-stay postoperative unit for the early discharge of patients undergoing a laparoscopic right hemicolectomy. *D. Jones, S. Zerbouni, P. Karanicolas, S. Ashamalla.* From the University of Toronto, Toronto, Ont.

Enhanced recovery after surgery (ERAS) allows patients an early discharge following major surgery. A surgical short-stay program (SSP) was implemented for patients undergoing laparoscopic right hemicolectomy (LRH). The objectives of this study were to assess the safety and feasibility of the SSP, comparing outcomes for patients in this unit with those of patients discharged from the standard ward. Patients undergoing LRH between 2012 and 2017 (single institution, single surgeon) were examined. Demographics, pathology, operative outcomes, complications, length of stay (LOS) and morbidity and mortality rates were collected. Statistical analysis included the χ^2 test for categorical variables and the Student t test for numerical variables. The entire cohort included 139 patients: 99 in the standard ward and 40 in the SSU. Age, body mass index, Charlson comorbidity index, Eastern Cooperative Oncology Group (ECOG) performance status, distance from home to hospital and independent living did not differ between the cohorts. The percentages of patients who were male and who had had previous abdominal surgery differed significantly between the ward and SSP cohorts (43% v. 62.5%, $p = 0.04$; 51% v. 37.5%, $p = 0.01$, respectively). In the entire cohort, 91% of patients had intracorporeal anastomosis (4% conversion rate), with the majority for adenocarcinoma (51%) or endoscopically unresectable polyps (32%). LOS was significantly shorter for patients in the SSP than for those in the standard ward (31 h v. 91 h, $p = 0.0003$). Mortality, Clavien–Dindo grade 3 or 4 complications and overall complications were similar in the 2 groups ($p = 0.4$). Readmission rates for the SSP cohort were almost double those of the standard ward cohort, although this difference failed to reach statistical significance. Early discharge from the SSP following LRH is feasible and safe. Even though readmission rates for SSP patients were higher, the rate of major complications did not differ between the cohorts. Future models may help predict which patients are most suitable for SSP care, reducing costs without compromising patient care.

30

What is the optimal bowel preparation to reduce surgical site infection in Crohn disease? *A. Pooni, M. Brar, A. De Buck van Overstraeten, R. Gryfe, H. MacRae, E. Kennedy.* From the University of Toronto, Toronto, Ont.

There is renewed interest in the use of mechanical bowel preparation (MBP) and oral antibiotic prophylaxis (OA) in colorectal surgery; however, evidence in Crohn disease (CD) is limited.

The aim of this study was to evaluate the impact of bowel preparation regimes on outcomes in elective colorectal resections for CD. The 2012–2017 American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP) colectomy-targeted database was used to identify patients who underwent elective colorectal resections for CD. Patients were divided into 4 groups: no bowel preparation (NBP), MBP alone, OA alone and combined preparation (OA + MBP). Demographics, comorbidities, operative details and 30-day outcomes were abstracted. Multivariable logistic regression was used to evaluate the effect of bowel preparation regime on outcomes adjusting for confounders. An interaction test was used to assess if the effect varied by type of resection. A total of 5910 patients were identified: 2116 (35.8%) received NBP, 894 (15%) received MBP alone, 561 (9.5%) received OA alone and 2349 (39.75%) received OA + MBP. The groups differed significantly with respect to age, obesity, steroid/immunosuppression, surgical approach and type of resection. The incidence of combined surgical site infections (SSI), anastomotic leak and ileus was 691 (11.69%), 200 (3.77%) and 888 (15.04%), respectively. On multivariable regression, OA + MBP was associated with significantly lower odds of SSI, ileus, postoperative sepsis and anastomotic leak. OA was associated with lower odds of SSI and postoperative sepsis. There was no significant interaction between bowel prep and type of resection. Renal complications and rates of *Clostridium difficile* infection were similar between groups. OA + MBP was associated with improved colorectal-specific outcomes in CD, including SSI, ileus, postoperative sepsis and anastomotic leak. OA alone was associated with lower SSI and postoperative sepsis. However, no significant differences were found for infectious complications between OA + MBP and OA alone in this analysis. Further study is required to assess the incremental benefit of MBP when OA are administered.

31

TaTME surgery and the learning curve: our early experience. *F. Saleh, T. McAlister.* From the William Osler Health System, Brampton, Ont.

Laparoscopic transanal total mesorectal excision (TaTME) surgery has revolutionized the way rectal cancer is being performed and has been widely adopted. We set out to examine our early case series and examine the learning curve for TaTME surgery on the basis of operative time. All cases from 2018–2019 were retrospectively collected for operative time and relevant patient characteristics. Linear regression was used to look for a trend in early operative times. Oncologic and postoperative outcomes and length of stay were also looked at. Twenty cases were looked at. The majority of cases were in the lower rectum (< 5 cm) and 90% received radiation preoperatively. There were no positive circumferential or distal margins. The average lymph node count was 22. Twenty percent of patients had significant complications. Linear regression showed a significant trend to improved time ($p < 0.001$). TaTME has provided excellent oncologic outcomes while maintaining reasonable complication results. Twenty cases showed dramatic improvement in operative time but our data suggest we are still early in the learning curve.

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Watch-and-wait experience in patients with rectal cancer: results in selected patients at a high-volume centre. *J. Rousseau, C. Richard.* From the University of Montreal, Montreal, Que.

Rectal cancer surgeries are associated with a potentially high morbidity rate and impact on quality of life. The watch-and-wait (W&W) approach after clinical complete response (cCR) is being increasingly studied with interesting outcomes for select patients. This retrospective study reviews the outcomes of a W&W approach in a high-volume rectal cancer centre, focusing on the detection of recurrence and the surgical outcomes in salvage surgery. A retrospective analysis was performed on 26 patients who had a cCR based on digital rectal exam (DRE), endoscopy and pelvic magnetic resonance imaging (MRI) after neo-adjuvant treatment, from September 2015 to September 2018. Patients were followed with DRE, endoscopy and CEA every 3 months and regular pelvic MRI. Local recurrence occurred in 8 of 26 patients (31%). Half of the recurrences

occurred within the first 12 months with a median time to recurrence of 13 months (5–25). No distant metastases were observed before local recurrence. Every recurrence was initially discovered by DRE or endoscopic assessment. CEA remained normal in all 8 patients. Only 1 patient had a high suspicion of recurrence on pelvic MRI and the MRI did not suggest recurrence in 5 patients. The median follow-up in the disease-free group was 21 months, with 16 (84%) who were followed for more than a year and 8 (42%) for over 2 years. Salvage surgery was performed on all patients with recurrence. Five patients had an abdominoperineal resection, 3 had a low anterior resection and 1 was treated with transanal local excision for a T1 lesion. One patient had a positive circumferential margin. Mesorectal excision was deemed complete in 5 of 7 patients after radical excision. This study suggests that a W&W approach in a select group of patients with cCR is a feasible option in a Canadian context. Follow-up has to be strictly maintained with DRE, endoscopy and MRI. Our data may question the accuracy of MRI for detection of recurrence. Salvage surgery seems possible in a high percentage of patients.

CANADIAN ASSOCIATION OF THORACIC SURGEONS

01

Automatic referral of suspicious findings detected on thoracic CT scan decreases delays in care without compromising referral quality. *T. Khalid, J. Veenstra, K. Stewart, A. Valji, E. Bédard, S. Johnson, B. Laing, S. Turner.* From the University of Alberta, Edmonton, Alta.

Delays in care may negatively affect outcomes for patients with potentially resectable thoracic malignancies. Reducing the time from initial computed tomography (CT) scan to referral to a thoracic surgeon may be an effective way to decrease delays in care. Our institution instituted an optional automatic referral process for patients who have had their CT scan flagged by a radiologist as featuring a suspicious lung nodule, lymphadenopathy or mediastinal mass. The objective of this study was to determine whether automatic referrals were associated with decreased time to referral. The secondary objective was to assess the quality of referral information provided in relation to defined referral criteria. A retrospective review was performed of all patients referred to our institution with suspicious CT chest findings between February and July 2018. The time between the date of CT scan and date of referral was calculated, and the type of information provided with the referral was tabulated. Four primary referral criteria were defined: clinical history, past medical/surgical history, medication list and radiologic testing results. Secondary referral criteria were pulmonary function testing, laboratory, microbiology and pathology results and allergies. There were 689 patients meeting the inclusion criteria: 405 automatic and 289 traditional referrals. Time to referral was significantly shorter in automatic referrals (4.7 v. 23.6 d, $p < 0.001$). Only 1 automatic referral took longer than 30 days, compared with more than 25% of traditional referrals. There was no difference in the number of primary (median 3 v. 3, $p = 0.38$) or secondary (median 1 v. 1, $p = 0.51$) referral criteria provided. Automatic referrals for patients with suspicious findings on CT scan may have a significant impact on delays in care, which

could result in decreased upstaging and mortality. This was not associated with a decrease in the amount of information provided with the referral. Thus, automatic referrals may streamline patient care without compromising quality.

02

Variation in receipt of therapy and survival with provider volume in noncurative esophagogastric cancer: a population-based analysis. *V. Gupta, N. Coburn, L. Davis, A. Mahar, Y. Liu, V. Zuk, C. Earle, J. Hallet.* From the University of Toronto, Toronto, Ont. (Gupta, Coburn, Earle, Hallet); the Sunnybrook Research Institute, Toronto, Ont. (Davis, Zuk); the University of Manitoba, Winnipeg, Man. (Mahar); and ICES, Toronto, Ont. (Liu).

Although surgical care by high-volume providers for esophagogastric cancer (EGC) yields better outcomes, volume–outcome relationships are unknown for systemic therapy. We examined receipt of therapy and outcomes in the noncurative management of EGC on the basis of medical oncology provider volume. We conducted a population-based retrospective cohort study of noncurative EGC over 2005–2017 by linking administrative health care data sets. The volume of new EGC consultations per medical oncology provider per year was calculated and divided into quintiles. High-volume (HV) providers were defined as the fourth and fifth quintiles. Outcomes were receipt of chemotherapy and overall survival (OS). Multivariate logistic and Cox proportional hazards regressions examined the association between management by HV provider, receipt of systemic therapy and OS. A total of 7011 patients with noncurative management of EGC consulted with medical oncology. One-year OS was superior for HV providers (> 11 patients/yr), with 28.4% (95% confidence interval [CI] 26.7%–30.2%) compared with 25.1% (95% CI 23.8%–26.3%) for low-volume providers ($p < 0.001$). After we adjusted for age, sex, comorbidity burden, rurality, income quintile and diagnosis year,

HV provider was independently associated with higher odds of receiving chemotherapy (odds ratio 1.13, 95% CI 1.01–1.26) and independently associated with superior OS (hazard ratio 0.89, 95% CI 0.84–0.93). Medical oncology provider volume was associated with variation in noncurative management and outcomes of EGC. Care by a HV provider was independently associated with higher odds of receiving chemotherapy and superior OS, after adjusting for case mix. This information is important to inform disease care pathways and care organization; an increase in the number of HV providers may reduce variation and improve outcomes.

03

What makes patients high risk for lobectomy in the era of minimally invasive lobectomy? *L. Donahoe, C. Kavanagh, T. Waddell, J. Yeung, M. Cypel, M. de Perrot, A. Pierre, S. Kesbavjee, K. Yasufuku, G. Darling.* From the University of Toronto, Toronto, Ont.

Lobectomy is standard of care for lung cancer, with increasing numbers being performed using minimally invasive surgery (MIS), including video- and robotic-assisted thoracic surgery (VATS and RATS). The objective of this study was to determine the factors associated with increased risk for lobectomy in a contemporary sample from a centre performing predominantly MIS lobectomies. This single-centre retrospective study reviewed all patients who underwent lobectomy from 2011 to 2014. Bilobectomies, pulmonary artery or bronchial sleeve resections and chest wall or vertebral resections were excluded. Of 385 lobectomies, 311 were MIS and 74 were open. In the MIS group, the median patient age was 68 years (interquartile range 61–74), 166 (53.4%) were female and the average body mass index (BMI) was 26.5 ± 4.8 . Fourteen (4.5%) MIS lobectomies were converted to open because of bleeding or inability to progress. Intraoperative complications occurred in 14 patients (4.5%), and any complication happened in 84 patients (27.0%). On univariate analysis, factors that were significantly associated with any complication were history of myocardial infarction ($p = 0.027$) and left ventricular ejection fraction ($p = 0.03$). Age ($p = 0.61$), sex ($p = 0.33$), BMI ($p = 0.44$), Eastern Cooperative Oncology Group Performance Status score ($p = 0.94$), smoking status ($p = 0.86$), FEV1% ($p = 0.86$), DLCO% ($p = 0.49$), 6-minute walk distance ($p = 0.14$), clinical tumour stage ($p = 0.97$) and clinical nodal stage ($p = 0.50$) were not associated with an increased risk of complications after MIS lobectomy. Increasing age ($p = 0.003$) and American Society of Anesthesiologists (ASA) score ($p = 0.012$) were associated with a significantly higher rate of requiring reintubation postoperatively but FEV1% was not ($p = 0.97$). In the MIS group, the 30-day mortality was 0, but 1 patient (0.3%) died at 6 weeks owing to previously undiagnosed interstitial lung disease. In the era of predominantly MIS lobectomies, few factors contribute to increased risk of perioperative complications. The operative mortality and rate of complications in MIS lobectomies is very low and all patients with lung cancer should be carefully evaluated for standard of care lobectomy.

04

The value proposition of minimally invasive esophagectomy: a community hospital perspective. *M. Busbra, V. Gupta, A. Mohammed, S. Uddin, D. Jones, A. Behzadi.* From the University of Toronto, Toronto, Ont.

Outcomes of minimally invasive esophagectomy (MIE) over the open approach in a community hospital setting have not been well examined. The objective of this study is to determine whether MIE offers more safety and efficacy than open Ivor Lewis esophagectomy in a community thoracic surgery setting. A retrospective cohort study of patients undergoing MIE or open esophagectomy for cancer from 2013 to 2017 was performed at a community thoracic surgery centre. Patients underwent open esophagectomy or MIE on the basis of referral patterns as 2 surgeons exclusively performed open esophagectomies during the study period. Baseline demographics, operative variables, tumour characteristics and postoperative outcomes were compared between MIE and open esophagectomies. Of 90 patients meeting the inclusion criteria, 34 (37.8%) underwent MIE. Patients in the MIE group were older (open, 63 ± 9.8 yr; MIE, 69 ± 9.5 yr; $p = 0.006$) and scored higher on the Charlson Comorbidity Index (open, 4.4 ± 1.7 ; MIE, 5.2 ± 1.6 ; $p = 0.049$) than patients in the open esophagectomy group. The median length of the operation was greater for those who underwent MIE than for those who underwent open esophagectomy (open, 310 min; MIE, 402 min; $p < 0.0001$). There was no significant difference in the length of hospital stay (open, 13 d; MIE, 14 d; $p = 0.829$), length of stay in the intensive care unit (open, 2.0 d; MIE, 2.5 d; $p = 0.281$), rate of postoperative complications (open, 16.1%; MIE, 20.6%; $p = 0.584$) or 90-day mortality (open, 1.79%; MIE, 2.94%; $p = 0.999$) between the 2 approaches. Equal rates of margin-negative resection (open, 91.1%; MIE, 85.3%; $p = 0.494$) and median lymph node clearance (open, 16; MIE, 18; $p = 0.575$) were achieved in the 2 groups. MIE appears to be a safe alternative to open esophagectomy for cancer patients treated in a community setting. Moreover, it appears to achieve similar outcomes in patients who are older or have more comorbidities. Further research is needed to evaluate differences in long-term oncological outcomes and confirm the safety of offering MIE to older, sicker patients.

05

Deviation from treatment plan in patients with potentially curable esophageal carcinoma. *M. Thivierge-Southidara, C. Vincelette, J. Molina, E. Lafontaine, J. Martin, B. Nasir, P. Ferraro, M. Liberman.* From Université de Montréal, Montreal, Que. (Thivierge-Southidara); Université de Sherbrooke, Sherbrooke, Que. (Vincelette); and Centre hospitalier de l'Université de Montréal, Montreal, Que. (Molina, Lafontaine, Martin, Nasir, Ferraro, Liberman).

The incidence of and reason for deviation from final treatment strategy in patients with potentially curable esophageal carcinoma (PCEC) is unknown. An assessment of deviation from planned treatment strategy in patients with PCEC was undertaken to better understand this problem. Patients with PCEC were identified from a prospective endoscopy database. All patients underwent endoscopic ultrasonography (EUS) by a thoracic surgical service between 2009 and 2017. All patients were deemed to have PCEC by a multidisciplinary upper gastrointestinal tumour board on the basis of endoscopic ultrasonography, computed tomography and positron emission tomography ($n = 357$). Final treatment plans were decided upon by this tumour board. Logistic regression models, adjusted for socio-demographics, tumour variables and illness severity variables (Eastern Cooperative Ecology Group [ECOG] Performance

Status score and Charlson Comorbidity Index [CCI] score), were used to identify predictors of deviation. Of patients with PCEC requiring chemoradiation ($n = 321$), 21% ($n = 66$) deviated from a curative or a neoadjuvant chemoradiation strategy to a palliative strategy. The most frequent reasons for deviation were medical contraindications (26%, $n = 17$), patient refusal (21%, $n = 14$), complications from chemoradiation (15%, $n = 10$) and an ECOG score preventing treatment (14%, $n = 9$). Of patients with PCEC requiring surgery ($n = 325$), 29% ($n = 95$) did not undergo their planned curative-intent surgery. The most frequent reasons were progression of cancer during treatment (28%, $n = 27$), medical contraindications (21%, $n = 20$) and an ECOG score preventing treatment (17%, $n = 16$). In adjusted models, age, tumour location and ECOG score were significant predictors of deviation from potentially curative chemoradiation treatments. For surgical interventions, age, ECOG score, CCI and T stage were significant predictors of deviation. A significant proportion of patients with PCEC did not undergo their planned treatment. Age and ECOG were associated with increased odds of deviation for both chemoradiation and surgery. Additionally, CCI and T stage were associated with increased odds of surgical treatment deviation. Further research should explore the impact of treatment plan deviations on patient outcomes.

06

Implementation of a standardized minimal opioid prescription for post-thoracic surgery patients is feasible and provides adequate pain control. *N. Safieddine, C. Simone, S. Gazala, R. Zeldin, N. Safieddine.* From the University of Toronto, Toronto, Ont.

Opioid prescription and use for postoperative pain control has recently been under increased scrutiny given the national opioid crisis. Data, specifically related to thoracic procedures, remain scarce. This study aims to assess the adequacy of pain control with standardized and limited opioid use after thoracic surgery. A standardized prescription (hydromorphone 2 mg orally every 4 hours to a maximum of 15 tablets, acetaminophen 1 g 3 times per day for 7 days, ibuprofen 400 mg orally 3 times per day for 3 days) was adopted and provided on discharge to all patients undergoing inpatient thoracic surgical procedures, excluding esophagectomies (Dec. 2018 to Feb. 2019) in a high-volume thoracic unit. A questionnaire on number of hydromorphone tablets used, need for additional opioids, pain-related limitation to function and patient-reported adequacy of pain control was completed by patients on the first postoperative visit (2–4 wk after discharge). Of a total of 65 patients, there were 27 (42%) video-assisted thoracoscopic surgery (VATS) lobectomies, 20 (31%) VATS wedge resections, 3 (4.5%) open lung resections, 5 (7.5%) sternotomies and 10 (15%) other procedures. Median age was 67 years (23–84 yr), and median length of stay was 2 days (1–15 d). Ten (15%) used all 15 tablets of 2 mg hydromorphone and 37 (57%) used none, 11 (17%) asked for additional/other opioid and 10 (15%) felt their pain significantly limited their daily function. Nine (14%) felt their pain was inadequately controlled; 3 of these patients had nonminimally invasive procedures. Pain after thoracic procedures, especially VATS, is not a significant issue for the vast majority of patients and is adequately controlled with minimal opioid doses com-

bined with adjuncts. A limited dose of opioids (48 morphine equivalents daily for 3 d) was associated with only 1 in 6 patients requiring additional prescriptions and therefore minimal inconvenience to patients and surgeons. Not all patients who felt their pain was inadequately controlled had any significant limitation to function, suggesting that patient education regarding expectations is an important component of postoperative pain management.

07

Sentinel node navigation surgery using indocyanine green in lung cancer: a systematic review and meta-analysis. *W. Sun, J. Dang, A. Modasi, A. Nasralla, D. Skubleny, N. Switzer, D. Birch, S. Turner, S. Karmali.* From the University of Alberta, Edmonton, Alta.

Lung cancer is the leading cause of cancer death worldwide. The use of sentinel node navigation surgery (SNNS) has been gaining popularity with the emergence of indocyanine green (ICG). We aimed to systematically review the literature and perform a meta-analysis on the diagnostic utility of ICG for SNNS in lung cancer. A comprehensive search of Medline, Embase, Scopus, Web of Science and the Cochrane Library using search terms “lung/pulmonary” AND “tumor/carcinoma/cancer/neoplasm/adenocarcinoma/malignancy/squamous/carcinoid” AND “indocyanine green” was completed in June 2018. Titles or abstracts were screened, and articles were selected by 2 independent reviewers on the basis of the following inclusion criteria: (1) diagnostic accuracy study design; (2) ICG injected at the tumour site; and (3) lymphadenectomy or systematic lymph node sampling was performed as the gold standard. Nine primary studies were included with a total of 382 patients. In these studies, 43.0% of patients were female and the mean tumour size was 2.3 cm. Sentinel node biopsy was successful with ICG in 298 patients, yielding a pooled identification rate of 0.77 (0.59–0.91). A meta-analysis of 7 studies computed a diagnostic odds ratio, sensitivity and specificity of 54.4 (12.4–238.1), 0.81 (0.64–0.93) and 0.96 (0.92–0.98), respectively. The summary receiver operator characteristic (SROC) demonstrated an area under the curve (AUC) of 0.849 (SE 0.038) and a Q^* of 0.78 (SE 0.075). Our review found suboptimal results for the use of ICG in SNNS for lung cancer. The diagnostic odds ratio, sensitivity and SROC AUC were promising but need improvement before consideration as a tool in the treatment of lung cancer. This was due to a mediocre identification rate and poor representation of all metastatic nodes. Further research is required to develop a robust protocol for the use of ICG in SNNS for lung cancer.

08

Surgical outcomes with trimodality neoadjuvant versus adjuvant therapy for esophageal cancer: results of the QUINTETT randomized trial. *R. Malthaner, E. Yu, M. Sanatani, D. Lewis, A. Warner, A. Dar, B. Yaremko, J. Bierer, D. Palma, G. Rodrigues, D. Fortin, R. Inculet, E. Frechette, J. Raphael, S. Gaede, S. Kuruvilla, J. Younus, M. Vincent.* From the London Regional Cancer Program, London, Ont. (Malthaner, Yu, Sanatani, Lewis, Warner, Dar, Yaremko, Bierer, Palma, Rodrigues, Fortin, Inculet, Raphael, Gaede, Kuruvilla, Younus, Vincent); and Université de Sherbrooke, Sherbrooke, Que. (Frechette).

We compared the surgical outcomes of standard neoadjuvant cisplatin/5-FU chemotherapy plus radiotherapy (nCFRT) followed by surgical resection with adjuvant epirubicin/cisplatin/5-FU chemotherapy with concurrent extended volume radiotherapy (aECFxRT) following surgical resection for resectable stage I to III esophageal carcinoma in a prospective randomized trial from April 2009 to November 2016. Forty-seven patients were randomly assigned to the nCFRT arm and 49 to the aECFxRT arm. The median follow-up was 5.0 years (95% confidence interval [CI] 4.6–5.5). Comparing nCFRT with aECFxRT, the majority of patients had adenocarcinomas of the distal esophagus or gastroesophageal junction (81% v. 88%), most surgeries were done minimally invasively (64% v. 80%), the most common approach was a laparoscopic transhiatal (53% v. 61%) and the most anastomoses were in the neck (68% v. 82%). Using an intention-to-treat analysis there were no significant differences in the quality of life (QOL) at 1 year. At 2 months, however, the nCFRT arm was significantly inferior for several domains ($p < 0.05$). There were no 30-day mortalities, 90-day mortalities were 2% versus 10% ($p = 0.20$) and 5-year overall survival was 38% versus 29% ($p = 0.32$). Anastomotic leak rates (15% v. 16%; $p = 0.95$) were similar in both arms, but there were significantly fewer strictures with nCFRT (15% v. 41%; $p = 0.007$). The resectability rates were similar (93% v. 92%) but the nCFTR arm had more complete resections (88% v. 51%; $p < 0.001$), fewer positive lymph nodes (5% v. 29%; $p < 0.001$) and fewer positive margins (6% v. 44%; $p < 0.001$). The complete pathologic response rate was 21% for the nCFTR arm. Of the 72 patients with neck anastomoses, 19 (25%) had a recurrent laryngeal nerve injury, 77% were mild and only 6% required a thyroplasty. Fourteen (19%) of the neck anastomoses leaked while only 1 (1%) of the chest anastomoses leaked. Neoadjuvant cisplatin 5-FU trimodality therapy or adjuvant ECF chemotherapy with extended volume radiation can be offered to patients with resectable esophageal cancers but their quality of life and adverse event experiences will be different.

09

Enhanced invasive mediastinal staging in an academic thoracic surgical unit by employing a shared accountability model for quality improvement *V. Resende, J. Villeneuve, M. Legacy, C. Anstee, A. Seely, D. Maziak, F. Shamji, S. Sundaresan, S. Gilbert.* From The Ottawa Hospital, Ottawa, Ont.

Invasive mediastinal staging is an integral part of lung cancer staging, a prerequisite to selection of the most appropriate treatment and a measure of quality surgical care. We sought to examine the performance of cervical mediastinoscopy in our academic unit and to determine the effect of an awareness intervention on the quality of mediastinal staging provided. The protocol received ethics approval. Over the period 2014–2017, a total of 284 patients underwent cervical mediastinoscopy. Data for the first 100 patients were analyzed with respect to the guideline recommendations (sampling of 2 N2 and 1 N3 nodal station, referred to as a “quality” intervention). The awareness intervention consisted of a presentation of blinded rates of quality mediastinoscopies by surgeon. It was a consensus that achieving a target of 80% quality mediastinoscopies represented

the minimum acceptable target. We then analyzed data for the subsequent 184 patients to assess for compliance with guidelines, sorting per participating surgeon, per specific lymph node station and per compliance with quality procedure. Statistical analysis was performed; significance at $\alpha = 0.05$ was determined by χ^2 and t testing. We observed a significant improvement in the compliance rate for appropriate overall quality mediastinal staging (57% to 84%; $p < 0.01$). This improvement was observed for individual nodal stations: 4R (85% to 98%; $p < 0.005$), 7 (77% to 91%; $p < 0.01$) and 4L (66% to 89%; $p < 0.001$). Each participating surgeon demonstrated improvement in the rate of quality staging procedures, and 66% were able to achieve/exceed the group consensus target of 80%. Our study confirms the importance of practice audits for quality improvement. We have further demonstrated that the presentation of blinded individual and group data was an effective intervention for quality improvement, as evidenced by the significant improvements in performance. There is opportunity to apply this simple and effective methodology in many other procedural aspects of thoracic oncologic surgical care.

10

Evaluation and harmonization of international database elements for adverse events monitoring following thoracic surgery: the pursuit of a common language. *G. Sigler, C. Anstee, A. Seely.* From The Ottawa Hospital, Ottawa, Ont.

Postoperative adverse events (AEs) are variably defined, yet a common language is paramount to collaboration. We sought to evaluate if the Canadian Association of Thoracic Surgeons (CATS) adverse events classification tool (based on the Ottawa Thoracic Morbidity & Mortality system) using 3 single-select lists and 1 optional multi-select list (i.e., system/AE/AE Claviën–Dindo grade/AE modifiers) could enable effective translation into other validated international AE classification systems. The AE definitions of the CATS system and those of the European Society of Thoracic Surgeons (ESTS), Society of Thoracic Surgeons (STS), Esophagectomy Complications Consensus Group (ECCG) and National Surgical Quality Improvement Program (NSQIP) were matched and compared. Discrepancies between definitions and grades of AEs were noted. Tables were created to facilitate systems-based comparison, to be made available online (see www.ottawatmm.org). The total numbers of AEs defined in the CATS, ESTS, STS, ECCG and NSQIP classification systems were 65, 20, 56, 50 and 22, respectively. The degree to which AE data elements of the classification systems were harmonized with the CATS system was categorized as perfect (i.e., exact wording), good (i.e., nearly exact) or nonharmonized. The CATS data elements were harmonized (i.e., perfect or good) with 100%, 89%, 74% and 73% for ESTS, STS, ECCG and NSQIP, respectively. Additional definitions from the other classification systems that CATS has not defined were identified. To achieve near-complete harmonization, the following changes to the CATS system would be required: addition of 1 classification system, 16 complications and 4 complication modifiers. This paper provides a framework for discussion and advancement toward a harmonized approach for AE definition and recording following thoracic surgery. An AE classification system that utilizes 3 single-select lists and 1 optional multi-select list with the additional elements identified would enable universal AE data collection, with potential for broad international benchmarking.

11

Endobronchial ultrasound staging of operable non-small cell lung carcinoma: triple-negative lymph nodes may not require routine biopsy. D. Hylton, K. Selvakumaran, B. Kidane, J. Spicer, S. Turner, D. French, C. Wen, J. Masters, J. Taylor, C. Finley, Y. Shargall, F. Farrokhyar, J. Agzarian, A. Seely, K. Yasufuku, W. Hanna. From McMaster University, Hamilton, Ont. (Hylton, Selvakumaran, Taylor, Finley, Shargall, Farrokhyar, Agzarian, Hanna); the University of Manitoba, Winnipeg, Man. (Kidane); McGill University, Montreal, Que. (Spicer); the University of Alberta, Edmonton, Alta. (Turner); Dalhousie University, Halifax, N.S. (French); the University of British Columbia, Vancouver, B.C. (Wen); Laurentian University, Sudbury, Ont. (Masters); the University of Ottawa, Ottawa, Ont. (Seely); and the University of Toronto, Toronto, Ont. (Yasufuku).

Current staging guidelines with endobronchial ultrasound (EBUS) still recommend systematic biopsy of at least 3 mediastinal stations before surgical resection. Recently, a 4-point ultrasonographic score (Canada Lymph Node Score, CLNS) was developed to determine the probability of nodal metastasis in any given lymph node. A lymph node (LN) with CLNS less than 2 is considered very low probability for malignancy. We hypothesized that during EBUS assessment of patients with cN0 non-small cell lung cancer, individual nodal stations that have CLNS less than 2 do not require routine biopsy because they are likely to represent true pN0 disease. The CLNS is a prospectively validated score that uses 4 ultrasonographic features to accurately predict LN malignancy. LNs were evaluated for ultrasonographic features at the time of EBUS and the CLNS was applied. Triple-negative LNs were defined as cN0 on computed tomography (LN \leq 1 cm), positron emission tomography (no hypermetabolic activity) and EBUS (CLNS < 2). Specificity, negative predictive value (NPV) and false-negative rates were calculated against the gold-standard pathologic diagnosis from surgically excised specimens. In total, 122 LNs in 58 cN0 patients were assessed. Triple-negative LNs were associated with the following T-stage distribution (T1a = 12.07%, T1b = 24.14%, T2a = 34.38%, T2b = 10.34%, T3 = 17.24%, T4 = 1.72%). Triple-negative LNs had a specificity, NPV and false-negative rate of 86.10% (95% confidence interval [CI] 78.40%–91.80%), 93.40% (95% CI 86.90%–97.30%) and 6.60%, respectively, when using less than 2 as the CLNS malignancy cut-off. In total, only 5.74% ($n = 7$) triple-negative nodes were actually proven to be malignant, 6/7 (85.71%) on EBUS – transbronchial needle aspiration and 1/7 (14.29%) only after surgical resection. Triple-negative LNs have a high NPV for malignancy. At the time of EBUS in cN0 patients, it may be possible that triple-negative LNs do not require tissue sampling, thereby saving procedural time, cost and discomfort. Findings also suggest that triple-negative LNs with inconclusive biopsy results may not require repeat sampling. A prospective comparative trial is required to confirm these findings.

12

Wait times in the management of non-small cell lung cancer before, during and after regionalization of lung cancer care: a high-resolution analysis. S. Shakeel, M. Dhanoo,

O. Khan, N. Akhtar-Danesh, P. Dibajnia, A. Behzadi. From the University of Toronto, Toronto, Ont. (Shakeel, Dhanoo, Khan, Dibajnia, Behzadi); and McMaster University, Hamilton, Ont. (Akhtar-Danesh).

The objective of this study was to evaluate changes in wait times for non-small cell lung carcinoma (NSCLC) and identify bottlenecks in cancer care pathways. Retrospective chart reviews were conducted for patients who received invasive mediastinal assessment for staging of NSCLC by the same thoracic surgical oncologist. Data were collected over 3 time periods: before regionalization (2005–2007: cohort 1), during regionalization (2011–2013: cohort 2) and 5 years after regionalization (2016–2017: cohort 3). The sequential care pathway includes symptom onset to first physician visit (S1), physician visit to computed tomography (CT) scan (S2), CT scan to first surgeon consult (S3), surgeon consult to staging completion (S4) and staging completion to first treatment (S5). Total wait time (TWT) and delays between sequential time points were compared across cohorts using multivariate Cox proportionality models. Our study included 299 patients ($n = 102, 101$ and 96), with median TWT of 122 (25th–75th percentile 95.5–216), 158 (105–230) and 139 (95–206) days for cohorts 1–3. Time for first physician visit (S1) was longest in cohort 3 versus 1 and 2 (hazard ratio [HR] 0.41, $p < 0.001$; HR 0.43, $p = 0.001$, respectively), whereas time for CT scan (S2) decreased in cohort 3 versus 2 (HR 1.54, $p = 0.03$). Time for surgeon consult (S3) also decreased over time: 2 versus 1 (HR 1.43, $p = 0.04$), 3 versus 1 (HR 4.47, $p < 0.001$) and 3 versus 2 (HR 2.67, $p < 0.001$). However, time to staging completion (S4) increased over time: 2 versus 1 (HR 0.36, $p < 0.001$), 3 versus 1 (HR 0.24, $p < 0.001$) and 3 versus 2 (HR 0.60, $p = 0.003$). In addition, time to initial treatment (S5) significantly decreased in cohort 3 versus 1 (HR 1.58, $p = 0.006$). TWTs were not significantly different across cohorts in adjusted analysis. Trends toward reduction in wait times were observed over time, primarily led by shorter time for CT scan and surgeon consult. However, TWT remained unchanged given the delays in initial detection and completion of staging. Future studies may examine the impacts of lung cancer screening on reducing TWT and whether a decrease in TWT affects survival rates.

13

Wearable technology for preconditioning before thoracic surgery: a feasibility study. Y. Patel, D. Hylton, M. Rok, M. Beauchamp, J. Wald, L. Mbuagbaw, C. Finley, J. Agzarian, Y. Shargall, Fahim, W. Hanna. From McMaster University, Hamilton, Ont. (Patel, Hylton, Beauchamp, Wald, Mbuagbaw, Finley, Agzarian, Shargall, Fahim, Hanna); and Western University, London, Ont. (Rok).

Preconditioning before surgery can lower complication rates, but there are significant barriers to its adoption in the lung cancer population, which is characteristically older, suffers multiple comorbidities and is averse to exercise. In an effort to overcome these barriers, we designed Move For Surgery (MFS), a home-based, pragmatic and wearable technology enhanced aerobic exercise preconditioning program. We aimed to test the feasibility of MFS in preparation for a randomized controlled clinical trial. Patients undergoing lung

resection for non-small cell lung carcinoma (NSCLC) were preoperatively enrolled and provided with a wearable activity tracker and a booklet describing various aerobic and deep breathing exercises and nutritional and smoking cessation tips. Daily step count, sleep cycle and calories burned were synced and tracked remotely. Daily step goals were set by increasing the participants' baseline step count by 600 steps each week until surgery. The EQ-5D-5L instrument was completed at baseline and day of surgery. Continuous variables were compared using the Student *t* test, and categorical variables were compared using χ^2 or Fisher exact tests with a level of significance of $p < 0.05$. Of the 40 patients screened, 62.5% (25/40) were eligible and enrolled and 37.5% (15/40) were ineligible. Median (min-max) age and days on trial were 62 (33-82) years and 25 (8-55) days, respectively. Fitbits were worn 94.6% of the time, and step goals were achieved on $41.1\% \pm 28.0\%$ of days. Mean baseline daily step count was 7786 ± 4007 . Participants with higher baseline step counts ($> 6000/\text{day}$) were more likely to achieve step goals (48.3% v. 22.9%, $p = 0.046$). Overall, 100% (25/25) recommended MFS for future patients, and 96.0% (24/25) stated they will buy their own wearable activity tracker and continue this lifestyle after surgery. MFS motivates patients to undergo preconditioning before lung resection and continue with a healthy lifestyle after surgery. Revision of the daily step goal is required to improve compliance. A randomized trial is in progress to determine the impact of MFS on postoperative outcomes.

14

Impact of carbohydrate-loading enhanced recovery after surgery protocol on adverse cardiopulmonary events in a thoracic surgery population. *E. MacKay, E. Alghunaim, A. McGuire.* From the University of British Columbia, Vancouver, B.C.

Enhanced recovery after surgery (ERAS) protocols, including carbohydrate loading preoperatively, are associated with improved postoperative outcomes in colorectal surgery. These results have been extrapolated to thoracic patient populations, despite notable differences in underlying patient factors and procedure-related complications and the lack of evidence regarding the safety and efficacy of ERAS in thoracic and foregut surgery. We aim to describe the impact of an ERAS carbohydrate-loading protocol implemented at an academic tertiary care centre on adverse cardiopulmonary events in a large thoracic surgery population. A retrospective chart-based review was conducted to identify patients who underwent elective thoracic surgery in the time period 1 year prior to, and 1 year following, the implementation of a standardized carbohydrate-loading preoperative ERAS protocol at our institution. Primary diagnosis, type of surgery, complications and patient comorbidities were evaluated. Univariable and multivariable analyses were conducted with appropriate statistical tests of comparison for continuous and categorical variables. A total of 879 patients met the inclusion criteria: 408 in the pre-ERAS group and 471 in the post-ERAS group. Sixty-six (16.1%) patients underwent foregut procedures in the pre-ERAS group and 67 (14.2%) in the post-ERAS group. Mean length of stay was 6.1 days in the pre-ERAS group and 5.8 days in the post-ERAS group ($p = 0.58$). Overall complica-

tion rates did not significantly differ between the groups ($p = 0.09$), although there was a trend toward lower rates of overall complications in the post-ERAS group. Specifically, there was no significant difference in rates of postoperative pneumonia between the 2 groups overall ($p = 0.66$) or when evaluating the foregut surgery group alone ($p = 0.98$). Multivariable analysis revealed chronic obstructive pulmonary disease and thoracic surgery subtype did not confound the relationship of carbohydrate loading and postoperative cardiopulmonary complications ($p = 0.18$). The current study suggests that ERAS carbohydrate loading does not have an adverse effect on cardiopulmonary complications in patients who undergo thoracic surgery. Interestingly, length of stay was not significantly affected by carbohydrate loading at our institution. Further prospective characterization of the impact of preoperative ERAS protocols in thoracic surgery populations is needed to better inform current and future ERAS guidelines.

15

Heat production during pulmonary artery sealing with energy vessel-sealing devices in a porcine model. *E. Goudie, R. Oliveira, V. Thiffault, A. Jouquan, R. Hadjeres, J. Berdugo, P. Ferraro, M. Liberman.* From Université de Montréal, Montreal, Que. (Goudie, Oliveira, Thiffault, Jouquan, Ferraro, Liberman); and Centre hospitalier de l'Université de Montréal, Montreal, Que. (Hadjeres, Berdugo)

Energy vessel-sealing devices are becoming increasingly used to seal pulmonary artery (PA) branches during lobectomy. Heat from these devices can injure surrounding tissues. We evaluated heat production using 4 different devices during PA sealing in a live animal model. PA branches were sealed in adult pigs with 4 different energy vessel-sealing devices: 2 ultrasonic (US) devices, 1 advanced bipolar (AB) device and 1 mixed ultrasonic and bipolar (mixed) device. Type T thermocouples were implanted in tissue immediately surrounding the PA branch being sealed (lung parenchyma, airway, mediastinum) to measure tissue temperature. A thermal camera measured tissue temperature at the site of sealing and instrument temperature. Pathologic analysis was performed on PA stumps to identify thermal damage. A total of 35 PA branches were sealed in 4 pigs. Average PA diameter was 4 mm (range 1-9 mm). Maximum tissue heat measured by the thermocouples for the 2 US, AB and mixed devices was 42°C, 39°C, 42°C and 46°C, respectively. Average tissue temperatures at site of sealing measured with the thermal camera for the 2 US, AB and mixed devices were 78°C, 75°C, 70°C and 82°C, respectively. The diameter of the region with tissue reaching 60°C or more measured with the thermal camera for the 2 US, AB and mixed devices was 4 mm, 6 mm, 5 mm and 4 mm, respectively. Mean instrument blade temperatures at the end of sealing for the 2 US, AB and mixed devices were 224°C, 195°C, 83°C and 170°C, respectively. On pathologic analysis, all PA stumps had either thermal damage on the adventitia and external media (24/35) or transmural damage (11/35) at 1 mm from the sealed site. Tissue surrounding energy vessel-sealing devices when activated on PA branches did not reach temperatures that can potentially cause irreversible cell damage. Instrument blades can reach high temperatures that may cause tissue damage.

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Who can afford to wait? The effect of wait times on survival in lung cancer patients: clinical predictors of poor outcomes. *N. Abmadi, S. Karri, F. Farrokhyar, Y. Shargall, C. Finley, W. Hanna, J. Agzarian.* From McMaster University, Hamilton, Ont.

Patients diagnosed with operable lung cancer undergo several resource-intensive and time-consuming investigations that are frequently associated with delays to surgery. The objective of this study was to determine the effect of extended wait times on survival after lung cancer resection. We performed a retrospective single-institution review of patients who underwent lung resection for stage I–IIIA lung cancer from 2014 to 2016. Patient demographics, preoperative investigations, operative details, tumour histology and oncological outcomes were collected. Patients were divided into early and delayed surgery cohorts on the basis of optimized wait-time cut-off obtained from receiver operating characteristic (ROC) curve. Cox proportional hazard models and Kaplan–Meier analysis were used to assess overall survival (OS) and disease-free survival (DFS). Overall, 236 patients undergoing lung resection for primary lung cancer met the inclusion criteria. Median age was 71 years (interquartile range [IQR] 64–76), with 50% (119) male patients, and an overall median Charlson Comorbidity Index score of 6 (IQR 5–7). From initial consultation, the median time to positron emission tomography (PET) scan was 20 days (IQR 12–32), transthoracic biopsy was 28 days (IQR 17–42), endobronchial ultrasound/mediastinoscopy was 46 days (IQR 27–68) and surgery was 65 days (IQR 48–82). On the basis of ROC analysis, a cut-off of 63 days was chosen as the optimal timeline from consultation to operation. One hundred and twelve (47%) patients were classified as the early-surgery group and had a trend toward improved OS compared with the delayed-surgery group (hazard ratio [HR] 1.7, 95% confidence interval [CI] 0.9–3.3), but no difference in DFS was identified (HR 0.6, 95% CI 0.4–1.2). Stratified survival analysis showed tumour SUV greater than 9 ($p = 0.047$), PET-positive mediastinal/hilar lymph nodes ($p = 0.07$) and preoperative adenocarcinoma diagnosis ($p = 0.045$) to be predictors of poor OS with prolonged wait times. The results of this study demonstrate trends toward improved OS with early surgery for operable lung cancer. Certain predictive preoperative patient and/or tumour characteristics might identify patients whose survival will be poorer if they have a prolonged wait time to surgery and accordingly facilitate expedited care.

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Impact of the Integrated Comprehensive Care Program after thoracic surgery: a propensity score matched study. *N. Abmadi, L. Mbuagbaw, C. Finley, W. Hanna, J. Agzarian, Y. Shargall.* From McMaster University, Hamilton, Ont.

Thoracic surgery (TS) is associated with high rates of postoperative morbidity and postdischarge return to the hospital or emergency department (ED). Postdischarge interventions to improve outcomes and reduce hospital visits have not been systematically evaluated in TS. This study aims to assess the impact of a novel integrated patient-centred, hospital-based multidisciplinary community program (Integrated Comprehensive Care, ICC) on

postdischarge outcomes in patients undergoing TS compared with the traditional provincial home care system. This was a retrospective cohort study of patients who underwent TS for lung malignancies at a tertiary care centre from 2010 to 2018. Patients were divided into 2 cohorts on the basis of their enrollment in the ICC program (2014–2018) or in a provincial standard home care system (2010–2014). Propensity score matching was performed to match the 2 cohorts on the basis of demographics, risk factors, disease stage and surgical approach. The impact of the ICC program on postoperative length of stay (LOS), rate of ED visits, readmissions and mortality within the first 60 days after discharge was assessed. Of the 1288 patients included in this study, 658 (51.1%) were male with mean age of 64 years (standard deviation 14.1). After propensity score matching, 478 patients were enrolled in the ICC cohort and 592 were enrolled as controls. The ICC cohort had significantly shorter LOS (4 d v. 5 d in controls, $p = 0.001$), a lower rate of 60-day ED visits (9.8% v. 28.4% in controls, $p < 0.001$) and a lower rate of readmissions (6.9% v. 8.6% in controls, $p < 0.001$). The 60-day mortality was also significantly lower in the ICC cohort than in the control group (0.6% v. 0.8% in controls, $p < 0.001$). The ICC program is effective and can result in shorter LOS and fewer ED visits and readmissions after discharge and ultimately may decrease postoperative mortality. This program could potentially be implemented in other TS centres and may be applicable to other surgical populations.

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Incidence, severity and risk of postoperative pulmonary complications in patients undergoing pulmonary resection for cancer. *N. Seyednejad, C. Anstee, A. Seely, S. Gilbert, D. Maziak, F. Shamji, S. Sundaresan, P. Villeneuve, S. Gagne, C. Thompson.* From the University of Ottawa, Ottawa, Ont.

Postoperative pulmonary complications (POPC) encompass adverse respiratory events after anesthesia and surgery. The incidence and severity of POPC following pulmonary oncologic resection have not been extensively studied. Further, there is a lack of studies on commonly applicable risk factors, which may be useful to target POPC preventive measures. The aims of this study were to (1) identify the incidence and severity of POPC and (2) identify if impaired predicted postoperative forced expiratory volume in 1 s (ppo FEV1) pulmonary function predicts increased risk for POPC after thoracic surgery. A retrospective review of prospectively collected adverse event (AE) data at a high-volume thoracic surgery centre (2008–2018) from patients ($n = 1347$) undergoing pulmonary resection for lung malignancies was performed. POPC were defined as a patient who developed pneumonia, atelectasis, aspiration pneumonia and/or any respiratory complication requiring antibiotics, bronchoscopy, high-flow oxygen and/or intubation. All AEs were defined using the www.ottawatmm.org system and graded by severity using the Clavien–Dindo complication grade. POPC rates were evaluated in patients with predicted postoperative FEV1 values of 50% or greater versus less than 50% predicted. The incidence of POPC in all patients was 4.9%, with 0.2%, 2.5%, 1.0%, 1.1% and 0.2% graded as grade I, II, III, IV and V, respectively. Of the

patients with ppo FEV1 values greater than or equal to 50%, 3.6% had POPC versus 12.5% in the group with ppo FEV1 less than 50% ($p < 0.000$). Minor grade I–II POPC were seen in 2.1% of the group with ppo FEV1 greater than or equal to 50%, and 8.3% in the group with ppo FEV1 less than 50% ($p < 0.000$). Major POPC (grades III–V) were seen in 1.8% of the group with ppo FEV1 greater than or equal to 50% and 4.7% in the group with ppo FEV1 less than 50% ($p < 0.013$). Patients with ppo FEV1 less than 50% have a 3-fold increase in risk of POPC following thoracic oncologic pulmonary resection, including both minor and major AEs. These patients may benefit from preoperative preventive therapies (e.g., inspiratory muscle training) as a targeted POPC risk mitigation strategy.

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Evaluation of the limits of use of a thoracoscopic lung palpation device to identify artificial tumour nodules in ex-vivo tissue. *R. Ralph-Edwards, C. Nicholson-Smith, M. Naish, R. Patel, R. Malthaner.* From Western University, London, Ont.

Lung cancer is the most common cancer worldwide. Screening for high-risk individuals results in earlier detection and smaller target lesions. Intraoperative tumour localization has proven challenging with minimally invasive surgery (MIS) because of loss of tactile feedback. A tactile sensing system (TSS) that provides visual–tactile feedback during thoracoscopic MIS was developed. The newest iteration is wireless. The detection parameters of TSS are undefined. Our aim was to evaluate the limits of size and depth in localizing artificial nodules in ex vivo bovine liver using TSS. Radio-opaque nodules 4, 8 and 15 mm in size were placed beneath 1- or 2-cm thick liver samples. Liver has been identified as a fair proxy for deflated lung in prior studies. Block randomization determined the number and size of nodules placed beneath each specimen. A blinded participant used TSS to locate the nodules and placed pins in the liver upon localization. Specimens were x-ray imaged, and the Euclidian distance from the pin to the nodule centre was measured. Seventy-two livers were tested, 36 at each thickness. At 1 cm, the device accurately (within 1 cm) identified 75% of 4-mm nodules, 96% of 8-mm nodules and 100% of 1.5-cm nodules. The average distance of the pin to the centre of the nodule was 5.4 ± 3.5 mm, 2.9 ± 2.5 mm and 1.3 ± 1.4 mm, respectively. At 1 cm, TSS had an overall accuracy of 87.2%, 82.3% sensitivity and 84.4% specificity. At 2 cm, the device identified 71% of 4-mm nodules, 83% of 8-mm nodules and 96% of 1.5-cm nodules. The average distance of the pin to the centre of the nodule was 5.6 ± 4.7 mm, 4.2 ± 5.5 mm and 3.0 ± 4.3 mm, respectively. At 2 cm, TSS had an overall accuracy of 83.5%, 84.5% sensitivity and 82.7% specificity. TSS appears highly sensitive and specific in identifying very small nodules up to 2 cm deep. This suggests TSS may be capable of identifying nodules at even greater depths than assessed thus far. TSS provides great promise in intraoperative tumour localization during thoracic MIS.

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Personalized surgical management of esophagogastric junction cancers. *A. Kammili, C. Mueller, J. Spicer, J. Cools-Lartigue, L. Ferri.* From the McGill University Health Centre, Montreal, Que.

Esophagogastric junction (EGJ) malignancies are rapidly increasing in incidence. The pattern of lymph node involvement is affected by tumour size and location. To ensure surgical quality, the optimal approach should be tailored accordingly to achieve complete oncologic (R0) resection and adequate lymphadenectomy. This study's aim was to highlight a tailored approach in a high-volume centre. Patients undergoing surgery for EGJ tumours between 2010 and 2018 were identified from a prospectively collected database. Surgical approach, tumour characteristics, surgical and oncologic outcomes and quality of life (QoL) were assessed. Analysis of variance, Kruskal–Wallis, χ^2 and log-rank tests were used to determine statistical significance ($p < 0.05^*$). Curative-intent surgery for upper gastrointestinal malignancies was performed in 763 patients. One hundred and thirty-six were performed for EGJ tumours. R0 resection was achieved in 130 (96%). Mean age was 67 (range 35–86) years with a male preponderance (106 males; 24 females). Left thoracoabdominal (LTA), Ivor Lewis (IL), transabdominal (TA) and minimally invasive esophagectomy (MIE) were performed in 38 (29%), 61 (47%), 20 (15%) and 11 (8%) patients, respectively. Lymph node retrieval (median 31 [interquartile range (IQR) 22–43]) did not differ between open approaches. No difference in mean blood loss (454 ± 342 mL), complications (Clavien–Dindo 2 [IQR 0–2]) or median length of stay (7 [IQR 7–13] days) was observed. Siewert I and II tumours were predominantly approached by IL (57%). Siewert III and larger tumours were predominantly approached by LTA (73%, stage III, mean \pm standard deviation [SD] 4.2 ± 2.4 cm*). Early-stage tumours were approached by MIE (mean \pm SD 2.3 ± 1.2 cm).* QoL did not differ preoperatively nor at 1, 3 or 6 months postoperatively (FACT-E mean \pm SD 123 ± 23 , 106 ± 23 , 123 ± 24 and 128 ± 28 , respectively). Overall survival at 1, 3 and 5 years (0.88, 0.71, 0.64) did not differ on the basis of approach. A personalized approach based on patient and tumour characteristics is associated with favourable outcomes. LTA for distal, advanced tumours is associated with high rates of R0 resection, adequate lymphadenectomy, survival and QoL comparable to other approaches.

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Validity of a model to predict the risk of atrial fibrillation after thoracic surgery. *H. Smith, H. Li, O. Brandts-Longtin, C. Yeung, D. Maziak, S. Gilbert, F. Shamji, P. Villeneuve, S. Sundaresan, R. Passman, A. Seely.* From the University of Ottawa, Ottawa, Ont. (Smith, Li, Brandts-Longtin, Yeung, Maziak, Gilbert, Shamji, Villeneuve, Sundaresan, Seely); and the Northwestern University Feinberg School of Medicine, Chicago, Ill. (Passman)

New-onset postoperative atrial fibrillation (POAF) is the most frequent postoperative arrhythmia following major thoracic surgery, with a reported incidence of 13%–46%. Prophylaxis is recommended for consideration in high-risk patients; however, no method of risk assessment has been externally validated. We aimed to evaluate the external validity of a published clinical tool developed to predict POAF in patients undergoing non-cardiac thoracic surgery. This POAF prediction model developed by Passman and colleagues stratifies patients' risk of POAF using 3 clinical risk factors (sex, age and preoperative resting heart rate). A retrospective cohort analysis of patients who underwent major noncardiac thoracic surgery at a single

institution between 2008 and 2017 was used for external validation. Results were compared with Passman's derivation sample (published in 2005, based on 856 patients). The model calibration was assessed by comparing patients' risk score of 0–6 with occurrence of POAF. Discrimination of the model was determined by calculating the concordance index. In the 2054 patients undergoing major thoracic surgery, we observed a greater proportion of patients with hypertension compared with Passman's sample (46.1% v. 29.4%, $p = 0.0002$) and a lower proportion of lung resection, particularly pneumonectomy (6.1% v. 21%, $p = 0.0002$). Despite the reduced incidence of POAF among patients in this study compared with Passman's study (164 [7.9%] v. 147 [17.2%], $p = 0.014$), the model was valid: it was well calibrated, demonstrated by a positive correlation between risk scores and POAF incidence, and the model demonstrated moderate discrimination with a c-statistic of 0.62 (compared with 0.65–0.73 in Passman's study). The incidence of POAF in this study was lower than in the derivation study of this POAF prediction model; nevertheless, we found the model to be externally valid in predicting risk of POAF after noncardiac thoracic surgery. This tool may be useful in identifying patients who will benefit from targeted prophylactic therapy.

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Severe symptoms persist for up to 1 year after diagnosis of stage I–III lung cancer: an analysis of province-wide patient-reported outcomes. *V. Gupta, D. Hirpara, H. Zhao, L. Davis, J. Hallet, A. Mahar, R. Sutradhr, M. Doberty, A. Louie, B. Kidane, G. Darling, N. Coburn.* From the University of Toronto, Toronto, Ont. (Gupta, Hirpara, Hallet, Doberty, Louie, Darling, Coburn); ICES, Toronto, Ont. (Zhao, Sutradhr); the Sunnybrook Research Institute, Toronto, Ont. (Davis); and the University of Manitoba, Winnipeg, Man. (Mahar, Kidane).

Lung cancer is associated with significant disease- and treatment-related morbidity. This study used population-level patient-reported Edmonton Symptom Assessment System (ESAS) scores collected as part of standard clinical care to describe symptom trajectories and characteristics associated with severe symptoms for patients with stage I–III lung cancer. Adults treated for stage I–III lung cancer between 2007 and 2016 at regional cancer centres and affiliates and assessed for symptoms in the 12 months following diagnosis were included. ESAS measures 9 common patient-reported cancer symptoms. The outcome was reporting of severe ($\geq 7/10$) symptom scores. Multivariable analyses were used to identify characteristics associated with severe symptom scores. In this study, 11 075 patients reported a total of 69 440 unique symptom assessments in the year following diagnosis. Severe tiredness and shortness of breath were reported at least once by 47% and 40% of patients, respectively. Thirty percent reported severe anxiety and 20% reported severe depression. Physical symptoms, including tiredness, dyspnea, drowsiness and pain, did not appear to improve with time, even among patients with stage I disease. Compared with the first month after diagnosis, the odds of experiencing severe anxiety and depression decreased over time. Characteristics associated with severe symptoms included younger age, female sex, high comorbidity, stage III

disease and urban residence. Lung cancer affects important aspects of physical and mental well-being in the first year following diagnosis. Severe physical symptoms persist during this time. Those at risk of experiencing a high symptom burden may benefit from targeted supportive care interventions alongside conventional treatment aimed at improving health-related quality of life.

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Do postoperative infectious adverse events influence cancer recurrence and survival after surgical resection of esophagogastric cancers? Experience from a Canadian university centre. *S. Gowing, C. Anstee, A. Mattice, M. Shen, P. Villeneuve, F. Shamji, D. Maziak, S. Gilbert, S. Sundaresan, L. Ferri, A. Seely.* From the University of Ottawa, Ottawa, Ont. (Gowing, Anstee, Mattice, Shen, Villeneuve, Shamji, Maziak, Gilbert, Sundaresan, Seely); and McGill University, Montreal, Que. (Ferri).

Surgical resection of esophageal and gastric cancers is a critical component of multimodality curative-intent therapy. We sought to evaluate if postoperative infectious adverse events (AEs) are associated with increased risk for earlier cancer recurrence and mortality. We retrospectively analyzed all patients who underwent surgical resection of esophageal or gastric cancers between 2008 and 2017 at a Canadian university centre, who were undergoing prospective AE monitoring. Patients with metastatic disease discovered intraoperatively, R2 resections, patients experiencing in-hospital mortality, gastrointestinal stromal tumours, neuroendocrine tumours and benign lesions were all excluded. Data are presented as median (interquartile range [IQR]). Log-rank and Cox regression analysis statistical tests were performed. Of the 315 patients analyzed (235 esophageal cancer and 80 gastric cancer), 183 (58%, 158 R0, 25 R1) patients experienced no complications or noninfectious complications; 132 (42%, 109 R0, 23 R1) patients experienced infectious complications. R0 patients in the noninfectious group demonstrated a median disease-free survival (DFS) of 811 days (IQR 430–1427.5) compared with 478 days (IQR 242–1082) in the infectious group ($p < 0.001$). In a similar manner, overall survival (OS) for R0 non-infectious patients was a median of 952 days (IQR 548–1729) compared with 744 days (IQR 355–1265) ($p < 0.001$). Regarding DFS, in multivariable analysis, pathological N stage, infectious complications and R1 resection were all strong predictors of recurrence ($p < 0.001$). With respect to OS, R1 resection, infectious complications and final pathologic stage all significantly influenced mortality ($p < 0.001$). Postoperative infectious AEs occur commonly following surgical resection of esophagogastric tumours, and they appear to increase the risk for early cancer recurrence and mortality. This highlights the imperative not only to reduce the incidence of infectious complications but also to investigate translational therapies to mitigate the potentially deleterious oncologic effects of infectious AEs.

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Utilization, safety and efficacy of hybrid esophagectomy on a population level. *V. Gupta, P. Carroll, J. Levy, G. Darling, N. Coburn.* From the University of Toronto, Toronto, Ont.

Population-based data on short- and long-term outcomes of minimally invasive or hybrid versus open esophagectomy are needed to determine utilization and real-world efficacy. This population-based study included adults undergoing esophagectomy for cancer in the province from 2009 to 2014. Patients undergoing a laparoscopic and/or thoracoscopic esophagectomy were classified as having undergone hybrid esophagectomy and were compared with patients undergoing open esophagectomy. Outcomes including hospital and intensive care unit (ICU) length of stay, readmission, mortality and long-term survival were compared between the 2 groups. A sensitivity analysis compared the 2 groups in a propensity score matched cohort. Subgroup analyses were performed in patients with available pathology data. Of 1467 included patients, 1003 underwent open and 464 underwent hybrid esophagectomy. In the unmatched cohort, patient characteristics were similar with the exception of year of surgery, which favoured the hybrid group more recently. For 850 patients with pathology data available, tumour size, T and N stage, and grade were similar. The proportion of patients undergoing hybrid surgery increased from 14% in 2009 to 43% in 2014 ($p < 0.001$). Importantly, lymph node yield was equivalent in the hybrid (median 17, interquartile range [IQR] 11–26) and open groups (median 17, IQR 11–24; $p = 0.69$). Patients in the hybrid group had shorter hospital stays than patients in the open group (median 10 d [IQR 8–15] v. 12 d [IQR 9–19]; $p < 0.001$). Ninety-day readmission was higher in the hybrid group (31% v. 24%, $p = 0.002$). There was no difference in 90-day mortality (6.5% v. 6.9%, $p = 0.77$) or median overall survival (23 mo [IQR 12–43] v. 25 mo [IQR 11–48]) between the 2 groups. Propensity score matching achieved balance for 464 patients in each group and confirmed findings from the primary analysis. Hybrid surgery was associated with shorter length of stay, a higher readmission rate and equivalent oncologic and mortality outcomes compared with open esophagectomy. This large population-based study supports the increasing use of hybrid esophagectomy.

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Endoscopic submucosal dissection for upper gastrointestinal neoplasia: lessons learned from a high-volume North American centre. *A. Chen, M. Chen, A. Siblini, C. Mueller, J. Spicer, J. Cools-Lartigue, L. Ferri.* From McGill University, Montreal, Que.

Organ-sparing endoscopic resection is an acceptable treatment strategy for superficial neoplastic lesions of the esophagus and stomach. Although endoscopic submucosal dissection (ESD) has been shown to be more effective than endoscopic mucosal resection (EMR), adoption of this technique has lagged significantly in North America compared with Asia. We report on our experience, one of the largest in the western world, on ESD for upper GI neoplasia. A prospectively entered database of all patients undergoing endoscopic resection of esophageal and gastric neoplasia was queried for those who received ESD between 2010 and 2018. Patient demographics, lesion characteristics, histology, procedural approach and variables, and postoperative outcomes were collected and reported. Ninety-three cases of consecutive ESD were identified. Most were male (71%) and median age was 72 years (range 38–90). Esophageal/EGJ ESD was performed in 45 cases and subcardia gastric (fundus 5, body

4, antrum 33) ESD was performed in the rest. Histology included invasive carcinoma (74%), high-grade dysplasia (11%), LGD (7%) and benign (8%). A total of 51% surgeries were performed under general anesthesia in the operating theatre; the rest were performed under sedation in endoscopy suite. The en bloc resection rate was 89%, with 11% piecemeal. The average resected specimen was 36 (12–70) mm. Of the invasive malignancies, R0 was achieved in 67% (43/64), most R1 being at the deep margin. Tumour depth was T1a (41%), T1b (55%) and T2 (4%). Twenty-six percent of cases were either poorly differentiated or had LVI. Perforation occurred in 17%, all being managed with endoscopic clips. Ninety-two percent of patients were admitted after ESD, with a median stay of 1 (1–43) day. Post-ESD complications (delayed perforation/bleeding) occurred in 4 cases (4%). Of the 56 patients with documented endoscopic follow-up, 1 had recurrence. We conclude that ESD is a viable, effective and safe option for superficial lesions of the stomach and esophagus. Efforts should be made to identify and address the barriers to adoption of this technique in North America.

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Long-term quality of life after esophagectomy. *J. Cools-Lartigue, C. Mueller, J. Spicer, M. Mulder, L. Ferri, A. Katz.* From McGill University, Montreal, Que.

Surgery for esophageal cancer offers the greatest chance for cure when combined with chemotherapy with or without radiation. However, esophagectomy is perceived by many as high risk with a lasting impact on quality of life (QoL), leading some to pursue nonoperative management such as definitive chemoradiation. We sought to determine the long-term QoL after esophagectomy to help patients make informed decisions. A prospectively entered university hospital esophagectomy database was queried for patients who survived at least 3 years. QoL was measured with the Functional Assessment of Cancer Therapy – Esophageal Module (FACT-E) at diagnosis (baseline) and last follow-up. Patient demographics, tumour characteristics/treatment, operative variables and postoperative outcomes were collected. FACT-E scores were compared with baseline and matched reference values from the general population. Paired t tests and Mann-Whitney U tests determined significance at $p < 0.05$. From 2005 to 2015, 465 patients underwent esophagectomy, 254 (55%) survived more than 3 years and 87 completed baseline and long-term QoL measurements. Most were male (81%) with mean age 64 (range 29–84) years, and 86% had adenocarcinoma. Clinical stage was I (26%), II (19%) and III (55%), and neoadjuvant therapy was given in 49% of cases. The operative approach was open (68/87) and minimally invasive esophagectomy (19/87). Postoperative complications occurred in 54% of cases (Clavien–Dindo 1–2 in 28% and 3–4 in 26%). FACT-E scores increased significantly from baseline (mean 125.5, range 72–174) to long term (mean 146.5, range 78–175) at 48 (range 36–144) months, which did not differ from normative population reference values. There was no difference in long-term FACT-E scores with respect to histology, approach, clinical stage at diagnosis or postoperative complications. At long-term follow-up, QoL increases significantly after esophagectomy and does not differ from that of the general population. Long-term QoL should not be a deciding factor in biasing patients and oncologists away from surgery in the treatment of esophageal cancer.

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Early and late outcomes after surgery for pT4 NSCLC reclassified by AJCC 8th edition criteria. *J. Moubanna, A. Katz, P. Fiset, R. Rayes, A. Siblini, E. Lee, A. Seely, J. Cools-Lartigue, C. Sirois, D. Mulder, L. Ferri, J. Spicer.* From the University of Ottawa, Ottawa, Ont. (Moubanna, Seely); and McGill University, Montreal, Que. (Katz, Fiset, Rayes, Siblini, Lee, Cools-Lartigue, Sirois, Mulder, Ferri, Spicer).

Classically, T4 non-small cell lung cancers (NSCLC) were tumours of any size but had features of local extension often precluding surgical resection or necessitating complex extended pulmonary surgery. However, the new 8th edition of the cancer staging manual of the American Joint Committee on Cancer (AJCC-8) includes tumours greater than 7 cm regardless of adjacent organ extension. The early perioperative outcomes from T4 resections must be contextualized to the increasingly heterogeneous classification offered by the new staging system. Our goal was to examine perioperative and long-term outcomes from pT4 resections based on the AJCC 7th edition (AJCC-7) versus those of the expanded criteria of AJCC-8. We retrospectively reviewed cases of pT4 surgical resections at the Montreal General Hospital from 2011 to 2018. We identified 163 patients with pT4 tumours on the basis of AJCC-8: 40 by AJCC-7 criteria (group 1) and 123 with tumours greater than 7 cm considered pT4 in AJCC-8 (group 2). The incidence of major complications (grade 3 or 4) was similar in both cohorts (18% in group 1 and 14% in group 2), with 3.7% in-hospital mortality (7.5% in group 1 and 2.4% in group 2). The R0 resection rate was 88% (83% in group 1 and 90% in group 2). Overall survival was 76% at 1 year, 44% at 3 years and 34% at 5 years. Median survival was 27.4 months and was similar between Group 1 and Group 2 (25.8 and 27.4 mo, respectively). Nevertheless, Group 2 had better perioperative survival than Group 1 (98% v. 92% 90-d mortality and 95% v. 83% 6-mo mortality). Finally, Kaplan-Meier curves adjusted for predictors of survival with regression showed early mortality in Group 1 with equalization of the curves at 1 year. Although long-term oncological outcomes are similar for patients with pT4 greater than 7 cm to those of patients with AJCC-7 pT4, differences in perioperative outcomes point to the heterogeneity of the new AJCC-8 classification with regard to surgical management.

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Early results on the learning curve for subxiphoid video-assisted thoracoscopic lobectomy. *A. Katz, J. Lorange, E. Tawfik, L. Aubin, J. Eustache, F. Aburaida, J. Cools-Lartigue, L. Ferri, L. Lee, J. Spicer.* From McGill University, Montreal, Que.

Traditionally, video-assisted thoracoscopic (VATS) lobectomy is performed through 1 or more intercostal ports. Although short-term recovery is improved via this approach over open surgery, randomized trial data indicate a persistently high rate of acute and chronic pain because of intercostal nerve manipulation. Subxiphoid video-assisted thoracoscopic (SVATS) lobectomy is a novel approach that has not been widely adopted but that might lead to reduced acute and chronic pain. Few data exist regarding the safety and feasibility of the learning curve

for this new technique. The aim of this study is to describe our initial experience and learning curve for SVATS lobectomy on a North American population of patients. This is a retrospective study using our prospectively maintained institutional lung surgery database. The McGill University Health Centre Research Ethics Board approved this study. We identified patients who underwent VATS lobectomy from 2006, when our team began performing VATS lobectomy, to 2016. We began performing SVATS in September 2018 and identified all cases until present. Demographic and perioperative data were obtained from our database and were supplemented with focused chart review. Kruskal-Wallis and Fisher exact tests were used to compare variables. We identified 205 patients who underwent standard VATS lobectomy and 12 patients who underwent SVATS. Both cohorts had similar age, gender, Charlson comorbidity score, body mass index and lung function distributions. There were no differences in median operative time (SVATS 113 min v. VATS 110 min, $p = 0.73$). The overall complication rate was identical (33%). No significant differences were noted in median chest tube duration (SVATS 2 d v. VATS 1 d, $p = 0.318$) nor length of stay (SVATS 2 d v. VATS 3 d, $p = 0.12$). No in-hospital mortalities were observed for either cohort. There were no significant intraoperative complications in the SVATS cohort and no conversions to regular VATS or open surgery. Learning SVATS lobectomy is feasible and safe and does not result in prolonged operative times. Randomized data are needed to establish whether SVATS provides significant benefits to patients undergoing lobectomy over more standard approaches.

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Should adjuvant therapy be offered for patients undergoing esophagectomy after neoadjuvant CROSS protocol for esophageal cancer? A multicentre cohort study. *R. Ben-Avi, E. Bedard, I. Tavakoli, A. Behzadi, M. Bushra, W. Hanna, F. Farrokhyar, J. Agzarian, M. Coret, M. Ferguson, C. Finley, Y. Lopez-Hernandez, L. Schneider, Y. Shargall.* From McMaster University, Hamilton, Ont. (Ben-Avi, Hanna, Farrokhyar, Agzarian, Coret, Finley, Lopez-Hernandez, Schneider, Shargall); the University of Alberta, Edmonton, Alta. (Bedard, Tavakoli); the University of Toronto, Toronto, Ont. (Behzadi, Bushra); and St. Joseph's Healthcare, Hamilton, Ont. (Ferguson).

Resectable esophageal adenocarcinoma is commonly treated with the Chemoradiotherapy for Oesophageal Cancer Followed by Surgery Study (CROSS) protocol, but the role of postoperative adjuvant treatment for this population is less clear. We assessed the impact of operative lymph node status on patient survival and recurrence following trimodality therapy. Data for patients undergoing esophagectomy after CROSS protocol for adenocarcinoma at 3 tertiary centres between January 2013 and June 2018 were retrospectively analyzed. Patients with or without residual disease (R0/1, T and N status) were compared on overall (OS) and disease-free (DFS) survival using Cox regression with clinical characteristics, pT status and resection margins as covariates. Of 700 patients undergoing esophagectomy (403 in centre A, 204 in centre B and 93 in centre C), 345 (49%) completed the CROSS protocol; 83% were male and the mean age was 64 ± 9 years. Mean

and median follow-up were 36.0 ± 1.6 (95% confidence interval [CI] 33–39) and 29.0 ± 4.1 (95% CI 21–37) months, respectively, with 95% complete follow-up. R1 resection was reported in 30 cases (8.7%), with recurrence in 160 patients (46%) and death in 144 (42%). Fifty-eight patients (17%) received salvage chemotherapy for recurrence and 4 patients (1.5%) received planned adjuvant chemotherapy. Nodal status after CROSS was associated with differences in estimated median OS with 52, 21, 17 and 14 months ($p < 0.001$) and DFS with 47, 12, 10 and 9 months ($p < 0.001$) for pN0, pN1, pN2 and pN3 disease, respectively. On multivariable analysis, nodal status (N0 v. any positive N) was a significant predictor of worse OS and DFS ($p < 0.001$), with pT and resection margin also significant. Patients with esophageal cancer who had residual nodal disease after neoadjuvant chemoradiation had worse prognosis following resection, suggesting a potential role for adjuvant chemotherapy for patients with positive nodal disease at resection after the CROSS protocol. The role of salvage therapy for recurrent disease should be further explored. A prospective feasibility trial comparing adjuvant to no adjuvant treatment after trimodality therapy in patients with residual nodal disease is needed.

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Outcomes of patients discharged home with a chest tube following anatomic lung resection: a multicentre cohort study. *Y. Shargall, F. Minervini, W. Hanna, A. Brunelli, F. Farrokhyar, T. Miyazaki, L. Bertolaccini, M. Scarci, M. Coret, K. Hughes, L. Schneider, Y. Lopez-Hernandez, J. Agzarian, C. Finley, Y. Shargall.* From McMaster University, Hamilton, Ont. (Shargall, Minervini, Hanna, Farrokhyar, Coret, Hughes, Schneider, Lopez-Hernandez, Agzarian, Finley, Shargall); the St. James University Hospital, Leeds, U.K. (Brunelli, Miyazaki); the AUSL Bologna Maggiore Teaching Hospital, Bologna, Italy (Bertolaccini); and the San Gerardo Hospital, Monza, Italy (Scarci).

CANADIAN SOCIETY OF SURGICAL ONCOLOGY

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Management of cancer-associated intestinal obstruction in the final year of life. *S. Merchant, S. Brogly, C. Booth, C. Goldie, Y. Peng, S. Nanji, S. Patel, K. Lajkosz, N. Baxter.* From Queen's University, Kingston, Ont. (Merchant, Brogly, Booth, Goldie, Peng, Nanji, Patel); ICES Queen's, Kingston, Ont. (Lajkosz); and the University of Toronto, Toronto, Ont. (Baxter).

There is variation in the clinical management of intestinal obstruction (IO) in cancer patients. We describe the management of cancer-associated IO near the end of life in a population-based cohort with universal health coverage. Patients who died of gastric, colorectal, ovarian and pancreatic cancers from 2002 to 2015 were identified from the Ontario Cancer Registry. Those with 1 or more hospital admissions for IO in the final year of life were identified from administrative data. Factors associated with admission for IO were determined. Management of IO at index admission was categorized: surgery, gastrostomy, stent, feeding jejunostomy and medical management. Trends in management

Prolonged air leaks are increasingly managed in the outpatient setting with patients discharged with chest tubes in place. We evaluated the incidence and risk factors associated with readmission, empyema development and further interventions in this patient population. A retrospective cohort analysis from 4 international tertiary academic centres between January 2014 and December 2017 extracted all patients who were discharged home with a chest tube after anatomic lung resection. Demographics and patient factors, surgical details, hospital readmission, reintervention, use of antibiotics at discharge, empyema occurrence and mortality were analyzed. We used χ^2 and Mann–Whitney U tests to assess patient and operative parameters associated with postdischarge outcomes. Logistic regression was performed to evaluate factors associated with risk of empyema development and need for readmission and intervention. Overall, 253 patients were discharged with a chest tube (7.8% of total resections); 67/857 were from centre A (7.8%), 30/759 from centre B (3.95%), 147/931 from centre C (15.78%) and 9/247 from centre D (3.64%) ($p < 0.001$). Median age was 69 years (19–88), and 56% were males. Initial length of stay was similar between admitted and not admitted patients ($p = 0.588$). Forty-nine patients (19.4%) were readmitted (21%, 0%, 23% and 11% in centres A–D, respectively, $p = 0.029$) with 18 patients (37%) developing empyema, 11 patients (22%) requiring surgery and 3 (6%) deaths. Median chest tube duration was 22 (4–141) days for readmitted versus 16 (1–148) for nonreadmitted patients. Only chest tube duration was a significant predictor of readmission ($p < 0.001$) and empyema development ($p = 0.003$), with the risk of empyema increasing 3-fold (odds ratio 2.94) when the chest tube remained in situ longer than 20 days. Discharge with chest tube following lung resection is associated with significant adverse events. Given the high risk of empyema development, removal of the chest tube should be considered, when appropriate, after 20 days. Our data suggest a potential need for proactive postdischarge outpatient management programs to diminish morbidity and mortality.

over the study period were assessed. The cohort included 57 378 patients (7448 gastric [13%], 30 577 colorectal [53%], 6273 ovarian [11%] and 13 080 pancreatic [23%] cancers). Of those, 7618 patients (13%) had 1 or more admissions for IO in the final year of life. In multivariate models, factors associated with admission for IO were younger age (relative risk [RR] 2.65, 95% confidence interval [CI] 2.45–2.87 for < 50 yr, reference ≥ 81 yr), female sex (RR 1.13, 95% CI 1.08–1.19) and colorectal cancer (RR 4.36, 95% CI 4.00–4.75, reference pancreatic cancer) and ovarian cancer (RR 5.69, 95% CI 5.18–6.26, reference pancreatic cancer). Of these, 2657 (35%) patients were managed with a surgical/procedural intervention at index admission (surgery [86%], gastrostomy [8%], stent [6%] and jejunostomy [0.4%]); the remainder ($n = 4961$, 65%) received medical management. Over the study period, there was a small but statistically significant increase in the use of stents (0% in 2002 to 5% in 2015, $p < 0.0001$) and gastrostomy tubes (2% in 2002 to 4% in 2015, $p = 0.002$) and a large decrease in the use of surgery (41% in 2002 to 28% in 2015, $p = 0.04$). Cancer-associated IO at the end of life occurs most commonly in patients with colorectal and ovarian cancers. Management of IO has changed over time, with increased use of stents and gastrostomy tubes and decreased use of surgery.

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Evaluating the prognostic significance of lymphovascular invasion in stage II and III colon cancer. *D. Mutabdzic, S. O'Brien, S. Reddy, E. Sigurdson, C. Denlinger, J. Meyer, J. Farma.* From the Fox Chase Cancer Center, Philadelphia, Pa.

Lymphovascular invasion (LVI) is a known predictor of lymph node involvement in colon adenocarcinoma (CA). Lymph node involvement is associated with poorer prognosis necessitating adjuvant therapy. Although some studies suggested that LVI predicts worse overall survival in colon cancer, the significance of LVI for prognosis has not been tested in a comprehensive North American data set. Patients with stage II and III CA who received predefined standard of care treatment were identified from the National Cancer Database from 2011 to 2015. The relationship between LVI and overall survival was tested using Kaplan–Meier curves and Cox proportional hazards regression analysis after adjusting for clinical and demographic variables. The data set included 93 070 patients with stage II and 66 701 patients with stage III CA. The proportion of patients with LVI was 14% in stage II and 52% in stage III CA. After we adjusted for age, sex, gender, race, comorbidities, socioeconomic status, T stage and N stage, LVI was associated with worse overall survival (OS) in stage II CA (hazard ratio [HR] 1.2, 95% CI 1.15–1.25, $p < 0.001$) and in stage III CA (HR 1.25, 95% CI 1.21–1.30, $p < 0.001$). Median OS was 6.51 years with LVI versus 6.85 years without LVI in stage II compared with 6.57 years with LVI versus not reached without LVI in stage III CA. Of the patients with stage II CA with LVI, 14% received adjuvant chemotherapy (CT); median OS was 6.91 years for those who received CT versus 6.07 years for those who did not receive CT. Our data suggest that LVI is an important predictor of OS in stage II and III CA. Despite some uncertainty as to the benefit of CT in stage II CA, guidelines suggest consideration of CT in patients with high-risk stage II disease. Our data support the recommendation that LVI be considered a high-risk feature in stage II disease.

03

A matched case–control study on real-time electromagnetic navigation for breast-conserving surgery using NaviKnife. *C. Yeo, G. Gauvin, T. Ungi, S. Merchant, A. Lasso, D. Jabs, T. Vaughan, J. Rudan, R. Walker, G. Fichtinger, C. Engel.* From Queen's University, Kingston, Ont. (Yeo, Ungi, Merchant, Lasso, Jabs, Vaughan, Rudan, Walker, Fichtinger) and the Fox Chase Cancer Center, Philadelphia, Pa. (Gauvin).

Breast-conserving surgery (BCS) is a mainstay of breast cancer treatment. For nonpalpable breast cancers, current strategies have limited accuracy, contributing to high positive margin rates. We developed NaviKnife, a surgical navigation system based on real-time electromagnetic (EM) tracking. The goal of this study was to confirm the feasibility of intraoperative EM navigation in patients with nonpalpable breast cancer and to assess the potential value of surgical navigation. We recruited 40 patients with ultrasound-visible, single nonpalpable lesions undergoing BCS. Feasibility was assessed by equipment functionality and sterility, acceptable duration of the operation and surgeon feedback. Secondary outcomes included specimen volume, positive margin rate and reoperation outcomes. Study patients were compared with a control

group by a matched case-control analysis. There was no equipment failure or breach of sterility. The median operative time was 66 (44–119) minutes with NaviKnife versus 65 (34–158) minutes for the control group ($p = 0.64$). NaviKnife contouring time was 3.2 (1.6–9) minutes. Surgeons rated navigation as easy to set up, easy to use and useful in guiding excision of nonpalpable tumours. The mean specimen volume was 95.4 ± 73.5 cm³ with NaviKnife and 140.7 ± 100.3 cm³ for the control ($p = 0.01$). The positive margin rate was 22.5% with NaviKnife and 28.7% for the control group ($p = 0.52$). The reexcision specimen contained residual disease in 14.3% of patients in the NaviKnife group and 50% in the control group ($p = 0.28$). Our results demonstrate that real-time EM navigation is feasible in the operating room for BCS. Excisions performed with navigation result in the removal of less breast tissue without compromising margin positivity rates.

04

Gaps in the management of depression symptom screening following cancer diagnosis: a population-based analysis of prospective symptom screening. *J. Hallet, L. Davis, E. Isenberg-Grzeda, A. Mahar, H. Zhao, V. Zuk, L. Moody, N. Coburn.* From the University of Toronto, Toronto, Ont. (Hallet, Isenberg-Grzeda, Coburn); the Sunnybrook Research Institute, Toronto, Ont. (Davis, Zuk); the University of Manitoba, Winnipeg, Man. (Mahar); ICES, Toronto, Ont. (Zhao); and Cancer Care Ontario, Toronto, Ont. (Moody).

One of the most common psychological morbidities of cancer is depression. Routine screening for depression symptoms (DS) is recommended, but evidence of its ability to facilitate psychosocial interventions and address DS in clinical practice is scant. We examined the use of and factors associated with psychosocial interventions for patient-reported DS following a cancer diagnosis. We conducted a population-based cohort study of patients with a cancer diagnosis in 2010–2017 who had a patient-reported Edmonton Symptom Assessment System (ESAS) score greater than 1. DS was defined as an ESAS score greater than 2 out of 10 for the depression item within 6 months of diagnosis. Outcomes were psychosocial interventions around the time of DS: palliative care assessment, psychiatry/psychology assessment, social work referral and antidepressant therapy (in patients aged > 65 yr with universal drug coverage). We examined reduction in DS (> 1 point) following intervention. Modified Poisson regression examined factors associated with interventions. Of 142 270 patients, 65 424 (46.0%) reported DS at a median of 66 days (interquartile range 34–105) after diagnosis. Of those with DS, 17.1% received palliative assessment, 1.7% psychiatry/psychology assessment, 8.4% social work referral and 4.3% antidepressant therapy. DS decreased in 67.2% who received palliative assessment, 63.7% with psychiatry/psychology assessment, 67.3% with social work referral and 71.4% with antidepressant therapy. On multivariable analysis, patients with older age, rural residence, the lowest income quintile and genitourinary or oropharyngeal cancer were more likely to not receive intervention other than palliative care. The proportion of patients reporting DS after a cancer diagnosis who received a psychosocial intervention is worryingly low. We identified patients vulnerable to not receiving interventions who may benefit from additional support, who deserve special attention. These data represent a call to action to modify current practice to facilitate interventions and optimize the usefulness of systematic symptom screening.

05

Patterns of symptom burden in neuroendocrine tumours: a population-based analysis of patient-reported outcomes. *J. Hallet, L. Davis, A. Mahar, E. Isenberg-Grzeda, C. Law, L. Bubis, S. Singh, S. Myrehaug, H. Zhao, K. Beyfuss, L. Moody, N. Coburn.* From the University of Toronto, Toronto, Ont. (Hallet, Isenberg-Grzeda, Law, Bubis, Singh, Myrehaug, Coburn); the Sunnybrook Research Institute, Toronto, Ont. (Davis, Beyfuss); the University of Manitoba, Winnipeg, Man. (Mahar); ICES, Toronto, Ont. (Zhao); and Cancer Care Ontario, Toronto, Ont. (Moody).

How to best support patients with neuroendocrine tumours (NETs) remains unclear. Improving symptom management and quality of life requires an understanding of the symptoms experienced by patients. Validated assessments of symptom trajectories over the course of disease are lacking. This study examined patterns and risk factors of symptom burden over time in NETs, using a patient-reported outcome tool. We conducted a population-based retrospective observational cohort study of all patients with NETs diagnosed from 2004 to 2015 who survived at least 1 year. Prospectively collected patient-reported Edmonton Symptom Assessment System scores were linked to provincial administrative health care data sets. Moderate to severe symptom scores were presented graphically for both the first year and the first 5 years following diagnosis. Multivariable Poisson regression was used to identify factors associated with moderate to severe symptom scores during the first year after diagnosis. Among the 2721 patients included in the study, 7719 symptom assessments were recorded during the first 5 years after diagnosis. Moderate to severe scores were most often reported for tiredness (40%–51%), well-being (37%–49%) and anxiety (30%–40%). The proportion of moderate to severe symptoms was stable over time, with a 10% reduction within 6 months of diagnosis for anxiety followed by stability, and changes of less than 5% for other symptoms. Similar patterns were observed for the first year after diagnosis. Primary tumour site, metastatic disease, younger age, higher comorbidity burden, lower socioeconomic status and receipt of therapy within 30 days of assessment were independently associated with higher risk of elevated symptom burden. Patients with NETs have a high prevalence of moderate to severe patient-reported symptoms, which does not change over 5 years after diagnosis. Patients remain at risk of a prolonged high symptom burden following diagnosis, highlighting potential unmet needs to be addressed. Combined with identified patient and disease factors associated with moderate to severe symptom scores, this information is important in supporting the design of symptom management strategies to improve patient-centred care for NETs.

06

Outcomes of salvage surgery for anal canal squamous cell carcinoma: a systematic review and meta-analysis. *D. Cyr, P. Savage, E. Theodosopoulos, T. Chesney, C. Swallow.* From the University of Toronto, Toronto, Ont. (Cyr, Theodosopoulos, Chesney, Swallow); and McGill University, Montreal, Que. (Savage).

Following definitive chemoradiotherapy for primary squamous cell carcinoma of the anal canal (A-SCCa), 10%–30% of patients develop persistent or recurrent cancer. Both persistent and recurrent A-SCCa may be amenable to salvage surgery, which is typically quite resource intensive. Because only small case series have been reported, we synthesized the evidence for salvage surgery to gain an understanding of expected outcomes. A systematic search of Medline, Embase and the Cochrane Library (up to Oct. 11, 2018) identified 39 retrospective, uncontrolled cohort studies reporting on early postoperative and/or long-term oncologic outcomes following salvage surgery for persistent or recurrent A-SCCa in 1388 patients. Overall survival (OS) and disease-free survival (DFS) were pooled using 2 approaches: survival curve meta-analysis and exact binomial likelihood random-effects model for survival probabilities. We used meta-regression, subgroup and sensitivity meta-analyses to explore sources of heterogeneity. Pooled 5-year OS was 45.5% (95% confidence interval [CI] 40.6%–49.9%, 33 studies, 1308 patients) and did not differ in patients resected for recurrent (14 studies, $n = 259$ patients) versus persistent ($n = 238$ patients) disease. There was no association of OS with study year, tumour size or resection margin status at the aggregate level. The pooled 5-year DFS was 38.3% (95% CI 31.4–43.9, 14 studies, 554 patients). The pooled 30-day complication rate was 65.3% (95% CI 50.2%–77.9%, 17 studies, 720 patients): major complications (Clavien–Dindo grade ≥ 3) 27.7% (95% CI 22.3%–33.8%), reoperations 12.7% (95% CI 8.7%–18.2%) and mortality 1.7% (95% CI 1.1%–2.6%). The pooled perineal complication rate was 32.7% (95% CI 25.0%–41.4%). Salvage surgery for recurrent/persistent A-SCCa offers 5-year OS of approximately 45% and DFS of approximately 40%. Although postoperative mortality is rare, major complications are very common. Comparative effectiveness studies comparing surgery with other treatments are warranted.

07

Expression of the Plk4 inhibitor FAM46C predicts better survival following resection of gastric adenocarcinoma. *S. Luu, K. Kazazian, J. Conner, J. Swett-Cosentino, K. Pacholczyk, S. Brar, A. Govindarajan, C. Swallow.* From the University of Toronto, Toronto, Ont. (Luu, Kazazian, Conner, Pacholczyk, Brar, Govindarajan, Swallow); and Western University, London, Ont. (Swett-Cosentino).

Despite improvements in surgical technique and perioperative adjuvant therapy for gastric adenocarcinoma (GCa), more than 40% of Western patients die of recurrent disease. Novel molecular markers and targets are urgently needed. We are investigating the role of the oncogene polo-like kinase 4 (Plk4) and a 61-gene panel of BioID-defined Plk4 interactors in GCa progression. Patients who underwent curative-intent resection for GCa from 2001 to 2016 were identified in our institutional database. Banked primary tumour (T) and paired normal mucosa (NM) samples were microdissected, RNA was extracted and the status of the Plk4 interactome was interrogated using quantitative polymerase chain reaction. Pattern of recurrence was categorized as locoregional, peritoneal or distant. Survival was estimated by the Kaplan–Meier method and comparisons were made by log-rank analysis. From 121 consecutive resection specimens, Plk4 interactome expression analysis was informative in 94 cases, and these patients form the study cohort (median age 70 yr, 62% male,

median follow-up time 28 mo, interquartile range [IQR] 10–63 mo). Plk4 was modestly overexpressed in GCa tumour tissue (median T/NM 1.32, IQR 0.57–2.6), but not prognostic of overall survival (OS) or disease-specific survival (DSS). The Plk4 inhibitory interactor FAM46C was depleted (T/NM < 1) in 95% of cases. Median FAM46C T/NM was 0.26 (IQR 0.12–0.49). Retention of FAM46C expression (defined as T/NM \geq 0.26, $n = 47$) was associated with superior 5-year DSS (61% v. 43%, $p = 0.04$). The prognostic significance of FAM46C persisted in the node-positive subgroup of patients ($n = 60$, DSS $p = 0.02$). Patients who developed recurrence in the liver ($n = 15$) had significantly lower FAM46C levels than those who did not (mean log T/NM -0.95 v. -0.64 ; $p < 0.05$, t test). Retention of FAM46C expression was associated with a better prognosis following curative-intent resection of GCa. FAM46C may be protective through its inhibition of Plk4 oncogenic function, reducing the risk of distant metastasis.

08

Current treatment strategies and patterns of recurrence in locally advanced colon cancer. *C. Huynh, S. Minkova, D. Kim, H. Stuart, T. Hamilton.* From the University of British Columbia, Vancouver, B.C.

Locally advanced colon cancer (LACC) is a frequent presentation and has a high rate of recurrence. This study aims to evaluate current population-based strategies and patterns of recurrence in LACC. We conducted a retrospective review of all patients with LACC treated with curative-intent resection at a regional cancer agency between 2005 and 2015. Inclusion criteria were adults with diagnosed T4 colon cancer, 16 cm above the anal verge and no distant metastases. Descriptive statistics were used to define the study population. Kaplan–Meier and Cox proportional hazards modelling were used for survival analysis. A total of 1394 patients were reviewed. The median age was 69 (interquartile range [IQR] 60–77) years and 49.3% of the patients were female. The primary tumour location was right sided in 57.1%. Most tumours were T4a (69.4%) and 39.4% were node positive. In the study population, 35.4% had urgent/emergent surgery, 46.4% of cases were at least partially obstructed, 22.0% were perforated, 66.4% of patients underwent a laparoscopic approach, 23.4% had an open procedure and 10.2% were converted. En bloc multivisceral resection occurred in 23.5% of cases. Positive margins were present in 14.3%. A total of 1.6% of the patients had neoadjuvant chemotherapy and 0.8% chemoradiation. Adjuvant chemotherapy was delivered in 59.8% of cases and adjuvant chemoradiation in 2.8%. Median follow-up was 37 months; 681 (48.9%) patients died and 584 (41.9%) developed recurrence. Rates of recurrences were local-regional (14.7%) and distant metastatic (35.1%). Overall survival was 63 months (95% confidence interval [CI] 55.7–70.3) and recurrence-free survival was 61 months (95% CI 38.8–83.2). Multivariate analysis identified age (hazard ratio [HR] 1.03, 95% CI 1.02–1.05, $p < 0.001$), node-negative status (HR 0.62, 95% CI 0.45–0.84, $p = 0.002$) and positive margin (HR 1.79, 95% CI 1.24–2.57, $p = 0.002$) as predictive of overall survival. Predictive factors for recurrence-free survival were node-negative status (HR 0.55, 95% CI 0.39–0.77, $p < 0.001$) and positive margin (HR 1.51, 95% CI 1.02–2.23, $p = 0.038$). Recurrence after curative-intent treatment for LACC is common. Recurrence and survival patterns are significantly influenced by tumour nodal status and margin positivity.

09

A 5-year retrospective review of outcomes after cytoreductive surgery (CRS) and hyperthermic intraperitoneal chemotherapy (HIPEC) in a provincial peritoneal malignancy program. *N. Jedrzejko, Y. McConnell, A. MacNeill, T. Hamilton.* From the University of British Columbia, Vancouver, B.C. (Jedrzejko, MacNeill, Hamilton); and the Puyallup Surgery Center, Puyallup, Wash. (McConnell).

Cytoreductive surgery (CRS) and hyperthermic intraperitoneal chemotherapy (HIPEC) has emerged as a curative-intent treatment option for select patients with peritoneal carcinomatosis (PC). Our province's Peritoneal Malignancy Program was established in 2013, joining 5 other Canadian centres offering CRS/HIPEC to highly selected patients with PC. Our objective is to retrospectively review patient morbidity, mortality and readmissions after CRS/HIPEC over the first 5 years of the Peritoneal Malignancy Program. A province-wide retrospective electronic chart review was conducted for all patients aged 18 years and over undergoing CRS/HIPEC from 2013 to 2018. Short- and long-term morbidity and oncologic outcomes were collected. Ninety-seven CRS/HIPEC procedures were performed on 93 patients from 2 Canadian provinces. Mean patient age at the time of the procedure was 52 years, and 60.8% of patients were female. The most common diagnoses include appendiceal neoplasms (50.5%), colorectal cancer (35.5%) and mesothelioma (9.7%). Mean Peritoneal Carcinomatosis Index was 15.2, with a median length of stay of 16.2 days. The most common postoperative adverse events were ileus (27.8%), urinary tract infection (21.6%) and surgical site infection (14.4%). Postoperative severe adverse events (Clavien–Dindo grade ≥ 3) occurred in 14 cases (14.4%). The 30-day readmission rate was 8.3% and the 90-day readmission rate was 7.2%, with the most common readmitting diagnoses being small bowel obstruction (10.3%) and surgical site infection (6.2%). Mortality at 30 and 90 days was 0. Five-year overall survival was 87.6%, with 12 deaths attributable to disease recurrence. Five-year disease-free survival was 58.8%. Outcomes after CRS/HIPEC in our provincial program are comparable to those in the published literature, with favourable oncologic outcomes in a highly selected patient population. Ongoing comparative analyses with Canadian CRS/HIPEC centres is required to establish perioperative standards of care for patients with peritoneal malignancy.

10

Withdrawn

11

Geographic disparities in care and outcomes for noncurative pancreatic adenocarcinoma: a population-based study. *E. Yee, N. Coburn, L. Davis, A. Mahar, Y. Liu, J. Hallet.* From the University of Toronto, Toronto, Ont. (Yee, Coburn, Davis, Liu, Hallet); and the University of Manitoba, Winnipeg, Man. (Mahar).

Noncurative pancreatic adenocarcinoma (PA) portends a guarded prognosis. Advancements in systemic therapy have improved this outlook, but little is known about whether patients access therapies and how this affects outcomes. We examined the geographic distribution of care delivery and survival for PA

across a Canadian province. We conducted a population-based analysis of nonresected PA between 2005 and 2017 by linking administrative health care data sets. Outcomes were medical oncology consultation, care by high-volume medical oncology provider (≥ 16 patients/year/provider), cancer-directed therapy (CDT) defined as chemotherapy or chemoradiation and overall survival. Geographic information system analysis was used to map outcomes across census divisions, including display of cancer care centres by care level. Multivariate models were used to examine the adjusted effect of cancer care centre density (centres per square kilometre) on outcomes. Of 15 970 patients surviving a median of 3.3 months (interquartile range 1.2–8.6), 38.5% received CDT. A total of 65.6% of patients had medical oncology consultation, including 45.2% of those not receiving CDT. High-volume medical oncologists cared for 17.1%. Regions of comparable survival and care delivery were clustered throughout the province. Cancer care centres were distributed unevenly, with higher level centres clustered in the southern part of the province. Higher level centres clustered in regions with higher rates of consultation, CDT and survival. Lower cancer care centre density was independently associated with lower likelihood of consultation and inferior survival, but not with CDT and care by high-volume providers. The majority of patients with noncurative PA did not receive CDT. Of those, more than half did not see medical oncology. Care delivery and survival exhibited high geographic variability. Proximity to cancer care centres influenced differences in outcomes, with cancer care centre density influencing access to medical oncology assessment and survival but not high-volume provider care or CDT. This information suggests inequitable delivery of care across the jurisdiction and is important in the design of strategies to improve access to care and outcomes for PA.

12

How often is implant-based breast reconstruction following postmastectomy radiation unsuccessful? *R. Liu, S. Chambers, S. Latosinsky, A. Grant, A. Maciver. From Western University, London, Ont.*

Successful breast reconstruction following radiation can be challenging, particularly with implants. Implant-based reconstruction is still common in this setting, as autologous reconstruction is not always feasible or desirable. Allogeneic reconstruction for patients after radiation has generally acceptable rates of complications, reconstructive failure and dissatisfaction, although these vary widely in the literature. We reviewed our reconstruction outcomes in this setting, particularly the rate of failure when considering multiple factors. Patients who underwent both postmastectomy radiation and delayed implant breast reconstruction from 2008 to 2016 were retrospectively identified from administrative data sets. The hospital electronic record was examined for patient, tumour, treatment and outcome data. Overall failure was a composite outcome defined as final status amastatic, more than 3 reconstructive general anesthetics, documentation of significant dissatisfaction or significant chronic pain. A similar cohort without radiation was also identified for comparison. Forty-two women were identified in the radiation cohort. The average age at diagnosis was 50.4 years, with an average body mass index of 28.7. Average time from radiation to reconstruction was 1.4 years. A

total of 88.1% of implant reconstructions included a latissimus dorsi flap. The average time of follow-up from reconstruction by plastic surgery was 1.8 years. Four women were final status amastatic, 3 had more than 3 general anesthetics, 3 were significantly dissatisfied and 2 had chronic pain. Thus, the reconstruction of at least 12/42 (28.6%, 95% confidence interval 17.2%–43.6%) women in our institution who received postmastectomy radiation and delayed implant reconstruction was considered a failure. Only 4/37 failures occurred in the similar cohort without postmastectomy radiation (10.8%, 95% CI 4.3%–24.7%). For nearly a third of patients undergoing delayed implant-based reconstruction after radiation, the reconstruction was unsuccessful. This is important information for counselling on reconstruction options and management of patient expectations even before mastectomy. Better insights into these results and the patient experience of the 2 cohorts will be obtained with a survey of patient-reported outcomes.

13

Comparison of partial mastectomy specimen volume and tumour volume following neoadjuvant chemotherapy in breast cancer. *A. Bazzarelli, F. Angarita, K. Carpenter, R. Au, D. McCreedy, T. Cil, M. Elmi. From the University of Toronto, Toronto, Ont.*

Neoadjuvant chemotherapy (NAC) increases breast conservation rates. Breast-conserving surgery (BCS) after NAC yields acceptable rates of locoregional recurrence (LRR). However, few data exist regarding the volume of tissue excised in this scenario. The aim of this study was to compare the volume of breast tissue resected in BCS with the disease volume based on preoperative imaging and pathological tumour size in the post-NAC setting. A prospectively maintained database was used to identify patients who underwent NAC for breast cancer with curative intent followed by BCS across 3 academic high-volume hospitals in Toronto, Canada, from January 2006 to July 2016. Clinicopathologic data were extracted. Tumour burden was measured on preoperative, pre-NAC as well as post-NAC magnetic resonance imaging (MRI) using the following volume calculation: $4/3\pi \times \text{radius (height)} \times \text{radius (length)} \times \text{radius (width)}$. Comparisons occurred between imaging measurements of tumours and volume of pathologic tumours and specimens. A total of 152 patients underwent BCS following NAC. The median age was 47 years (interquartile range 39–55). The most common histology was invasive ductal carcinoma (93.4%). Tumours were frequently grade 2 (58.5%). The distribution of clinical T-stage was as follows: 1 (62.5%), 2 (30.0%) and 3 (7.5%). The majority of tumours were estrogen receptor positive (61.3%) and HER2 negative (73.4%). Imaging tumour volume on MRI diminished with NAC (22.5 cm³ to 5.2 cm³, $p = 0.07$). Pathologic tumour volume corresponded to post-NAC MRI imaging volume (14.3 cm³ v. 5.2 cm³, $p = 0.35$). However, mean specimen volume was substantially greater than tumour volume at 93.6 cm³ ($p = 0.005$). This study demonstrated significantly lower tumour volumes on imaging and final pathology following NAC. However, the volume of resected tissue remained high. Potentially lower specimen volumes may be achievable than was found in our series. Future studies are needed to determine the effects of tumour and patient factors on volume of resected tissue and to assess long-term oncologic outcomes.

14

Two-year experience with hookwire localized clipped node and sentinel node as alternative to targeted axillary dissection in a regional centre. *S. Seidl, H. Cheab, R. Poon.* From the Central Coast Local Health District, Gosford, Australia.

Optimal management of the axilla after neoadjuvant chemotherapy (NACT) for node-positive breast cancer remains debatable. Emerging use of targeted axillary dissection (TAD) using radioactive iodine seeds has been shown to improve the accuracy of axillary staging and reduces the need for axillary lymph node dissection (ALND). However, in small regional centres without accreditation to store and dispose of radioactive seeds, an alternative strategy is to use existing resources to perform hookwire localized excision of clipped nodes (HWLCN). The aim of the study is to evaluate the outcomes of HWLCN with sentinel lymph node (SLN) biopsy when radioactive seed or Magseed is not available. A review of a prospectively collected database of patients who underwent HWLCN with SLN biopsy after NACT for node-positive breast cancers by a single surgeon from 2017 to 2018 was performed. Patient demographics, tumour biology, radiological findings and surgical specimens were analyzed. Of the 13 patients, 1 was converted to ALND because of poor wire placement by the radiologist. The clipped node was found in the 12 remaining patients. Two patients had on-table conversion to ALND (1 failed to be mapped on lymphoscintogram and 1 had only 1 additional SLN found). All patients with residual disease in the clipped node regardless of the size of the deposits had additional positive lymph nodes in ALND. One patient with a 0.1-mm deposit in the clipped node declined further ALND but had axillary radiotherapy; another did not have ALND because of solitary liver metastasis. Four patients had no residual disease found on the clipped node. Further analysis showed that 3 of these converted N0 patients had triple-negative breast cancers with complete pathological response in breast and axillae. In conclusion, HWLCN with SLN biopsy is a safe and feasible alternative to allow selective removal and analysis of residual nodal disease and avoid the unnecessary morbidities associated with ALND.

15

Opioid use among cancer patients undergoing surgery and their associated risk of readmissions and emergency department visits in the 1-year postsurgical period. *R. Tamblin, A. Meguerditchian, S. Kurteva.* From McGill University, Montreal, Que.

Prescription opioid use and overdose has steadily increased over the past years, resulting in a dramatic increase in opioid-related emergency department (ED) visits and hospital admissions. This study used a prospective cohort of cancer patients having undergone surgery to describe their opioid use and identify potential patterns of health service use (ED visits, hospital admissions). Provincial health administrative claims were used to measure opioid dispensations as well as hospital readmissions and ED visits. Cox proportional hazards models were used for the association between opioid use and risk of ED visits and hospital admissions in the 1 year after surgery. Propensity scores were constructed to properly adjust for important patient and medication characteristics. A total of 663 patients were included in the study; of these, 76% ($n = 502$) received an opioid prescription at

discharge with the majority being opioid naïve (72%, $n = 363$). Among patients who were opioid naïve before admission but did not receive an opioid at discharge, 50% had filled at least 1 opioid prescription in the community. At postoperative discharge, most opioid dispensations (73%) were for oxycodone, with hydromorphone being the second most prescribed (31%). Among opioid users, the mean age was 68 years and 85% had a previous history of opioid use. Overall, opioid use was associated with a 10% increase in the risk of ED visits and hospital readmissions. When considering cumulative duration of use, there was a 40% decrease in the risk of readmissions when patients were using opioids for fewer than 30 days. However, the risk doubled when opioid treatment continued for more than 60 days. This study helps identify the risk profile of cancer patients who are most likely to continue using opioids for prolonged period following surgical procedures as well as quantify the impact of opioid use and its associated burden on the health care system to identify areas for possible interventions.

16

Preliminary results of a pilot randomized controlled trial comparing axillary reverse mapping with standard axillary surgery in women with operable breast cancer. *P. Lovrics, N. Hodgson, S. Cornacchi, E. Parvez, I. Dayes, M. Forbes, L. Thabane, S. Reid.* From McMaster University, Hamilton, Ont.

Axillary reverse mapping (ARM) uses blue dye injected in the arm at axillary surgery to identify and preserve specific axillary nodes/lymphatics to potentially decrease arm lymphedema (LE). The goal of this study was to compare ARM with standard axillary surgery in a pilot randomized controlled trial (RCT). Patients with invasive or in situ breast carcinoma undergoing sentinel lymph node biopsy (SLNB) and mastectomy, or axillary lymph node dissection (ALND) with lumpectomy or mastectomy were eligible. Consenting patients were randomly assigned to axillary surgery with or without ARM. Preliminary outcomes included rates of blue ARM node/lymphatic(s) identification and preservation, and ARM node metastasis. Twenty-eight patients were randomly assigned to the ARM group (10 SLNB, 18 ALND) and 27 to the control group (11 SLNB, 16 ALND). One patient randomly assigned to the ARM group undergoing SLNB did not receive blue dye. Approximately 45% of each group received neoadjuvant therapy. There were no differences in mean age, body mass index, postoperative nodal stage or postoperative complications. No patients had an allergic reaction to the blue dye. At 6-month follow-up, 75% had light blue staining at the arm injection site. In 6/9 (67%) of SLNB cases, a blue node/lymphatic(s) were visualized: 3 cases had 1 crossover (blue and "hot") node identified and removed, 1 of which had micrometastasis; 3 cases had all or some blue node/lymphatic(s) preserved. For 9/18 (50%) ALND cases, a blue node/lymphatic(s) were identified: 6/9 (67%) had 1 blue node removed and all were negative for metastases; 5/9 (56%) had all or some blue lymphatics preserved. The feasibility of the ARM technique and pilot RCT were demonstrated. Rates of identification of blue nodes/lymphatics and preservation of arm lymphatics were similar to reported rates. Investigation of the potential impacts on LE and risk of long-term blue staining at the injection site will require longer follow-up and a larger sample size.

17

Complementary and alternative medicine among general surgery patients in Nova Scotia. E. Roach, L. Helyer. From Dalhousie University, Halifax, N.S.

Use of complementary and alternative medicines (CAM) among the general Canadian population is reported to be high. Health care providers have a responsibility to identify CAM use among their patients, partly out of a duty to provide patient-centred care but also because of an emerging understanding of the potential risks associated with some types of CAM. We sought to identify trends in the pattern of CAM usage among general surgery patients in Nova Scotia. We conducted a survey of patients attending general surgery clinics in Halifax, Nova Scotia, from October to December 2017. These clinics include patients with both benign and malignant conditions. Demographic data were collected including medical history and details of CAM use. We used χ^2 analyses to test for relationships between independent variables and CAM use. A total of 195 patients completed the survey; 128 (65.6%) reported using 1 or more CAM practices. Vitamins (78.1%), massage (21.1%) and chiropractic (19.5%) were the most commonly reported practices. Age, gender and income were not correlated with CAM use. Patients with only a high school diploma were significantly less likely to use CAM than patients with higher levels of formal education (χ^2 [2, $n = 194$] = 0.95, $p = 0.009$). Patients with a cancer diagnosis were not more likely to use CAM (χ^2 [1, $n = 195$] = 0.104, $p = 0.75$). Improving nutrition, immune system and energy level were the most commonly cited reasons for using CAM. Fewer than 15% of patients reported disclosing CAM use to their surgeons. CAM use is highly prevalent among general surgery patients in Nova Scotia in patients with both benign and malignant disease. Most patients do not disclose this information to their surgeon and some of these practices have described risks relevant to the perioperative period. Surgeons should make an effort to initiate discussions about CAM use with their patients.

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Improving wait times and patient experience through implementation of a provincial expedited diagnostic pathway for BI-RADS 5 breast lesions. A. Laws, A. Crocker, J. Dort, D. Olson, A. Elwi, S. Anderes, S. Parker, A. Estey, A. Keehn, M. Quan. From the University of Calgary, Calgary, Alta. (Laws, Dort, Keehn, Quan); Alberta Health Services, Calgary, Alta. (Crocker, Elwi, Anderes, Parker, Estey); and the University of Alberta, Edmonton, Alta. (Olson).

Long diagnostic intervals following abnormal breast imaging are associated with anxiety and possibly poorer prognosis. We developed a provincial clinical pathway for expedited workup of Breast Imaging Reporting and Data System (BI-RADS) 5 lesions, coupled with early surgical referral. This study evaluates wait times and the patient-reported experience (PRE) during the first year of the pathway's implementation. We included 1205 patients managed on the pathway from 2017/18 at 2 regional breast health programs. Diagnostic intervals from BI-RADS 5 imaging (DI) were prospectively collected, and retrospective chart review for 128 prepathway controls was performed. Intervals were compared between

pre- and post-pathway patients using the nonparametric median test. PRE measures were obtained from a voluntary survey completed by 294 patients. A total of 797 family physicians and 57 diagnostic imaging centres participated in the pathway. Median duration from DI to biopsy and biopsy to pathology was 6 days (90th percentile [Pi] 14 d) and 5 days (90th Pi 8 d), respectively; these intervals did not differ before and after the pathway was implemented ($p = 0.71$, $p = 0.11$). Median duration from DI to surgical referral and DI to surgical consult was 6 days (90th Pi 18 d) and 21 days (90th Pi 34 d), respectively; both were significantly shorter for patients on the pathway (6 v. 15 d, $p < 0.001$; 21 v. 26 d, $p < 0.001$). Most patients (91.5%) experienced 1 or more anxiety complaints during diagnostic assessment. Prompt surgical consultation was the most commonly selected factor reducing anxiety ($n = 265$, 89.8%), followed by features of nurse navigator support including the ability to contact a registered nurse with questions ($n = 240$, 66.4%), having a registered nurse coordinate appointments ($n = 196$, 66.4%) and preconsultation education ($n = 173$, 58.6%). We successfully implemented a provincial pathway for expedited assessment of BI-RADS 5 lesions that reduced wait times for surgical consultation. Through PRE data, we demonstrated that diagnostic assessment is highly anxiety provoking, but multiple features of the pathway improve the patient experience.

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Population-based regional recurrence patterns in Merkel cell carcinoma: a 15-year review. M. Talbot, H. Stuart, T. Hamilton. From the University of British Columbia, Vancouver, B.C.

Merkel cell carcinoma (MCC) is a rare neuroendocrine tumour of the skin that commonly metastasizes to lymph nodes. Current guidelines recommend sentinel lymph node biopsy (SLNB) for patients with clinically node-negative disease. A retrospective review of all cases of MCC referred to a provincial cancer agency from 2000 to 2015 was conducted. Patient demographics and therapeutic interventions were assessed focusing on the use of SLNB in patients with clinically node-negative disease. Kaplan–Meier curve estimates and log-rank testing were used to compare survival and regional recurrence. A total of 227 cases of MCC were identified of which 58% were male with median age of 77 years (interquartile range 68–83). At diagnosis, 74.7% were clinically node negative and of these 17.4% had a SLNB; 6.2% had distant metastatic disease. Median overall survival (OS) for patients with clinically node-negative and metastatic disease was 52 and 9 months, respectively. The 5-year regional recurrence was 29.1% in the entire cohort, and all regional recurrences occurred within the first 3 years. In the cohort with clinically node-negative disease, the regional recurrence rate was 26.3% in those with SLNB and 32.7% in those who did not have a SLNB ($p = 0.41$). The median OS for patients with clinically node-negative disease who had a SLNB was 106 months versus 51 months for those who did not have a SLNB ($p = 0.107$). Despite current recommendations, the routine practice of SLNB in patients with clinically node-negative MCC is lacking. Further study of the impact of SLNB on survival and regional recurrence is required with a larger cohort.

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Survival and health care cost benefits of high-volume care in the noncurative management of pancreatic adenocarcinoma: a population-based analysis. *N. Coburn, L. Davis, N. Look-Hong, A. Mahar, N. Mittmann, Y. Liu, C. Earle, J. Hallet, V. Zuk.* From the University of Toronto, Toronto, Ont. (Coburn, Davis, Look-Hong, Mittmann, Liu, Earle, Hallet, Zuk); and the University of Manitoba, Winnipeg, Man. (Mahar).

Although high-volume (HV) providers for pancreatic adenocarcinoma (PA) surgery have better outcomes, the volume–outcome relationships are unknown for systemic therapy. We examined the effect of care by HV providers on outcomes and costs for noncurative management of PA. We conducted a population-based cohort study of nonresected PA over 2005–2016 by linking administrative health care data sets. Volume quintiles were based on the volume of new PA consultations per medical oncologist per year. HV providers were defined as the fifth quintile. Outcomes were overall survival (OS) and health care costs (\$CAD/patient/month lived) from diagnosis. Multivariate Cox and Poisson regressions examined the association between care by HV providers and outcomes. Sensitivity analyses varying costs measurement horizon examined changes in cost-effectiveness. A total of 7062 patients with unresected PA consulted with medical oncology. Median survival was superior for HV providers (> 16 patients/year), with 7.2 (interquartile range [IQR] 3.1–13.7) compared with 4.7 (IQR 2.1–10.1) months ($p < 0.01$). HV provider was independently associated with superior OS (hazard ratio [HR] 0.79, 95% confidence interval [CI] 0.74–0.84) adjusted for age, sex, comorbidity, rurality, income quintile and diagnosis year. Median costs were lower for HV providers (\$7552.37 v. \$8680.07; $p < 0.001$) because inpatient, home care, long-term care and laboratory costs were lower with HV providers, even though higher costs were incurred for radiation and chemotherapy. The overall incremental cost-effectiveness ratio (ICER) was -451.2. When we varied the time horizon for costing, HV providers remained cost-effective at all times. The ICER initially dropped from -432.6 at 3 months to -401.7 at 12 months and subsequently up to -461.9 at 24 months. Palliative management of PA by HV providers is simultaneously associated with improved OS and lower health care costs, indicating a dominant cost-effectiveness strategy. This information is important to inform disease care pathways and care organization. Increasing the number of HV providers at the population level would be beneficial for patients and cost-effective from a health systems perspective.

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Trends in the use of sentinel node biopsy after neoadjuvant chemotherapy in the United States. *G. Gauvin, N. Melchior, D. Sachs, C. Chang, C. Wang, A. Aggon, J. Daly, E. Sigurdson, R. Bleicher.* From the Fox Chase Cancer Center, Philadelphia, Pa.

Neoadjuvant chemotherapy (NACT) is used to attempt to downstage patients with breast cancer who have large tumours and positive nodes. Surgical management of the axilla is becoming less extensive, although practice patterns in the United States are still variable. This study was performed to

evaluate axillary surgery practice patterns in the US for patients who have had NACT. Using the National Cancer Database (NCDB), female patients who underwent NACT for advanced, noninflammatory breast cancer were identified. Patient and treatment characteristics were compared by surgical treatment, and predictive factors were explored using multivariable logistic regression analyses. Between 2006 and 2015, 42.5% of patients underwent sentinel lymph node biopsy (SLNB) and 57.5% had an axillary lymph node dissection (ALND). The mean number of positive nodes was 0.4 ± 2.4 for SLNB, 3.1 ± 5.2 for SLNB converted to ALND and 4.6 ± 9.0 for ALND. In patients who underwent SLNB, 46.4% had 3 or more nodes examined and 25.5% had positive nodes (mean 1.6 ± 4.5) without undergoing an ALND. Conversely, 19.9% of patients who underwent upfront ALND had no positive lymph node on pathology. SLNB after NACT was predicted by patient with triple-negative and HER2-positive disease and higher income, while upfront ALND was seen more frequently in pre-NACT clinical N stage 1 or above and clinical T stage 3 or above, tumour grade 2 or above and older patients. Between 2010 and 2015, there was a 16.1% increase in SLNB and a 27.3% decrease in SLNB conversion to ALND. Conversion from SLNB to ALND was predicted by pre-NACT clinical N stage 1 or above, clinical T stage 3 or above and a higher number of nodes examined, especially 3 or more. The use of SLNB after NACT has increased over time. A decrease in the rate of SLNB conversion to ALND may reflect improvements in response rates or better patient selection. Further education and long-term outcome data assessing recurrence risks may assist in making practice more uniform.

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Predictors of grossly incomplete resection in primary retroperitoneal sarcoma (RPS). *D. Ng, D. Callegaro, C. Raut, D. Strauss, C. Honore, E. Stoeckle, S. Bonvalot, W. Van Houdt, P. Rutkowski, Y. Schrage, M. Fiore, C. Swallow.* From the University of Toronto, Toronto, Ont. (Ng, Callegaro, Swallow); the Dana-Farber Cancer Institute, Harvard Medical School, Boston, Mass. (Raut); the Royal Marsden Hospital, London, U.K. (Strauss); Institut Gustave Roussy, Villejuif, France (Honore); Institut Bergonié, Bordeaux, France (Stoeckle); Institut Curie, Paris, France (Bonvalot); the Netherlands Cancer Institute, Amsterdam, Netherlands (Van Houdt); Maria Skłodowska-Curie Memorial Cancer Centre and Institute of Oncology, Warsaw, Poland (Rutkowski); the Leiden University Medical Centre, Leiden, Netherlands (Schrage); and the Fondazione IRCCS Istituto Nazionale dei Tumori, Milan, Italy (Fiore).

Grossly incomplete resection (R2) of primary retroperitoneal sarcoma (RPS) may be either planned, for palliative intent, or unplanned, owing to unexpected intraoperative findings. Limited prospective data exist to help predict unplanned R2 resection preoperatively. The purpose of this study was to investigate tumour and patient factors associated with R2 resection and determine associated oncologic outcomes. Consecutive patients who underwent resection of nonmetastatic primary RPS at 1 of 10 sarcoma referral centres between 2002 and 2017 were included; data were collated from each centre's prospective RPS database. Overall survival (OS) curves were

constructed using the Kaplan–Meier method. Univariate and multivariable logistic regression analyses were performed to investigate predictors of R2 resection. Of 1946 RPS patients who underwent resection, 1850 (95.1%) had R0/R1 resection and 96 (4.9%) had R2 resection. As expected, R2 resection was associated with a lower 5-year OS (37.5% v. 69.1%) and a shorter median OS (23 v. 129 mo) than R0/R1 resection. On univariate analysis, male sex ($p = 0.003$), dedifferentiated liposarcoma (DDLPS) histologic subtype ($p = 0.03$), multifocality ($p < 0.0001$) and grade 3 histology ($p = 0.0068$) were associated with R2 resection; grade 3 histology ($p = 0.04$) and multifocality ($p < 0.0001$) retained significance on multivariable analysis. The combination of multifocality, grade 3 and DDLPS histology was highly significant in predicting R2 resection ($p < 0.0001$); 25% of such patients underwent an R2 resection. Predictors of R2 resection include male sex, multifocality, grade 3 and DDLPS histology. Preoperative decision-making should take these variables into account, and neoadjuvant strategies should be considered.

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Mastectomy versus breast conservation therapy: an examination of how individual, clinicopathologic and physician factors influence decision making. *J. Gu, M. Delisle, R. Engler-Stringer, G. Groot.* From the University of Saskatchewan, Saskatoon, Sask. (Gu, Engler-Stringer, Groot); and the University of Manitoba, Winnipeg, Man. (Delisle).

Canada's interprovincial mastectomy rates vary from 25% to 68%, with Saskatchewan reporting the nation's second-highest mastectomy rate at 63%. The aim of our research was to better understand the factors that influence decision-making for women with early-stage breast cancer (ESBC). We created a survey based upon a previously developed framework that organizes the influencing factors into 3 constructs: clinicopathologic, physician and individual belief factors. All Saskatchewan women diagnosed and treated with ESBC in 2014–2015 inclusive were invited to participate in our survey. A total of 276 participants completed our survey; 150 underwent mastectomy (54.3%) and 126 underwent breast-conserving therapy (BCT) (45.7%). Treatment choice was influenced by disease stage and multiple individual belief factors. Women with stage 2 disease were significantly more likely to undergo mastectomy than those with stage 1 disease (odds ratio [OR] 7.48). Patients rating “worry about cancer recurrence” (OR 3.4) and “total treatment time” (OR 1.8) as more influential on their choice were also more likely to undergo mastectomy. Conversely, women rating “wanting to keep own breast tissue” (OR 0.17), “tumour size” (OR 0.66) and “surgeon's opinion” (OR 0.69) as influential on their choice were more likely to undergo BCT. Our study demonstrates that treatment decision-making for Saskatchewan women with ESBC was primarily influenced by disease stage and individual belief factors. These findings would suggest that women are making their treatment choices predominantly on the basis of individual values and preferences. Furthermore, when physician input is a factor, the direction of treatment influence is toward BCT. The use of mastectomy and BCT rates as an indicator of quality of care may be misleading. A shift in attention toward patient-centred care is more appropriate.

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Immunophenotyping postoperative myeloid-derived suppressor cells in cancer surgery patients. *L. Angka, M. Andre, A. Jeong, M. Scaffidi, M. Market, L. Kuhlmann, T. Kislinger, R. Auer.* From the University of Ottawa, Ottawa, Ont. (Angka, Andre, Scaffidi, Market); the University of Toronto, Toronto, Ont. (Kuhlmann, Kislinger); and the Ottawa Hospital Research Institute, Ottawa, Ont. (Jeong, Auer).

Immunosuppression following curative cancer surgery is multifaceted but ultimately predisposes patients to postoperative infections and cancer recurrence. We have previously demonstrated, in murine studies, that myeloid-derived suppressor cells (MDSCs) play a major role in mediating postoperative immunosuppression. These surgery-induced MDSCs were shown to be directly responsible for postoperative natural killer cell dysfunction and increased metastases. We hypothesize that targeting surgery-induced MDSCs in cancer patients will improve postoperative immune function and cancer outcomes. Unfortunately, human MDSCs are challenging to define and surgery-induced MDSCs have not been previously characterized. To investigate unique surface markers on surgery-induced MDSCs, patients who underwent cancer surgery ($n = 28$) at a university-affiliated hospital were prospectively enrolled. Peripheral blood mononuclear cells were isolated before and after surgery and assessed for common human MDSC markers (CD33, CD11b, CD14, CD15, HLA-DR, CD124). We observed a large and consistent increase (2.4 fold, $p < 0.0001$) in monocytic-MDSCs (Mo-MDSCs, CD33+/CD14+/CD15lo/Lin-), with an immature phenotype (78.7% HLA-DRlo) on postoperative day 1 (POD1). These POD1 MDSCs potently suppress natural killer cell cytotoxicity ex vivo (53.6% suppression, $n = 19$, $p < 0.0001$) while the POD1 neutrophils (which also expand 2.7 fold) do not suppress. To further characterize these surgery-induced MDSCs, we performed a proteomics screen of cell surface proteins from sorted MDSCs before and after surgery, using a glyco-capture technique. Upon validating the proteins that were most upregulated following surgery, we report that a unique marker (CDX) was restricted to MDSCs and increased after surgery in all 5 patients tested (44.7%–67.9%, $p = 0.06$). This is a provocative finding as CDX expression on cancer cells is associated with immune suppression, including NK cell dysfunction through binding of inhibitory receptors. This study provides characterization of a previously unrecognized population of surgery-induced MDSCs and identifies a novel molecule for perioperative targeting.

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Adherence to sentinel lymph node biopsy guidelines in the management of cutaneous melanoma in the province of British Columbia. *S. Ollek, S. Minkova, K. Taqi, M. Martinka, N. Davis, A. McFadden, A. MacNeill, T. Hamilton, H. Stuart.* From the University of British Columbia, Vancouver, B.C.

Sentinel lymph node biopsy (SLNB) for melanoma plays a central role in determining prognosis and guiding treatment and surveillance strategies. The National Comprehensive Cancer Network (NCCN) guidelines recommend the use of SLNB in

select patients. The aim of this study was to determine the frequency of SLNB performed in patients with melanoma in British Columbia. A retrospective review was performed of patients diagnosed with clinically node-negative melanoma between January 2015 and December 2017 at a tertiary referral centre in BC. Patients were included if their melanoma had a Breslow depth greater than 0.75 mm and less than or equal to 0.75 mm in the presence of ulceration or a mitotic rate of 1/mm² or greater. Data on primary tumour characteristics and operative procedures were collected and the frequency of SLNB was determined. SLNB was considered to be indicated in any patient with clinical stage IB–IIC disease. A total of 759 patients were included with a median age at diagnosis of 66 years. Using the staging system of the 7th edition of the American Joint Committee on Cancer (AJCC) staging manual, the distribution of clinical stage at presentation for stages IA, IB and II was 12%, 46% and 42%, respectively. Overall, 88% (665) of patients had an indication for a SLNB, while only 49% (372) of patients underwent a SLNB. The SLNB was positive in 11.5% of patients. With a mean duration of follow-up of 105 weeks, the rates of local, regional and distant recurrence in those compliant versus noncompliant with SLNB recommendations were 1.6% versus 0.1%, 12.7% versus 7.3% and 9.4% versus 7.8% respectively. Using the staging system of the 8th edition of the AJCC staging manual, the proportion of patients with an indication for a SLNB rose to 99%. Variation exists in the frequency of SLNB. Appropriate staging is imperative to guide treatment and optimize outcomes. With the evolving field of adjuvant systemic treatment options, accurate staging is particularly relevant today.

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Breast cancer with supraclavicular and internal mammary node metastases: therapeutic options. *L. Meloche-Dumas, A. Christopoulos, T. Ayad, R. Younan, A. Kavian, K. Boulva, M. Liberman, A.-A. Bernard, J. Beaulieu, P. Borduas, N. El Sayed, X. Ma, E. Sédillot, É. Patocskai.* From the Centre hospitalier de l'Université de Montréal, Montreal, Que.

The optimal treatment of supraclavicular and internal mammary lymph node metastases from breast cancer remains controversial. This study aims to compare 2 main adjuvant therapies, namely radiotherapy and regional lymph node resection, in patients with this nodal involvement. This retrospective study included 31 patients with internal mammary and/or supraclavicular lymph node metastases between 2006 and 2017. Patients with concomitant distant metastases were excluded. A Cox regression model was used to compare the groups. Patients were 51 ± 13 years old at diagnosis. Luminal A or B breast cancer was found in 18/31 (58%), whereas the basal-like molecular subtype was present in 11/31 (35%) of pathologic specimens. Multimodal therapy with curative intent was administered to all patients, with neoadjuvant or adjuvant chemotherapy in 100% of patients, radiotherapy in 29/31 (94%) and hormone therapy in 20/31 (65%) patients. Seven patients underwent resection of internal mammary nodes at the time of mastectomy. Among these, no patient had locoregional recurrence at a median time of 14 months (range 3–55) and only 1/7 developed a distant recurrence. In the group that did not undergo lymph node dissection, 5/31 (16%) of patients had locoregional recurrence and 8/31 (26%) had distant recurrence, with a median follow-up of 24 months (range 5–121).

There was no statistical significance between the groups. This retrospective study did not demonstrate a statistically significant benefit to adding lymph node dissection to multimodal medical treatment in patients with supraclavicular and internal mammary nodal involvement breast cancer. Although mean follow-up was short, survival and recurrence-free survival in our cohort with aggressive multimodal treatment seemed superior to that of previous cohorts treated with chemotherapy alone. This paves the way to a prospective trial to assess determining factors that could play a role in choosing a more aggressive surgical therapy.

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Textbook outcomes and survival in patients with gastric cancer: an analysis of the population registry of esophageal and stomach tumours of Ontario (PRESTO). *J. Levy, V. Gupta, C. Allen-Ayodabo, E. Amirazodi, N. Jivraj, Q. Li, A. Mahar, O. Saarela, C. De Mestral, N. Coburn.* From the University of Toronto, Toronto, Ont. (Levy, Gupta, Jivraj, Saarela, De Mestral, Coburn); the Sunnybrook Research Institute, Toronto, Ont. (Allen-Ayodabo, Amirazodi); ICES, Toronto, Ont. (Li); and the University of Manitoba, Winnipeg, Man. (Mahar).

The association of textbook outcomes (TO), a novel composite of 8 surgical and postoperative metrics in gastric cancer surgery, with survival remains poorly defined. The objectives of this study were to describe the survival of patients with and without TO and measure the association between TO and long-term survival. This is a population-based retrospective cohort study using routinely collected administrative data and a province-wide chart review of pathology reports. Adults with nonmetastatic gastric adenocarcinoma who were treated with gastrectomy between 2004 and 2016 were identified from a population-based cancer registry. Vital status information was available until March 31, 2018. Postoperative outcomes were analyzed, and patients were assigned to TO versus non-TO groups. Median and 5-year survival rates were estimated using the Kaplan–Meier method. A marginal Cox proportional hazards model accounting for clustering and regressed on patient confounders was used to assess the association between achieving TO metrics and survival from gastrectomy date. In total, 2076 gastrectomy patients were identified, and TO was achieved in 21.6% of them ($n = 448$). Patients with TO were significantly younger, had fewer comorbidities, received neoadjuvant treatment and adjuvant treatment more often and had tumours that were less proximal, smaller and of lower T-stage. Median survival was greater in patients in the TO group compared with those in the non-TO group (166 mo [interquartile range (IQR) 38–NA] v. 49 mo [IQR 15–NA], log-rank $p < 0.001$). Patients in the TO group had a higher 5-year survival probability than patients in the non-TO group (68% v. 46%, log-rank $p < 0.001$). Following adjustments for covariates and clustering within hospital, TO was associated with a reduced risk of death (hazard ratio 0.62, 95% confidence interval 0.52–0.73, $p < 0.001$). TO is a composite outcome of several markers of surgical quality. Although uncommon, TO is associated with improved survival and should be considered the new benchmark in gastric cancer surgery.

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Withdrawn

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Symptomatic bowel complications in patients with metastatic cancer: comparison of surgical versus medical outcomes and development of a prediction model for successful surgical palliation. *H. Li, B. Dingley, O. Brandts-Longtin, J. Dobransky, L. Baker, C. Nessim.* From the University of Ottawa, Ottawa, Ont. (Li, Dingley, Brandts-Longtin, Baker); and The Ottawa Hospital, Ottawa, Ont. (Dobransky, Nessim).

Selecting appropriate management for metastatic cancer complications is crucial in prolonging survival, palliating symptoms and maximizing quality of life. To date, no studies have compared surgical versus medical management outcomes for bowel obstruction, bleeding or perforation in patients with metastatic cancer with all types of primaries. A prediction model for identifying patients who would most benefit from palliative bowel surgery is needed. A retrospective single-centre analysis evaluated and compared demographic, clinical and surgical variables and outcomes for patients managed medically or surgically, following presentation of malignant bowel obstruction (MBO), between 2008 and 2017. Mann-Whitney *U* test was used to compare continuous variables, the Fisher exact test was used for dichotomous variables and the log-rank (Mantel-Cox) test was used for comparison of survival curves between surgical and medical groups. In the surgical group, logistic regression identified predictors of survival greater than 3 months following MBO surgery. Among 402 patients, 144 (36%) were surgically managed and 258 (64%) were medically managed. The surgical group had statistically significantly higher survival at 3 months (68.4% [95% confidence interval (CI) 60.6%–76.2%] v. 34.9% [95% CI 28.8%–41.0%]) and 24 months (31.8% [95% CI 23.6%–40.0%] v. 8.7% [95% CI 4.78%–12.6%]) ($p < 0.001$). Median survival for the surgical group, 8 months (0–70), was statistically significantly longer than for the medical group, 1 month (0–87) ($p < 0.001$). Significant differences between the surgical and medical groups included survival, ascites, lymph node/soft tissue metastases, active treatment at acute presentation and disposition at discharge ($p < 0.05$). Statistically significant predictors for dying within the first 3 months in the surgical group included low albumin (odds ratio [OR] 0.711, $p = 0.036$) and diversion surgery (OR 28.822, $p = 0.026$) (R^2 0.612), and in the medical group they included the presence of peritoneal metastases (OR 4.262, $p = 0.001$) and the absence of active treatment at acute presentation (OR 0.0506, $p = 0.023$) (R^2 29.5). Palliative bowel surgery may result in better short- and long-term survival than medical management for patients presenting with bowel obstruction, perforation or bleeding owing to metastatic cancer. Predictors of survival greater than 3 months following MBO surgery were combined to form a strong prediction model. We hope to develop and validate a simple, usable clinical risk score to appropriately select patients for palliative surgical management.

CANADIAN HEPATO-PANCREATO-BILIARY ASSOCIATION

01

Management of high patient-reported pain scores in noncurative pancreatic adenocarcinoma: a population-based analysis. *S. Tung, N. Coburn, L. Davis, A. Mahar, S. Myrehaug, H. Zhao, C. Earle, A. Nathens, J. Hallet.* From the University of Toronto, Toronto, Ont. (Tung); Sunnybrook Health

30

Rejected

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Gastric cancer biopsies show distinct biomarker profiles compared with normal gastric mucosa in Canadian patients. *D. Skubleny, E. Boivin, S. Bhavanam, S. Garg, R. McLean, M. McCall, D. Schiller, G. Rayat.* From the University of Alberta, Edmonton, Alta.

Gastric cancer (GC) is the third most common cause of cancer-related death worldwide. Currently little is known about GC biomarker expression within Canadian populations despite this group possessing a worse 5-year survival than Asian populations. The overall goal of this study is to characterize biomarkers within the Canadian population. Adult patients diagnosed with stage I–IV GC were included and patients with an identified or suspected inherited oncogenic germline mutation were excluded. Endoscopic biopsies were obtained from GC and normal adjacent gastric mucosa. The biopsies were processed for immunostaining for APJ, Galectin-3, Actin-related protein 2 (ARP-2), ARP-2/3 inhibitory molecule (Arpin), XPF, MutL homologue 1 (MLH-1), human epidermal growth factor receptor 2 (HER2) and E-cadherin. The area and intensity of immunostaining was assessed by light microscopy and expression of the molecules was quantified using a 4-point scale. A cumulative score for each sample was derived from the sum of the intensity and area of immunostaining scores. Data were analyzed using a Mann-Whitney test. Fifteen GC patients aged 45–80 years were identified, consisting of 11 men and 4 women. Stage IV disease was present in 4 patients. The location of GC was anatomically heterogeneous consisting of 6 gastresophageal junction, 5 distal, 2 proximal and 2 linitis plastica-type cancers. Lauren classification identified 7 intestinal-type and 8 diffuse-type cancers and all cancer was moderately or poorly differentiated. The cumulative immunostain score in GC mucosa for APJ, ARP-2, HER2 and E-cadherin was significantly ($p < 0.05$) decreased compared with normal tissues. The expression of Galectin-3 was significantly ($p < 0.0001$) increased in cancer tissue compared with normal mucosa. These molecules probably play a role in the establishment and growth of GC in Canadian patients. Studies on the expression of these molecules in additional patients and their relationship to clinicopathologic indices are ongoing.

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Withdrawn

Sciences Centre, Toronto, Ont. (Coburn, Davis, Myrehaug, Earle, Nathens, Hallet); the University of Manitoba, Winnipeg, Man. (Mahar); and ICES, Toronto, Ont. (Zhao).

Pain is a common debilitating symptom in pancreatic adenocarcinoma (PA). Data regarding multidisciplinary pain management

for patients reporting high pain scores (HPS) are lacking. We examined the use of, and factors associated with, pain-directed interventions for HPS in noncurative PA. We linked administrative databases and identified patients with nonresected PA diagnosed in 2010–2016 who reported at least 1 patient-reported Edmonton Symptom Assessment System (ESAS) score. HPS was defined as ESAS greater than 4 out of 10. Outcomes were pain-directed interventions: opiates (assessed in patients > 65 yr old with universal drug coverage), nerve block and radiation therapy around the time of HPS. We also examined reduction in pain score (> 1 point) following pain-directed intervention. Modified Poisson regression examined factors associated with use of opiates and other pain-directed interventions. Of 2623 patients, 1621 had HPS at a median of 38 days (interquartile range 21–69) after diagnosis. Of those with HPS, 75.6% received opiates ($n = 688/910$), 13.5% radiation ($n = 219/1621$) and 1.2% nerve block ($n = 19/1621$). The pain score decreased in 62.2% of patients after opiates, 73.8% after radiation and 100% after nerve block. On multivariable analysis, no patient factor (age, sex, comorbidity burden, rurality, income quintile, diagnosis year) was associated with receipt of a nonopiate pain-directed intervention for HPS. In patients older than 65 years, more advanced age was associated with lower odds of opiate use. Opiates are the most common pain-directed intervention for noncurative PA. Despite their effectiveness in reducing high pain scores, radiation therapy and nerve blocks are seldomly used. The lack of association of nonopiate pain-directed interventions with patient factors points toward decision-making dependent on established practice patterns. These data should encourage more consideration of nonopiate interventions and ensuring that patients have access to all appropriate pain-directed interventions.

02

Outcomes of liver donors with a future liver remnant less than or equal to 30%: a matched-cohort study. *J. Zuckerman, A. Gorgen, S. Acuña, N. Goldaracena, M. Cattral, A. Ghanekar, I. McGilvray, D. Grant, G. Sapisochin.* From the University of Toronto, Toronto, Ont.

Living donor liver transplantation (LDLT) is an accepted strategy to reduce waiting list mortality. The main concern with LDLT is the risk to the donor. Given the potential risk of liver insufficiency, most centres will accept only candidates with a future liver remnant (FLR) above 30%. Outcomes of donors with a FLR below 30% are unknown. The goal of this study was to compare outcomes between live liver donors undergoing right hepatectomy with future liver remnants (FLR) less than or equal to 30% and greater than 30%. A prospective database of live donors who underwent right hepatectomy between April 2000 and June 2018 was retrospectively analyzed. Remnant liver volumes were estimated using computed tomography (CT) volumetry. Donors with a FLR less than or equal to 30% were matched 1:2 on the basis of age, sex, body mass index and era of transplant to donors with a FLR greater than 30%. Postoperative complications and posthepatectomy liver dysfunction were compared between the groups. Six hundred and four live donors were identified, 28 (4.6%) of whom had a FLR less than or equal to 30%. Twenty-eight cases were successfully matched with 56 controls; the matched cohorts were mostly similar in terms of donor and graft characteristics. Median FLR was 29.8 (interquartile range [IQR] 28.9–30.0) and 35.2 (IQR 33.0–37.9) in each group, respectively. Median follow-up was 36.5 months (IQR 11.8–66.1 mo).

Postoperative outcomes were similar between groups. No difference was observed in overall complication rates (FLR \leq 30%: 32.1% v. FLR > 30%: 28.6%; odds ratio [OR] 1.22, 95% confidence interval [CI] 0.46–3.27) or major complication rates (FLR \leq 30%: 14.3% v. FLR > 30%: 14.3%; OR 1.17, 95% CI 0.33–4.10). Posthepatectomy liver failure was rare, and no difference was observed (FLR \leq 30%: 3.6% v. FLR > 30%: 3.6%; OR 1.09, 95% CI 0.11–11.1). Right hepatectomy for live donation may be performed with a FLR less than or equal to 30% without increasing the donor morbidity in selected cases.

03

The applicability of intraoperative fluorescent imaging with indocyanine green in hepatic resection for malignancy: a systematic review and meta-analysis. *K. Purich, J. Dang, A. Poonja, W. Sun, D. Bigam, D. Birch, S. Karmali.* From the University of Alberta, Edmonton, Alta.

Intraoperative use of fluorescent imaging during hepatic resection has been shown to have the potential to identify additional malignant tumours, providing an increased chance for complete tumour resection. Indocyanine green (ICG) is a common dye used intraoperatively. A systematic review and meta-analysis on the diagnostic ability of ICG when visualized with intraoperative fluorescent imaging for the detection of hepatic malignancy was needed. Manuscript selection criteria included: (a) liver resection for malignant disease, (b) ICG injected pre- or intra-operatively, (c) use of infrared electronic endoscopy or near-infrared fluorescent imaging intraoperatively to identify lesions, (d) patient age 18 years and older, (e) sample size greater than 5 patients, (f) human studies only and (g) English studies only. Results obtained from ICG fluorescent imaging were compared with intraoperative ultrasound and pathology. Outcome measures included the sensitivity of intraoperative fluorescent imaging with ICG for the detection of hepatic malignancy and the number of cases where ICG identified additional malignant lesions. Twenty-one studies and 841 patients were included in our systematic review. Seven studies were included in the meta-analysis (325 patients). The pooled sensitivity of intraoperative fluorescent imaging with ICG was 0.78 (0.74–0.82). Pooled heterogeneity (I^2) was 78.7%. Intraoperative fluorescent imaging with ICG was unable to identify tumours seated deep within the liver. ICG detected new malignant tumours that were not detected by conventional means including intraoperative ultrasound in 42 of 362 patients across 13 studies. Intraoperative fluorescent imaging using ICG may lead to the identification of a greater number of superficial hepatic tumours. However, the sensitivity of ICG-related intraoperative fluorescent imaging is low, and consequently ICG must be used in combination with current intraoperative tumour identification methods. A prospective trial with an intraoperative ICG fluorescent imaging treatment group could be used to observe survival and recurrence rates, which would help establish the clinical applicability of this technology in hepatic resection.

04

Impact of adjuvant chemotherapy completion on outcomes following pancreaticoduodenectomy for pancreatic ductal adenocarcinoma. *R. Liu, S. Patel, C. Garcia-Ochoa, D. Breadner, S. Welch, K. Leslie.* From Western University, London, Ont.

Many patients who undergo pancreaticoduodenectomy with curative intent for pancreatic ductal adenocarcinoma do not complete the planned adjuvant chemotherapy regimen. Understanding the impact of partial treatment and what factors lead to reduced chemotherapy completion rates will guide management decisions in this patient population. A retrospective cohort analysis was performed using a clinical database from a tertiary referral hospital and included patients undergoing pancreatic resection for ductal adenocarcinoma from 2007 to 2016. Fifty-four patients who completed planned adjuvant chemotherapy were compared with 44 who did not. Overall survival and disease-free survival (DFS) were analyzed and a logistic regression analysis was performed to evaluate what factors may influence chemotherapy completion rates. DFS at 1 year was significantly improved with completion of chemotherapy (HR 0.225, $p < 0.01$). However, this effect was no longer seen when overall DFS was evaluated (HR 0.901, $p = 0.76$). There were no measurable differences in 1-year (HR 0.997, $p = 0.99$) or overall survival (HR 0.993, $p = 0.98$) between these groups. Chemotherapy completion rates were reduced with increasing age ($p < 0.01$) and improved with the addition of adjuvant radiation ($p < 0.01$). Perioperative complications, pancreatic fistula, length of stay and time from resection to first chemotherapy treatment did not have a significant impact on chemotherapy completion rates. Subgroup analysis showed that in patients who received adjuvant radiation, not completing chemotherapy was associated with a significantly worse 1-year DFS (HR 0.100, $p < 0.01$). Completion of adjuvant chemotherapy in patients undergoing resection for ductal adenocarcinoma appears to have a DFS benefit within the first year, but its effect is lost beyond this point. These results suggest that complete and partial adjuvant chemotherapy have similar long-term benefits. The influence of radiation on DFS and overall survival needs to be further examined.

05

Primary hepatic acinar cell carcinoma. *J. Grab, D. Skubleny, D. Rayner, N. Kneteman.* From the University of Alberta, Edmonton, Alta.

A large mass identified as a hepatic acinar cell carcinoma (ACC) was incidentally discovered in a clinically asymptomatic 80-year-old man. Gadolinium-enhanced magnetic resonance imaging (MRI) revealed a heterogenous, cystic $7.7 \times 11.1 \times 10.4$ cm tumour occupying hepatic segments II and III that was not present on abdominal MRI or ultrasound just 19 months earlier. No pancreatic, salivary gland or other primary and metastatic lesions were discernable on multiple computed tomography (CT), MRI and positron emission tomography (PET) scans. The mass demonstrated mild diffuse enhancement in hepatic arterial phase with minimal portal venous washout in a liver without cirrhotic features. A central stellate T2-hyperintense necrotic scar and outer capsule were also apparent. The predominant differential diagnosis on imaging included benign focal nodular hyperplasia (FNH) or hemangioma but also malignant fibrolamellar hepatocellular carcinoma (HCC) or cholangiocarcinoma. The patient underwent a formal left hepatic lobectomy and tolerated the procedure well. The tumour immunophenotype was atypical for the presumptive diagnoses (Hep Par 1 and Cytokeratin 19 double negative) and required extensive morphologic workup by electron microscopy. Acinar cell differentiation including the presence of intracytoplasmic microvilli definitively diagnosed ACC, but strangely confined

to the liver. The patient had a follow-up PET scan 3 and 10 months postoperatively, which corroborated no distant disease or local recurrence. Primary hepatic ACC may easily be confused with other benign or malignant hepatic masses on the basis of non-specific imaging patterns. Specifically, the presence of a central scar without risk factors for HCC can favour a diagnosis of FNH and is important to distinguish as this lesion typically requires no further treatment. This may have previously led to poor patient outcomes because of misdiagnosis of primary hepatic ACC. The aim of this study is to further delineate the characteristics of this rare malignant tumour originating from a unique location.

06

Laparoscopic distal pancreatectomy provides equivalent oncologic outcomes for pancreatic ductal adenocarcinoma. *M. Driedger, S. Cleary, M. Kendrick.* From the Mayo Clinic, Rochester, Minn.

As minimally invasive surgery approaches continue to advance within the field of hepato-pancreato-biliary surgery, it is imperative to ensure equivalent oncologic outcomes can be achieved. Limited data exist for patients undergoing laparoscopic distal pancreatectomy for left-sided pancreatic ductal adenocarcinoma (PDAC), particularly in the setting necessitating multivisceral and vascular resection. Consecutive cases of distal pancreatectomy (DP) for PDAC were reviewed retrospectively at a single high-volume institution over a 13-year period (2005–2018). Two-way statistical analyses were used. Multivariable analysis of survival was performed using a Cox proportional hazards model. Statistical significance was defined as $p < 0.05$. A total of 218 patients underwent DP: 84 underwent laparoscopic DP (LDP) and 134 underwent open DP (ODP). The rate of open conversion was 4.8%. No statistical difference existed for patient demographics or tumour characteristics. Operative variables including multivisceral (16.6% v. 15.7%) and vascular resection (15.5% v. 17.9%) as well as node harvest (17.4 v. 15.9, $p = 0.24$) and margin positivity (2.4% v. 5.2%, $p = 0.27$) were comparable for LDP and ODP. Patients undergoing LDP experienced decreased blood loss (356.8 mL v. 786.2 mL, $p < 0.001$) and a trend toward a decreased rate of transfusion (9.5% v. 17.9%, $p = 0.089$). No statistical differences were appreciated for inpatient morbidity, pancreatic fistula and mortality. Median length of stay was decreased (5 v. 7 d, $p = 0.048$). Mean duration of follow-up was equivalent (LDP 19.3 mo, ODP 22.1 mo, $p = 0.41$). Median survival (LDP 23 mo, ODP 25 mo, $p = 0.72$), as well as 5-year (LDP 27.0%, ODP 16.3%) survival were statistically equivalent. Multivariate analysis revealed predictors of survival to be T-stage ($p = 0.032$), tumour diameter ($p < 0.001$) and receipt of adjuvant therapy ($p = 0.001$). This is the largest single-institution, North American experience of LDP for PDAC that provides direct comparison with a contemporary cohort of ODP. These results demonstrate that in a tertiary centre, a laparoscopic approach can achieve equivalent oncologic outcomes even in the setting of borderline resectable or locally advanced disease.

07

Passive versus active intraabdominal drainage following pancreatic resection: Does a superior drainage system exist? A systematic review and meta-analysis. *L. Baker, H. Smith, A. Davis, J. Abou-Khalil, G. Martel, F. Balaa, K. Bertens, L. Park.* From the University of Ottawa, Ottawa, Ont.

Controversy exists regarding the use of passive gravity (PG) versus closed suction (CS) drainage systems following pancreatic resections, and their impacts on the development of clinically relevant postoperative pancreatic fistula (CR-POPF). The objective of this systematic review was to identify and compare the incidence of adverse events and resource utilization associated with PG and CS drainage following pancreatic resections. Medline, Embase and Central databases were searched from inception to January 2019. Published studies comparing PG and CS drains following pancreatic resections were identified. The primary outcome was CR-POPF. Secondary outcomes included delayed gastric emptying (DGE), intraabdominal infections, postpancreatectomy hemorrhage (PPH), hospital readmission and mortality. Where appropriate, data were pooled using the random-effects model and reported as odds ratios (ORs). One randomized controlled trial (RCT) and 4 cohort studies involving 4351 patients were included. One study ($n = 181$) reported a significant decrease in CR-POPF with CS, while the remaining studies found no differences. Considerable between-study variability was identified, namely differences in the model of drain employed, drain removal protocols and the use of perioperative adjuncts to mitigate CR-POPF. Meta-analysis ($n = 5$ studies) found no difference in the odds of developing CR-POPF between CS and PG systems (OR 0.62, $p = 0.21$, $I^2 = 86\%$). Subgroup analysis for pancreaticoduodenectomy markedly reduced heterogeneity (OR 1.06, $p = 0.64$, $I^2 = 0\%$) while subgroup analysis for distal pancreatectomy maintained high heterogeneity. PG was associated with decreased odds of DGE (OR 1.29, $p = 0.04$, $I^2 = 0\%$) in pancreaticoduodenectomy and intraabdominal infections (OR 1.38, $p = 0.01$, $I^2 = 0\%$). There were no differences between groups for other secondary outcomes. Current evidence suggests that the type of drainage system may not affect the risk of CR-POPF following pancreatic resection. However, high heterogeneity between studies limits the interpretation of results. Possible superiority of PG drains in decreasing DGE and intraabdominal infections merits further exploration. Higher quality RCTs are required to draw more robust conclusions.

08

Low yield of preoperative MRCP and ERCP in the management of low-intermediate suspicion choledocholithiasis. *Y. Wang, D. Mergui, J. Pelletier, T. Vanounou.* From McGill University, Montreal, Que. (Wang, Pelletier, Vanounou); and the Jewish General Hospital, Montreal, Que. (Mergui).

The role of preoperative magnetic resonance cholangiopancreatography (MRCP) and endoscopic retrograde cholangiopancreatography (ERCP) in the management of patients with low-intermediate suspicion choledocholithiasis remains controversial. We conducted a single-centre retrospective review of all patients with low-intermediate suspicion choledocholithiasis (bilirubin between 30–70 $\mu\text{mol/L}$ and/or common bile duct dilatation without evidence of definitive choledocholithiasis on ultrasound or computed tomography) undergoing nonelective laparoscopic cholecystectomy between 2013 and 2017. Patients were classified as undergoing upfront laparoscopic cholecystectomy (LC), laparoscopic cholecystectomy with intraoperative cholangiogram (LC-IOC), MRCP-first or ERCP-first. A total of 105 patients were included: 61 in the LC group, 10 in the LC-IOC group, 18 in the MRCP-first group and 16 in the ERCP-first group. In the

MRCP-first group, 5 (27.8%) patients had a positive MRCP, of whom 1 subsequently had a positive ERCP. Of the 16 patients in the ERCP-first group, 1 (6.3%) had a positive ERCP. Three (4.9%) patients in the LC group required a postoperative ERCP for retained stones. One (10%) patient in the LC-IOC group had a positive cholangiogram. The LC group had a significantly shorter length of stay until OR (LOS-OR) than the MRCP-first group (2.59 v. 4.83 d, $p = 0.001$) and the ERCP-first group (2.59 v. 4.25 d, $p = 0.042$). LOS-OR for the LC-IOC group was also significantly shorter than for the MRCP-first group (0.90 v. 4.83 d, $p < 0.001$) and the ERCP-first group (0.90 v. 4.25 d, $p = 0.002$). There were no differences in 90-day complications. In patients with low-intermediate suspicion choledocholithiasis, preoperative MRCP and ERCP carry a low diagnostic yield and are associated with longer hospital admissions. Judicious use of these investigations is warranted to deliver cost-effective care.

09

Pancreatic cancer resection rates and survival in the United States and Canada. *J. Levy, M. Guttman, V. Gupta, Y. Liu, J. Hallet, N. Coburn.* From the University of Toronto, Toronto, Ont. (Levy, Guttman, Gupta, Hallet, Coburn); and ICES, Toronto, Ont. (Liu).

Population-based economic analyses demonstrate a 50% increase in health care costs in the United States compared with Canada for the treatment of pancreatic cancer. The objectives of this study were to compare resection rates and survival in patients with pancreatic adenocarcinoma in the US and Canada. Adult patients with pancreatic adenocarcinoma between 2004 and 2014 were identified from the Surveillance, Epidemiology, and End Results (SEER) cancer registry and a provincial cancer registry. Database linkage was used to harmonize all demographic, clinical and survival data. Patients were followed up until Dec. 31, 2015. Survival was estimated using the Kaplan–Meier method. Resection rates and survival were measured in each patient group, and survival was further stratified by resection status. In total, 80 372 American and 12 590 Canadian patients were identified from the SEER registry and the provincial cancer registry, respectively. Median survival in the US group compared with the Canadian group was 4 months (interquartile range [IQR] 1–11) versus 3 months (IQR 1–10). Resection rates in the US and Canada were 15% and 12%, respectively. Median survival in resected patients was 18 months (IQR 9–37) in the US compared with 19 months (IQR 10–41) in Canada. Survival was worse in the nonresected group and was estimated to be 3 months (IQR 1–8) in both geographic regions. Despite increased health care expenditures and resection rates, survival outcomes in these US and Canadian populations were similar. To create a more sustainable health care system, the costs as well as the outcomes of care should be further examined.

10

Prognostic value of immune heterogeneity in colorectal cancer liver metastases. *D. Henault, P. Saint-Hilaire, D. Stephen, N. Messaoudi, M. Plasse, A. Roy, M. Dagenais, R. Létourneau, R. Lapointe, F. Vandenbroucke-Menu, G. Soucy, S. Turcotte.* From the Université de Montréal, Montreal, Que.

In patients with multiple colorectal cancer liver metastases (CRLMs), tumour heterogeneity is a therapeutic challenge and its prognostic value has been little studied. In this study, we evaluated the prognostic value of inpatient CRLM heterogeneity assessed by immune scoring and pathologic response to chemotherapy in patients who underwent resection with curative intent. Immune scoring, measured by automated immunohistochemistry quantification of tumour-infiltrating CD3+ T cells and tumour expression of class I major histocompatibility complexes (MHC-I), was obtained with tissue microarray analysis of 220 CRLMs resected in 97 patients prospectively followed (2011–2014). pathologic tumour regression grade (TRG) in response to chemotherapy was scored on whole tumour slides. The association between these variables, time to recurrence (TTR) and disease-specific survival (DSS) was tested with the log-rank test and Cox regression modelling. Most patients (93.8%) in this cohort received perioperative chemotherapy. We performed immune scoring of 2 CRLMs in 71 patients (73.2%) and of 3 CRLMs in 26 (26.8%). Inpatient CRLM immune heterogeneity was seen in 68 (70.1%) patients, defined as nonconcordant high versus low CD3 and MHC-I levels between metastases. Immune heterogeneity compared with homogeneity was associated with shorter median TTR (12 v. 30 mo, $p = 0.0018$) and DSS (48 mo v. not reached, $p = 0.0009$). Inpatient CRLM TRG heterogeneity was seen in 34 (35.8%) patients and was not significantly associated with poorer outcomes. Immune heterogeneity was strongly and independently associated with shorter TTR (HR 2.612, $p = 0.001$) and DSS (HR 3.601, $p = 0.004$) in a multivariate analysis controlling for standard clinicopathological variables. Inpatient CRLM immune heterogeneity may be superior to heterogeneity in pathological response to chemotherapy for prognostication and may help individualize follow-up or adjuvant therapy in patients with metastatic colorectal cancer undergoing surgery with curative intent.

11

Impact of intraoperative hypovolemic phlebotomy on blood loss and perioperative transfusion in patients undergoing hepatectomy for cancer. *M. Al Khaldi, F. Gryspeerd, C. Bouchard, M. Dagenais, F. Vandenbroucke-Menu, M. Plasse, L. Massicotte, B. Rioux-Massé, A. Roy, R. Létourneau, F. Carrier, S. Turcotte, R. Lapointe.* From the Centre hospitalier de l'Université de Montréal, Montreal, Que.

Minimizing intraoperative blood loss (IOBL) and allogeneic blood transfusions are important components in the management of patients undergoing hepatectomy for cancer. We assessed whether intraoperative hypovolemic phlebotomy (HP) during hepatectomy was associated with lower IOBL and perioperative transfusion rates, and whether these variables were associated with oncological outcomes. We performed a retrospective analysis of a prospective database complemented with transfusion and anesthesiologic data of patients operated on for liver malignancies at our institution (January 2011 to June 2017). We compared characteristics of patients who did not undergo HP with those of patients who did and tested associations of selected variables with outcomes (log-rank test and Cox regression modelling). Intraoperative HP was used in 520 (76.0%) of the 664 patients included in this study. The median phlebotomy volume was 400 mL (range 50–900 mL), and the median volume per patient weight was 5.3 mL/kg (range 0.5–30.1 mL/kg). Patients with large HP (> 5.3 mL/kg) had lower IOBL than those with smaller HP

(507 mL v. 640.2 mL, $p = 0.008$). The perioperative transfusion rate was 14.6% in patients when HP was used, compared with 22.2% ($p = 0.022$) when HP was not used. The transfusion rate was lower in patients in the HP group than in patients in the non-HP group even though more major hepatectomies (≥ 4 segments) (36.0% v. 27.1%, $p = 0.028$) were done in the HP group. In patients in the HP group predicted to have a 54.8% transfusion risk according to the “3-point risk score,” only 23.8% were transfused. IOBL and transfusions were not associated with recurrence-free or disease-specific survival. Intraoperative HP was associated with low perioperative transfusions, more strikingly in high transfusion risk patients. This has a significant impact on blood management, while transfused patients have similar oncological outcomes compared with nontransfused patients. Prospective studies are needed to determine whether HP is superior to other anesthesiologic techniques in reducing IOBL and transfusions.

12

Prediction of postoperative pancreatic fistula following pancreatectomy: a systematic review of clinical tools. *V. Zuk, E. Theodosopoulos, J. Abou-Khalil, J. Pelletier, K. Bertens, M. Segedi, J. Ouellet, J. Hallet.* From the University of Toronto, Toronto, Ont. (Zuk, Theodosopoulos, Hallet); the University of Ottawa, Ottawa, Ont. (Abou-Khalil, Bertens); McGill University, Montreal, Que. (Pelletier); the University of British Columbia, Vancouver, B.C. (Segedi); and Laval University, Québec, Que. (Ouellet).

Postoperative pancreatic fistula (POPF) is a main driver of morbidity and mortality following pancreatectomy. Although predictive scores have been suggested, little is known about their accuracy and clinical utility. We aimed to evaluate the quality of predictive tools for POPF following pancreatectomy. We systematically searched the literature for studies reporting development, validation or clinical application of tools predicting POPF following pancreatectomy. Data abstraction followed the Critical Appraisal and Data Extraction for Systematic Reviews of Prediction Modelling Studies (CHARMS) checklist, and risk of bias was appraised using the Prediction Model Risk of Bias Assessment Tool (PROBAST). We identified 34 studies reporting on 25 predictive tools. All studies used the International Study Group of Pancreatic Fistula grading classification on patients operated between 1981 and 2017. They included 2–7 prognostic factors; duct width, pathology, body mass index and pancreatic texture were most commonly included across models. Additional intra- and post-operative factors were also included and altered the setting for use of the tools. Eight models were internally validated, using validation data sets ($n = 6$) and k-fold cross-validation ($n = 2$). Eight tools underwent external validation. Risk of bias was rated high for all studies, owing to prognostic factor selection using univariate analysis, lack of reporting of frequency and handling of missing data, and small sample sizes lacking a sufficient number of events. Existing predictive models cannot be confidently used to predict POPF following pancreatectomy in current practice, owing to methodological flaws limiting their accuracy and generalizability. Selection of prognostic factors using clinical reasoning and focus on preoperative variables could improve face validity and clinical application. To support individualized risk stratification and clinical decision-making, existing tools require external validation and higher quality tools could be developed and validated using gold standard methodology.

13

The impact of preoperative frailty in liver resection: an analysis of the American College of Surgeons' National Surgical Quality Improvement Program (ACS NSQIP). *C. Garcia-Ochoa, E. McArthur, K. Leslie, A. Skaro.* From the London Health Sciences Centre, London, Ont. (Garcia-Ochoa, Leslie, Skaro); and ICES, Toronto, Ont. (McArthur).

Our aim was to determine the impact of preoperative frailty on morbidity and mortality after liver resections in a contemporary cohort. We identified patients who underwent liver resection for any cause within the ACS NSQIP registry from 2014 to 2017 and compared the risk of 30-day morbidity and mortality between patients with different levels of preoperative frailty. We stratified the level of frailty using the modified frailty index (mFI-5), with 0 denoting no frailty and 5 denoting the highest level of frailty. This index includes previous chronic obstructive pulmonary disease, congestive heart failure, hypertension, diabetes and partial/total dependence. We performed an adjusted Poisson regression model to estimate the risk ratio of postoperative complications (composite outcome), prolonged length of stay (> 75th percentile) and mortality within 30 days within different levels of frailty. We stratified the 15 748 patients who had a liver resection into 7823 (50%) with a mFI-5 of 0, 5468 (35%) with a mFI-5 of 1 and 2428 (15%) with a mFI-5 of 2 or more. Patients with a mFI-5 of 0 and 1 had a total of 1850 (24%) and 1484 (27%) complications, respectively, compared with 755 (31%) for those with a mFI-5 of 2 or more (risk ratio 1.60, 95% confidence interval [CI] 1.09–2.36, $p = 0.01$). Patients with a mFI-5 of 2 or more had a 78% increased risk for prolonged length of stay and an almost 3 times higher risk (2.7, 95% CI 1.9–3.8, $p < 0.01$) of mortality within 30 days. Preoperative frailty was associated with an increased risk of morbidity and mortality in patients undergoing liver resection for any cause. In patients with higher preoperative frailty scores, pre-conditioning should be considered before liver resection to potentially reduce the incidence of these complications.

14

Topical agents as adjuncts in pancreatic surgery for prevention of postoperative pancreatic fistula: a systematic review and meta-analysis. *E. Theodosopoulos, V. Zuk, J. Abou-Khalil, M. Segedi, K. Bertens, J. Ouellet, J. Hallet, J. Pelletier.* From the University of Toronto, Toronto Ont. (Theodosopoulos, Zuk, Hallet); the University of Ottawa, Ottawa, Ont. (Abou-Khalil); the University of British Columbia, Vancouver, B.C. (Segedi); Western University, London, Ont. (Bertens); Laval University, Québec, Que. (Ouellet); and McGill University, Montreal, Que. (Pelletier).

Many strategies to reduce postoperative pancreatic fistula (POPF) following pancreatectomy have been suggested, but the best approach remains debated. We reviewed the effect of adjunct topical agents on POPF following pancreatectomy. We conducted a systematic review of randomized controlled trials (RCTs) and nonrandomized studies (NRSs) comparing topical agents to no adjuncts for pancreatectomy. The outcome of interest was overall POPF and clinically relevant POPF (CR-POPF) defined by the International Study Group of Pancreatic Surgery. We searched electronic databases and the grey literature and included articles' bibliographies. Pooled risk estimates were

computed separately for RCTs and NRSs using random-effects methods. We included 29 studies reporting on the use of either fibrin products, autologous patches or polyglycolic acid (PGA) mesh for pancreatectomy. No intervention demonstrated a difference compared with control for overall POPF in RCTs. Fibrin glue had a risk ratio of 1.02 (95% confidence interval [CI] 0.90–1.15) in 13 RCTs including 1658 patients. Autologous patches had a risk ratio of 0.72 (95% CI 0.32–1.62) in 2 RCTs including 222 patients. PGA mesh had a risk ratio of 1.20 (95% CI 0.87–1.67) in 97 patients. No difference was identified in CR-POPF with a risk ratio of 1.00 (95% CI 0.77–1.29) for fibrin glue, a risk ratio of 2.71 (95% CI 0.81–9.11) for autologous patches and a risk ratio 0.40 (95% CI 0.16–1.02) for PGA mesh, for RCTs. Pooled risk estimates for NRSs similarly showed no difference in overall POPF and CR-POPF for fibrin glue and autologous patches. Four NRSs on PGA mesh showed a benefit in overall POPF (risk ratio 0.75, 95% CI 0.62–0.91) and CR-POPF (risk ratio 0.48, 95% CI 0.28–0.85). No difference was observed in POPF following pancreatectomy when fibrin glue and autologous patches were used, compared with no intervention. The suggested reduction in POPF with PGA mesh in NRSs was not identified with the RCT design. The role of topical agent adjuncts for pancreatectomy remains undetermined and further prospective randomized evidence is warranted.

15

Phlebotomy resulting in controlled hypovolemia to prevent blood loss in major hepatic resections (PRICE-1): a feasibility randomized controlled trial. *L. Baker, C. Wherrett, D. Fergusson, E. Saidenberg, A. Workneh, K. Gadbois, R. Jee, J. McVicar, P. Rao, C. Thompson, P. Wong, J. Abou-Khalil, K. Bertens, F. Balaa, G. Martel, S. Saeed.* From The Ottawa Hospital, Ottawa, Ont. (Baker, Wherrett, Workneh, Gadbois); and the University of Ottawa, Ottawa, Ont. (Fergusson, Saidenberg, Jee, McVicar, Rao, Thompson, Wong, Abou-Khalil, Bertens, Balaa, Martel, Saeed).

Major liver resection remains associated with the potential for significant blood loss and transfusion. Observational data support the use of intraoperative hypovolemic phlebotomy (HP), without volume replace, to decrease blood loss and transfusion. A feasibility randomized controlled trial (RCT) comparing HP with the standard of care was undertaken to inform a future multicentre trial. A RCT was carried out (June 2016 to January 2018), comparing HP with the standard of care. Patients undergoing major liver resection or posterior sectionectomy were eligible. Patients were randomly assigned to a group intraoperatively, before liver transection. The surgical team, nurses and patient were blinded to the intervention. Feasibility and estimated blood loss (EBL) were coprimary outcomes. Secondary outcomes included safety, morbidity and mortality, physiologic parameters and transfusion. Sixty-two patients were randomly assigned to the HP ($n = 31$) and control groups ($n = 31$). The groups were evenly matched. Median EBL was 761 mL (451–1100) in the HP group and 872 mL (557–1248) in the control group ($p = 0.458$). All feasibility end points were met: 89% of eligible patients consented, 3.1 patients/month were randomly assigned to a group, surgeon blinding was maintained (98%) and HP was successfully (mean phlebotomy 607 ± 167 mL). Blinded surgeon perception questionnaires revealed ease of

resection favoured the HP group in 52% versus 32% ($p = 0.0613$). HP was correctly predicted in 65% of patients in the HP group and incorrectly predicted in 32% of patients in the control group ($p = 0.0110$, accuracy 66%). Overall complication (HP 32% v. control 48%, $p = 0.196$) and major complication (HP 32% v. control 48%, $p = 0.196$) rates were comparable. No difference was noted in the proportion of patients receiving a blood transfusion. This trial successfully met its feasibility end points but did not identify a significant difference in estimated blood loss. Safety end points were comparable between HP and the standard of care. The success of this trial justifies pursuit of a multicentre trial (PRICE-2) powered to identify a difference in perioperative blood transfusion.

16

Pylorus-preserving versus classic pancreaticoduodenectomy: a single-centre retrospective review of total lymph node yield. *Y. Essaji.* From McMaster University, Hamilton, Ont.

Pylorus-preserving pancreaticoduodenectomy (PPPD) has been promoted for its ability to preserve the entire gastric reservoir and pyloric sphincter; however, some surgeons favour classic pancreaticoduodenectomy (PD) with distal gastrectomy for resection of carcinoma of the pancreas as it encompasses pyloric and peri-gastric lymphadenectomy. We evaluated patients undergoing PD for pancreatic cancer and established total lymph node yield (LNY) to determine if this reflects any difference in lymphadenectomy yield. This is a retrospective review of 216 patients undergoing PD for pancreatic ductal adenocarcinoma (PDAC) between 2009 to 2015 at a high-volume institution by subspecialty-trained hepatobiliary surgeons. Lymph node yield as well as pathology specimen outcomes associated with poor prognosis were evaluated by univariable and multivariable analysis between patients undergoing classic PD versus PPPD. Clinically relevant variables were included as covariables and adjustments were made for other baseline characteristics. There were 18 patients who underwent PPPD with mean LNY 18.3 (SD 6.70). This was found to be significantly lower than for classic PD (mean 25.7; SD 13.6) ($p < 0.001$). Mean survival was 18.9 months with no difference in overall survival between patients who underwent PPPD or classic PD ($p = 0.120$). Adequate LNY, which is defined by the American Joint Committee on Cancer as 12 or more total lymph nodes and is associated with higher survival, was achieved in 88.9% (16/18) of patients undergoing PPPD in comparison with 90.4% (179/198) of patients undergoing classic PD. Preservation of the pylorus in pancreaticoduodenectomy specimens does result in significantly lower LNY; however, this has no impact on other pathological outcomes (lymph node involvement, margin status) or overall survival. Also, adequate LNY of 12 or more was achieved in 88.9% of PPPD specimens in comparison with 90.4% of classic PD specimens. This suggests that PPPD is valid for adequate lymph node sampling in PD specimens and does not affect overall survival.

17

An audit and evaluation of appropriateness of intraoperative allogenic red blood cell transfusion in liver surgery: application of 3 decision rules. *L. Baker, D. Ferguson, G. Martel.* From the University of Ottawa, Ottawa, Ont.

Red blood cell (RBC) transfusion in liver surgery is common and associated with postoperative morbidity. Knowledge of the appropriateness of administered transfusions in this patient population is lacking. The objective of this study is to evaluate the appropriateness of intraoperative transfusions. A retrospective review of patients undergoing hepatectomy at The Ottawa Hospital from March 2011 to April 2018 was performed. Demographic characteristics, details of intraoperative transfusions, blood loss, biochemical markers of cardiac ischemia, hemoglobin values and course in hospital were collected. A transfusion event was defined as transfusions given in succession. Three published tools were applied to evaluate the appropriateness of administered transfusions. A cohort of 49 patients who received intraoperative RBC transfusion at the time of hepatectomy was identified. A total of 124 units of RBCs were administered during 76 transfusion events. Twenty-nine (59.2%) patients were anemic before surgery (mean hemoglobin, 118, SD 118 ± 18 g/L). Twenty-one (42.9%) underwent major liver resection; the primary indication for surgery was colorectal liver metastases (57.1%). Mean estimated blood loss was 1684 ± 1370 mL. Transfusion was considered appropriate in 69.4%, inappropriate in 10.2% and indeterminant in the remainder of patients by Bennett's criteria. Fifty-two (68%) transfusion events were considered inappropriate by Spradbrow's criteria, most commonly because pre- and post-transfusion hemoglobin were greater than 70 and 90 g/L, respectively. Mean hemoglobin on postoperative day (POD) 5 was 98 ± 14 (range 63–155) for this cohort. Utilization of POD5 hemoglobin to adjudicate appropriateness by Frank's method indicated that 45 (92%) patients were overtransfused a mean of 2 units. This work shows that although the decision to initiate intraoperative RBC transfusion was considered appropriate in the majority of patients by the Ottawa Criteria for Appropriate Transfusion in Hepatectomy, application of the other appropriateness criteria suggests the quantity of blood transfused may be inappropriate. Further work in this area is warranted to minimize the administration of unnecessary transfusions.

18

A comparison of lymph node ratio with AJCC lymph node status for survival after Whipple resection for pancreatic adenocarcinoma. *Y. Essaji.* From McMaster University, Hamilton, Ont.

Pancreaticoduodenectomy is a complex surgical procedure to resect periampullary neoplasms including pancreatic ductal adenocarcinoma (PDAC). Lymph node status is the strongest predictor of survival after resection for PDAC. Lymph node ratio (LNR) has been suggested as a novel marker of poor outcome in periampullary malignancies. We evaluated LNR in comparison with lymph node status as per the 7th and 8th editions of the staging manual of the American Joint Committee on Cancer (AJCC) in predicting overall survival. This is a retrospective review of 216 patients undergoing pancreaticoduodenectomy for PDAC between 2009 and 2015 at a high-volume institution by subspecialty-trained hepatobiliary surgeons. The predictive value of LNR for 2-year survival was calculated using a Cox proportional hazards model. A receiver operating characteristic (ROC) curve and area under the curve

(AUC) were used to determine the accuracy of estimating survival according to LNR greater than or equal to 20% and nodal status as defined by the 7th and 8th editions of the AJCC's staging manual. Mean LNR was 0.18 (range 0–0.88). LNR in patients with survival less than 2 years was higher (0.28, range 0–0.65) than in patients who survived longer than 3 years (0.15, range 0–0.39). Other staging factors including T stage, margin status, perineural invasion and grade were similar regardless of LNR or lymph node yield (LNY). As LNY increased, the accuracy of predicting survival with LNR was significantly better than when using the 7th and 8th editions of the AJCC's staging manual. LNR is an established marker for prediction of survival in node-positive PDAC and is comparable to the 7th and 8th editions of the AJCC's staging manual in predicting overall survival. With greater LNY, LNR greater than or equal to 20% shows increasing accuracy in predicting survival. What constitutes an adequate LNY remains to be determined for optimal prediction of survival for pancreaticoduodenectomy resection for PDAC.

19

Duodenopancreatéctomie céphalique (intervention de Whipple) par voie laparoscopique pure. *E. Girard, F. Gryspeerd, F. Vandenbroucke-Menu.* From Centre hospitalier de l'Université de Montréal, Montreal, Que.

La chirurgie minimalement invasive, comprenant la laparoscopie, est devenue un standard pour de nombreuses procédures chirurgicales. La localisation anatomique du pancréas céphalique ainsi que les caractéristiques oncologiques des tumeurs pancréatiques sont responsables de la complexité technique de la duodéno-pancréatéctomie céphalique par voie laparoscopique. Plusieurs études récentes démontrent sa faisabilité en toute sécurité. Lorsque cette intervention est réalisée par des chirurgiens expérimentés avec sélection des patients, le taux de morbidité et les résultats oncologiques de la voie d'abord laparoscopique sont équivalents à ceux de la voie d'abord laparotomique. Les avantages de cette technique par laparoscopie sont des pertes sanguines moins importantes, une durée de séjour raccourcie et surtout une meilleure récupération postopératoire. La réalisation de cette intervention par voie purement laparoscopique est marquée par plusieurs enjeux techniques : la dissection extensive de l'axe mésentérico-portal, la lymphadénectomie du hile hépatique avec la dissection des branches artérielles du tronc cœliaque, et surtout de la réalisation intracorporelle des 3 anastomoses. Nous avons effectué les premiers cas avec une technique en développement afin de réaliser une intervention la plus sécuritaire possible pour le patient. Cette vidéo (<https://youtu.be/pkR3wiRSbxs>) présente les différentes étapes permettant la réalisation de cette intervention de façon sécuritaire, avec mise en lumière des points techniques les plus importants.

20

Use of the Molecular Adsorbent Recirculating System (MARS) in acute liver failure: a multicentre experience. *A. MacDonald, B. Shropshire, J. Olson, C. Karvellas.* From the University of Alberta, Edmonton, Alta. (MacDonald, Karvellas); and the University of Kansas, Kansas City, Kans. (Shropshire, Olson).

Acute liver failure (ALF) is a fulminant disease characterized by acute hepatic injury in combination with hepatic encephalopathy (HE) and impaired hepatic synthetic function. Despite maximal medical therapy, ALF carries high mortality, with liver transplantation representing the only definitive management strategy. Studies have demonstrated a beneficial effect on HE and hemodynamics; however, the role of the Molecular Adsorbent Recirculating System (MARS) in transplant-free survival remains in question. This study primarily aimed to describe the ALF population receiving MARS therapy at 2 large North American tertiary hospitals. Secondary outcomes included change in hemodynamic and biochemical parameters after MARS treatment and survival to intensive care unit (ICU) discharge and hospital discharge. As part of a large retrospective case series, all patients with ALF receiving MARS therapy between January 2009 and January 2019 were identified through existing databases and reviewed. Paired mean differences for pre- and post-MARS parameters were calculated using the Student *t* test. Forty-seven patients (mean age 39.74 yr; 22 males and 25 females) were treated with MARS (mean 1.96 runs; range 1–4; mean 15.10 total hours), with acetaminophen/paracetamol toxicity representing the most common cause of ALF ($n = 21$). Following MARS therapy, patients displayed increased mean arterial pressure (+5.53 mmHg, $p = 0.14$), with no significant increase observed in vasopressor requirements. Serum bilirubin (–16.13 mmol/L, $p = 0.39$), international normalized ratio (–1.24, $p = 0.001$), creatinine (–53.59 mmol/L, $p = 0.0001$), ammonia (–61.88 mmol/L; $p = 0.001$) and lactate (–1.53 mmol/L, $p = 0.11$) decreased following MARS treatment. Overall, 14 patients underwent orthotopic liver transplantation (29.79%), with 1 patient dying intraoperatively. Twenty-seven patients survived to ICU discharge (57.45%, mean ICU length of stay 15.81 d), with 26 surviving to hospital discharge (55.32%, mean hospital length of stay 31.88 d). Among patients with ALF, MARS therapy improves hemodynamics and trends biochemical variables toward normalization. A larger case-control study is required to evaluate any potential survival advantage (currently ongoing).

21

Barriers to adjuvant chemotherapy after resection for pancreatic cancer. *J. Li, E. Vasilyeva, D. Renouf, M. Segedi, S. Chung, C. Scudamore, A. Buczkowski, P. Kim.* From the University of British Columbia, Vancouver, B.C.

Surgical resection with adjuvant chemotherapy increases survival for patients with resectable pancreatic adenocarcinoma. This study aimed to identify the rate of initiation and completion of adjuvant therapy after resection for pancreatic adenocarcinoma and to identify factors associated with failure to do so. A retrospective study was performed on adult patients who underwent resection for pancreatic adenocarcinoma at our centre between 2008 and 2015. Perioperative variables were compared between patients who received adjuvant therapy and those who didn't. The cancer agency referral rate was 96.9%. Of those patients seen by an oncologist, 58.9% initiated and 39.4% completed adjuvant chemotherapy. Patients who did not initiate adjuvant chemotherapy were older (72 v. 65 yr, $p < 0.001$), had a higher comorbidity index (5.4 v. 4.7, $p = 0.004$), had lower hemoglobin at discharge (99 v. 107, $p = 0.002$), had a longer hospital stay (20 v. 13 d, $p = 0.004$), had a higher rate of ICU admission (8.6% v.

2.7%, $p = 0.002$), had a higher rate of total parenteral nutrition (13.2% v. 6.6%, $p = 0.001$), were more likely to require rehabilitation (4.6% v. 0.7%, $p = 0.08$) and took longer to see an oncologist (85 v. 49 d, $p < 0.001$). Major postoperative complications were more common in patients who did not initiate adjuvant therapy (19.1% v. 13.9%, $p = 0.055$). There was no difference in distance to the closest cancer centre. Median overall survival was 14.5, 13.9 and 31.4 months for patients who received no adjuvant, partial adjuvant and full adjuvant, respectively. Median recurrence-free survival was 8.7, 7.4 and 17.7 months for patients who received no adjuvant, partial adjuvant and full adjuvant, respectively. In this study, 58.9% of patients initiated and 39.4% completed adjuvant chemotherapy after resection. Median overall and recurrence-free survivals were higher for patients who completed adjuvant but were similar between those who received no adjuvant and those who received only partial therapy. Older age and factors associated with a complicated postoperative course were identified as barriers to adjuvant chemotherapy.

22

Comparison of primary and metastatic pancreatic cancer by clinical and genomic features. *A. Connor, S. Gallinger.* From the University of Toronto, Toronto, Ont.

Pancreatic ductal adenocarcinoma (PDAC) has a dismal prognosis because of rapid dissemination, often from small primary tumours. Primary PDAC has 4 driver genes, 2 mutational signatures, 2 transcriptional subtypes, rapid growth and hypoxic stroma. How these clinical, genomic and transcriptional features progress from primaries to metastases has not been studied in large series. We integrated clinical, pathologic, genomic and transcriptomic data from 319 PDAC specimens, including 224 primaries and 95 metastases, from 289 patients in 2 cohorts, “unpaired” (270) and “paired” (19). All underwent tumour cell enrichment, whole genome and RNA sequencing. We applied bioinformatic cell cycle progression (CCP), hypoxia and intertumoural heterogeneity (ITH) metrics. Primary and metastatic tumours had several differing genomic and transcriptional features that were correlated with clinical covariates. CCP increased with sequential inactivation of tumour suppressor genes in both primaries and metastases, yet was consistently greater in metastases. This may explain rapid metastatic spread. CCP also correlated with responses to both neoadjuvant and palliative chemotherapy. Hypoxia was present in half the cohort and inherent to PDAC rather than a consequence of its microenvironment. Hypoxia predicted therapeutic response. In paired primaries and metastases, ITH measurement showed truncations, inversions and translocations were most conserved and thus potential targets for directed therapies. Paired tumour phylogenies revealed Halstedian

sequential progression from primary to lymphatic to distant sites, informing clinical staging. We identified several uncommon cases of synchronous and metachronous disease, that is, multiple PDAC in the same patient, revealing each to be intraparenchymal metastases rather than independent primaries. This informs a clinical conundrum not addressed by current American Joint Committee on Cancer staging. Overall, our study characterizes novel molecular features that distinguish PDAC primaries and metastases. These may provide further insight into PDAC management in prospective clinical trials that make use of routine molecular analysis, such as the Comprehensive Molecular Characterization of Advanced Ductal Pancreas Adenocarcinoma for Better Treatment Selection (COMPASS) trial at our institution.

23

Factors associated with invasion and postoperative overall survival in resected IPMN. *A. Connor, A. Wei.* From the University of Toronto, Toronto, Ont. (Connor); and the Memorial Sloan Kettering Cancer Center, New York City, N.Y. (Wei).

Intraductal papillary mucinous neoplasms (IPMNs) are dysplastic lesions of the pancreas with malignant potential. Their management may be informed by an improved understanding of their natural history. A retrospective cohort study of patients who underwent pancreatectomy for IPMN at the University Health Network from 2000 to 2012 was conducted. Clinicopathologic and treatment data were extracted, and associations with invasion and outcomes were evaluated. Seventy-eight patients underwent resections for IPMN, of whom 26 (33%) had invasive adenocarcinoma. A median 51 months (Q1–Q3 19.2–71.8) of follow-up was available. Jaundice, weight loss and a solid component were strongly associated with invasion ($p \leq 0.001$), although cyst size above 3 cm was not. Invasive disease was associated with increased mortality ($p = 0.007$). In the invasive strata, lymph node metastases, lymphovascular invasion (LVI) and perineural invasion (PNI) were associated with decreased overall survival. Survival at 5 years (> 60%) was higher than expected by American Joint Committee on Cancer stage relative to typical ductal adenocarcinoma. Patients with noninvasive pathology died of nonpancreatic causes rather than postoperative complications or IPMN recurrence. Time-to-surgery analysis revealed a nonsignificant trend toward improved survival with earlier resection in the invasive group only. Few invasive cases were identified in those resected after prolonged follow-up. Our results suggest that early surgical intervention for patients with factors predictive of invasive disease may improve overall survival, while prolonged watchful waiting of noninvasive cases does not worsen survival.

CANADIAN HERNIA SOCIETY

01

Incisional hernia repair surgery improves patient-reported outcomes. *S. Manoharan, G. Liu, T. Crump, A. Karimuddin, T. Scott, J. Sutherland.* From the University of British Columbia, Vancouver, B.C. (Manoharan, Liu, Karimuddin, Scott, Sutherland); and the University of Calgary, Calgary, Alta. (Crump).

Incisional hernias are a frequent complication after abdominal surgeries and can cause significant symptoms such as pain, obstruction, strangulation and negative cosmesis. Surgery is usually performed on these patients to alleviate these symptoms. The aim of this study was to investigate the impact of surgery on health-related quality of life in patients with incisional hernias. This study is based on a prospectively

recruited sample of patients waiting for incisional hernia repairs. Study participants self-reported their pain, depression and overall quality of life using the validated patient-reported outcome measures PEG, PHQ-9 and EQ-5D, respectively. These measures were recorded as patients were placed on the surgical wait list and 6 months after their surgery. There were 121 patients who responded to the preoperative survey and 87 who responded to the postoperative survey. The average wait for surgery was 20.3 weeks. Patients with poor baseline health preoperatively had significant improvement of their symptoms of pain, depression and quality of life as measured by the PEG, PHQ-9 and EQ-5D, respectively. The length of time spent on the wait list was not associated with postoperative outcomes. Among patients with poorer baseline health, patients who underwent surgery for incisional hernias demonstrated a significant benefit in depression, pain and overall quality of life. Prolonged wait times did not have a negative effect on postoperative outcomes.

02

Prospective study of single-stage repair of contaminated hernias with the novel use of calcium sulfate antibiotic beads in conjunction with biologic porcine submucosa tissue matrix. *A. Drohan, S. Minor.* From Dalhousie University, Halifax, N.S.

Single-stage repair of incisional ventral hernias in contaminated fields has a high rate of surgical site infection (30%–50%). Stimulan calcium sulfate antibiotic beads (CSAB) are a biodegradable material that deliver high levels of antibiotics locally and their use has been described with other permanent prostheses including orthopedic implants, breast implants and vascular grafts, but not in incisional hernia repair. In an attempt to decrease the risk of infection, CSAB impregnated with vancomycin/gentamicin were used in combination with implantation of a biologic porcine submucosa graft in patients with contaminated fields undergoing incisional hernia repair. This prospective, single-institution, single-arm observational study was designed to determine the incidence of surgical site infection following implantation of CSAB and biologic graft into surgical fields characterized as class II, III or IV. Hernia recurrence and postoperative complications were recorded. Repair required complete fascial coverage of the graft and removal of all infected mesh. A total of 11 patients were enrolled with a median fascial defect 20.0 cm long and 13.5 cm wide. All patients required component separation to achieve primary fascial closure over the graft. Median follow-up was 12 months (range 3–12 mo). Most patients were female (7, 63.6%) and nonsmokers (10, 90.1%), with a median age of 64 years (range 36–76 yr). Over half of the patients were obese (median body mass index 39.6), and 1 patient had diabetes. The majority of the surgical wounds were class IV (7, 63.6%). In terms of short-term outcomes, 2 patients (18.1%) developed a postoperative wound infection, and 1 patient (9.0%) had hernia recurrence. No patients required mesh explantation to manage their infection. Single-stage hernia repair with mesh and CSAB is a promising new technique for the treatment of patients with complex abdominal wall hernias with or without concurrent infection.

03

e-TEP transversus abdominis release. *F. Saleh.* From the William Osler Health System, Etobicoke, Ont.

This video is of an e-TEP transversus abdominis release for a 9-cm midline abdominal wall hernia. This surgery is intended for massive ventral hernias requiring abdominal wall reconstruction. YouTube video link: <https://youtu.be/KwA3j0MHtew>

04

Umbilical hernias. *R. Bendavid, M. Mainprize.* From the University of Toronto, Toronto, Ont. (Bendavid); and the Shouldice Hospital, Thornhill, Ont. (Mainprize).

Although many publications have recommended mesh repairs for all umbilical hernias, the Shouldice Hospital has decided to review their own statistics for the year 2012, allowing for a reasonable follow-up of 7 years. Fully aware of what mesh complications can be, we were hoping to conduct a comparative study of mesh and nonmesh repairs. To our big surprise, not a single umbilical hernia was done with mesh. We have therefore analyzed the male to female ratio so that we may present data from men and women separately at all times and for all parameters. We have classified all the umbilical hernias into the internationally recognized classification of small (≤ 2 cm), medium (2–4 cm) and large (> 4 cm). We have also recorded data on infection and pain as well as recurrences. The total patient population was 676 patients with a response from 303 patients, amounting to a 45% response rate. We will also present a breakdown of the nonresponders. Amazingly, we could find only 4 recurrences in those who responded, an incidence of 1.2%. When one considers the shortcomings with reference to pain, infection and possible mesh removals, our statistics reveal that a pure tissue repair is still a valid option. As in groin surgery, it appears that volume of surgery per surgeon is an important parameter to predict success. We are presently designing statistical tables and graphs to better illustrate our findings.

05

Review of 1061 femoral hernias done at the Shouldice Hospital over a period of 6 years. *R. Bendavid, M. Mainprize.* From the University of Toronto, Toronto, Ont. (Bendavid); and the Shouldice Hospital, Thornhill, Ont. (Mainprize).

Ostensibly, femoral hernias are the most prone to failure among all the groin hernias. Because the surgeons at Shouldice Hospital have the freedom to use any suitable method of repair, mesh and nonmesh, we decided to look into any risk factors leading to recurrence. We have begun receiving replies (a 35% response rate so far) and we are meaning to be tenacious here. We will have the assistance of a statistician to prepare a talk and eventual publication. Males and females will contribute to different analyses within the same paper. We should have interesting results and conclusions in another month or 2 and we hope to come to a certain recommendation. It appears that mesh repairs may win out here, but some mesh repairs, as we can already see trending, have had a high failure rate. Among those failed repairs are plugs, especially the “cigarette roll” as had been designed by Lichtenstein. Pain will also be part of the analysis we aim to expand on.

CANADIAN OBESITY NETWORK/CANADIAN ASSOCIATION OF BARIATRIC SURGERY

01

Metabolic outcomes after bariatric surgery for a provincial Indigenous population. *O. Lovrics, A. Doumouras, S. Gmora, M. Anvari, D. Hong.* From McMaster University, Hamilton, Ont.

In 2013, 18% of Canadian adults had obesity (body mass index [BMI] > 30 kg/m²), compared with 25.7% of Canada's Indigenous population. Bariatric surgery has been shown to be an effective treatment for obesity and related comorbidities, but it has not been studied in Canadian Indigenous populations. Therefore, this study aims to determine the effects of bariatric surgery in an Indigenous provincial population using multicentre data from a publicly funded bariatric registry. Prospectively collected data for all surgical patients between March 2010 and 2018 were included in the initial analysis. Analyzed postoperative outcomes included diabetes, hypertension, gastroesophageal reflux disease and medication requirements. Demographics, baseline characteristics and univariate outcomes were assessed using Pearson χ^2 or *t* tests. Multivariable regression for BMI change was used with complete case analysis and multiple imputation. Of 13 840 individuals initially identified, 338 self-identified as Indigenous, 13 502 self-identified as non-Indigenous, and 2789 omitted ethnicity designation and were excluded. Baseline demographics were not statistically different between Indigenous and non-Indigenous groups; rates of hypertension ($p = 0.03$) and diabetes ($p < 0.001$) were higher in the Indigenous population. Univariable analysis showed similar 1-year BMI change (Indigenous: 15.8 ± 6.0 kg/m²; non-Indigenous: 16.1 ± 5.6 kg/m², $p = 0.362$). After adjustment, BMI change was not different between groups at 6 months (effect size 0.07, 95% confidence interval [CI] -0.45 to 0.58, $p = 0.803$) and 1 year (effect size -0.24, 95% CI -0.93 to 0.45, $p = 0.489$). Rates of comorbidities were similar at 1 year between the 2 populations despite differences at baseline. Six-month and 1-year follow-up rates were higher in the non-Indigenous population ($p < 0.001$, $p = 0.005$, respectively). Weight loss and resolution of obesity-related comorbidities are similar in Indigenous and non-Indigenous patients following either sleeve gastrectomy or Roux-en-Y gastric bypass surgery. Additional factors, such as access to surgery, patient selection and long-term results, merit further investigation.

02

Outcomes of sleeve gastrectomy performed in a regional hospital. *N. Ares Bruneau, D. Khalil, R. Villiard, P. Koch, L. Windisch, M. Pyrali.* From Laval University, Québec, Que. (Bruneau, Khalil, Koch); and Centre intégré de santé et de services sociaux de Lanaudière, Saint-Charles-Borromée, Que. (Villiard, Windisch, Pyrali).

A bariatric surgery program was developed in a regional community hospital to address the increasing prevalence of obesity. This retrospective study evaluated and compared the clinical outcomes of sleeve gastrectomies performed with the literature. A total of 651 sleeve gastrectomies were

performed between April 2013 and June 2018. Patient charts were reviewed to identify the effect of sleeve gastrectomy on weight loss, type 2 diabetes mellitus (T2DM), hypertension, dyslipidemia, sleep apnea and gastroesophageal reflux disease (GERD) at 18 and 36 months. Sleeve gastrectomy adverse events were identified. The average preoperative body mass index (BMI) was 48 kg/m². Sufficient follow-up data were available for 157 patients (48%) at 18 months and 33 patients (28%) at 36 months. At 18 and 36 months, the total weight losses were $33.8\% \pm 8.7\%$ and $22.6\% \pm 19\%$, respectively, and the average BMI decrease was of 13.6 kg/m² and 12.7 kg/m². T2DM remission was observed in 66% ($p < 0.01$) and 55.6% ($p < 0.05$) at 18 and 36 months. Statistical significance was observed at 18 months ($p < 0.01$) for treatment cessation of hypertension, dyslipidemia and sleep apnea. At 18 months, preoperative GERD symptoms were reduced in 66.2% but increased in 12.5% of patients. Gastric leak and bleeding were reported in 0.3% and 2.6%. Significant decreases in BMI and related comorbidities at 18 and 36 months were observed when sleeve gastrectomy was performed, and with low adverse effects. Even with higher average preoperative BMI, the outcomes of this regional program are comparable to published data.

03

A longitudinal analysis of wait times in a publicly funded, regionalized bariatric care system. *S. Albacete, A. Doumouras, D. Hong.* From McMaster University, Hamilton, Ont.

The combination of high demand and high costs can result in increasing wait times for bariatric surgery. Understandably, longer waits put patients at significantly increased risk of mortality and a decrease in mental and physical well-being. Few studies have evaluated the reasons associated with prolonged wait times and the objective of this study is to characterize wait times within a provincial bariatric network. This was a population-based study of all patients aged over 18 years who received bariatric surgery from April 2009 until December 2016. The registry data were linked to various administrative databases within the area that capture demographic variables as well as all health care utilization within the region. The main outcome of interest was a wait time greater than 18 months. Logistic regression was used to analyze the primary outcomes. Overall wait times continually increased every year of the study from 229.74 ± 100 days for patients receiving surgery in 2010/2011 to 387.64 ± 192.65 days in 2016 ($p < 0.001$) with median wait times of 212 (interquartile range [IQR] 162–286) and 376 (IQR 256–470) days, respectively. Male gender and smoking status were associated with increased odds of wait times over 18 months (odds ratio [OR] 1.47, 1.46; 95% confidence interval [CI] 1.28–1.7, 1.09–1.97; $p < 0.0001$, $p = 0.0118$). Obesity-related comorbidities such as diabetes and heart failure were also associated with longer waits (OR 1.29, 1.72; 95% CI 1.14–1.44, 1.43–2.07; $p < 0.0001$, $p < 0.0001$). Socioeconomic variables including unemployment, disability and immigration status were correlated with increased odds of longer wait times (OR 1.18, 1.64, 1.35; 95% CI 1–1.38, 1.38–1.92, 1.11–1.64; $p = 0.0437$, $p < 0.0001$,

$p = 0.003$). Wait times increased substantially throughout the course of the study. They also varied by region and appeared to be influenced by certain patient characteristics and socioeconomic factors. Further study is required to better understand possible explanations for these variations and create a more supportive system for marginalized populations that may be at risk.

04

Concurrent laparoscopic ventral hernia repair with bariatric surgery: a propensity-matched analysis. *M. Moolla, J. Dang, A. Modasi, S. Byrns, N. Switzer, D. Birch, S. Karmali.* From the University of Alberta, Edmonton, Alta. (Moolla, Dang, Modasi, Byrns, Birch, Karmali); and Ohio State University, Columbus, Ohio (Switzer).

Ventral hernias are a common finding during bariatric surgery; however, the risks and benefits of repair during surgery remain unclear. Using the Metabolic and Bariatric Surgery Accreditation and Quality Improvement Program (MBSAQIP) database, we examined the short-term outcomes of patients undergoing bariatric surgery with concurrent ventral hernia repair (VHR) versus bariatric surgery alone. Patients undergoing laparoscopic Roux-en-Y gastric bypass (LRYGB) or laparoscopic sleeve gastrectomy (LSG) were included. Patients with previous bariatric surgery or undergoing an emergency procedure were excluded. A propensity-matched analysis was performed between laparoscopic bariatric surgery with and without concurrent VHR. The primary outcome was the 30-day major complication rate, which includes but is not limited to 30-day reoperation, deep surgical site infection and sepsis. Secondary outcomes included operative time, length of hospital stay, 30-day readmission and 30-day mortality. A total of 430 225 patients were included, of which 4690 (1.1%) received concomitant VHR. With 1-to-1 propensity score matching, 4648 pairs were selected. Concurrent VHR was associated with a higher major complication rate (5.8% v. 3.8%, $p < 0.001$) but no significant difference in mortality (0.3% v. 0.2%, $p = 0.531$). Both LSG with VHR (3.2% v. 2.4%, $p = 0.007$) and RYGB with VHR (9.3% v. 5.7%, $p < 0.001$) were associated with an increase in major complications. Rates of superficial surgical site infections were similar between cohorts (0.7% v. 0.8%, $p = 0.631$). However, rates of deep surgical site infections were higher in patients undergoing concurrent VHR (0.7% v. 0.3%, $p = 0.025$). Patients undergoing VHR during bariatric surgery do not experience higher mortality. However, these patients have an elevated risk of major complications, with this risk being higher among patients undergoing concurrent VHR and LRYGB. Bariatric surgeons should consider these risks when choosing to perform VHR at the time of bariatric surgery.

05

Outcomes from explantation of laparoscopic adjustable gastric band: experience from a Canadian bariatric centre of excellence. *S. Stogryn, A. Maeda, S. MacLellan, A. Vergis, A. Okrainec, T. Jackson.* From the University of Toronto, Toronto, Ont. (Stogryn, Maeda, MacLellan, Okrainec, Jackson); and the University of Manitoba, Winnipeg, Man. (Vergis).

Laparoscopic adjustable gastric banding (LAGB) is a common procedure that has significantly declined primarily because of poor weight loss and high revision rates. LAGB explantation is commonly performed and often concurrently converted to other bariatric procedures. Reported complication rates for LAGB removal alone were 6.8%. The objective was to evaluate outcomes after LAGB removals at our institution including conversions to other bariatric procedures. Patients were identified using the Metabolic and Bariatric Surgery Accreditation and Quality Improvement Program (MBSAQIP) database from the Toronto Western Hospital site, filtered by LAGB removal using principal procedure code and concurrent procedural terminology (CPT) codes (43773, 43774). Patients converted to other bariatric procedures were included. Outcomes were evaluated for 30-day morbidity, mortality and readmission. Between 2011 and 2018, 93 patients met the inclusion criteria. The majority were elective (96.77%) with only 3 emergent cases (3.23%). The 30-day postoperative complication rate was 11.83% with a 4.30% readmission rate and no deaths. Surgical site infections accounted for 81.82% of complications (54.55% superficial, 27.27% deep). The 30-day adverse event rate for LAGB removal alone was 15.00%; however, emergent explantation was 33.33%. Half (56.99%) were converted to other bariatric procedures (48.39% laparoscopic Roux-en-Y gastric bypass [LRYGB], 8.6% sleeve gastrectomy [LSG]). Conversion to LSG had the highest 30-day complication rate (37.50%) versus conversion to LRYGB at 2.22% ($p = 0.375$). Thirty-day complication rates for explantation of LAGB and conversion to other bariatric procedures are significant and may be higher than previously reported for LAGB removal alone. Conversion to LSG may have the highest complication rate.

06

Development of consensus-derived quality indicators for laparoscopic sleeve gastrectomy. *S. Stogryn, A. Sharples, K. Hardy.* From the University of Toronto, Toronto, Ont. (Stogryn); and the University of Manitoba, Winnipeg, Man. (Sharples, Hardy).

Synoptic operative reporting has gained popularity as a solution to the poor overall quality of narrative reports. The sleeve gastrectomy is the most common bariatric procedure performed in North America. The objective was to systematically develop operative report quality indicators for a laparoscopic sleeve gastrectomy (LSG) to generate validated items to include in a synoptic operative report for LSG. A Delphi protocol was used to determine quality indicators for LSG reporting. Bariatric surgeons from across Canada were recruited along with local physician key stakeholders to participate via a secure Web-based platform. We aimed for 1 representative surgeon from all Royal College of Physicians and Surgeons regions in Canada. Participants initially submitted potential quality indicators for a LSG. Suggested quality indicators were then assessed and grouped by theme. Items were then rated on a 5-point Likert scale in subsequent rounds. For consensus, a score of 70% (mean score 3.5) or greater indicated inclusion of an item and 30% (mean score 1.5) or less denoted exclusion. Elements ranging from 30% to 70% consensus were recirculated by runoff in subsequent rounds to generate the final list

of quality indicators. Seven bariatric surgeons were invited and we achieved our goal of representation from all regions performing LSG in Canada. The 3 multidisciplinary invitees were 1 academic minimally invasive/acute care surgeon, 1 tertiary abdominal radiologist and 1 academic gastroenterologist performing endoscopic management of bariatric complications. The overall survey response rate was 90.0% (9/10) and the survey identified 61 potential quality indicators for consideration. In the second-round survey, 53 items reached inclusion consensus. This study has established consensus-derived multidisciplinary quality indicators for LSG operative reports. This information will allow assessment of existing reports and will afford the development of a synoptic report that may improve this documentation.

07

Conversion of sleeve gastrectomy to laparoscopic Roux-en-Y gastric bypass in intestinal nonrotation. *N. Hanna, B. Zevin.* From Queen's University, Kingston, Ont.

We present a case of nonrotation incidentally found at the time of bariatric surgery in a 46-year-old woman. She was appropriately worked up by the multidisciplinary bariatric team and was initially consented for a laparoscopic Roux-en-Y gastric bypass. At the time of surgery, intestinal nonrotation was found, and a decision was made to perform a laparoscopic sleeve gastrectomy instead. There were no intraoperative or postoperative complications, and the patient was discharged home on postoperative day 2. In follow-up clinic she complained of severe reflux symptoms and liquid dysphagia, despite maximum medical management. Her body mass index (BMI) was 29. An upper gastrointestinal (UGI) series and upper endoscopy both demonstrated a straight sleeve with no kinking or twisting. The UGI series demonstrated severe reflux disease. We decided to perform a conversion procedure from the sleeve gastrectomy to a laparoscopic Roux-en-Y gastric bypass. This occurred 6 months after the initial operation. Intestinal nonrotation results in all the small bowel being located on the right side of the abdomen and the colon on the left side. This poses unique challenges to performing a Roux-en-Y gastric bypass. Firstly, the biliary-pancreatic limb comes across the abdomen in a counter-clockwise fashion (instead of clockwise) and the Roux limb is positioned in a clockwise manner (instead of counter-clockwise). Secondly, the jejunum-jejunostomy must be created in the right upper quadrant of the abdomen (instead of the left upper quadrant). Thirdly, the gastric pouch must be made longer than usual to reduce the tension on the gastrojejunal anastomosis given that the Roux limb has farther to travel than usual. There were no intraoperative or postoperative complications, and the patient was discharged home on postoperative day 2. At routine follow-up clinic she denied any reflux symptoms and was tolerating her prescribed oral intake. Her BMI had dropped to 25.

08

The utility of routine preoperative upper gastrointestinal series for laparoscopic sleeve gastrectomy. *W. Sun, J. Dang, N. Switzer, D. Birch, S. Karmali.* From the University of Alberta, Edmonton, Alta.

Laparoscopic sleeve gastrectomy (LSG) has become the most commonly performed primary bariatric procedure in North America. However, there is no consensus for the preoperative diagnostic evaluation for patients undergoing LSG. The role of preoperative upper gastrointestinal (UGI) series to evaluate candidates for LSG is debatable. We aim to study the diagnostic utility of routine UGI series for preoperative evaluation of LSG in our centre. A retrospective chart review for patients planning to undergo LSG with 1 surgeon at our hospital from May 2015 to April 2017 was completed. Primary outcomes included UGI findings and subsequent changes in clinical management. Secondary outcomes included preoperative symptomatology and postoperative complications. Thirty-six patients were identified from billing records of a single surgeon and were originally scheduled to undergo LSG. Thirty-two patients (88.9%) were female. The average age was 43.2 ± 2.1 years and average preoperative body mass index was 47.3 ± 1.2 kg/m². Twenty-two (61.1%) patients underwent a preoperative UGI series, of which 8 (36.4%) patients had hiatal hernias, 9 (40.9%) had gastroesophageal reflux and 2 (9.1%) had dysmotility. Additionally, four (18.2%) of the 22 patients had a change from LSG to laparoscopic Roux-en-Y gastric bypass (LRYGB) because of significant reflux or dysmotility found on UGI. The average postoperative BMI was 38.7 ± 1.4 kg/m², after an average follow-up period of 8.3 ± 0.8 months. Four (11.1%) patients had postoperative complications, including 2 LSG requiring revision to LRYGB for reflux esophagitis, 1 LSG with dysphagia and 1 LRYGB with a marginal ulcer. Our cohort demonstrated that preoperative UGI has the potential to screen for pathology that may affect outcomes after LSG and changed clinical management in almost one-fifth of patients undergoing UGI. Overall, UGI is a relatively simple and inexpensive test for the preoperative evaluation of patients before LSG.

09

Body image concerns, depression, suicidality and psychopharmacological changes in postoperative bariatric surgery patients: a mixed-methods study. *K. Bartellas, D. Smith.* From the Memorial University of Newfoundland, St. John's, Nfld.

Bariatric surgery has been linked to an increased risk of adverse psychological outcomes postoperatively including self-harm, suicidality, decreased life satisfaction, excess skin folds, body image concerns and psychopharmacological changes. Given the rising demand for bariatric surgery and the obesity trends for both child and adult populations in our province, the integration of a psychologist into the bariatric surgical program is worth exploring. This study aims to (1) explore the perspectives of local health care providers with respect to the most common psychological challenges facing bariatric surgery patients postoperatively and (2) develop recommendations that will lead to comprehensive and longitudinal health care services for these patients. A mixed-methods research approach was used for this study incorporating an online survey and semi-structured interviews with health care providers including nurses, dietitians, general surgeons, psychologists, psychiatrists and family physicians. Triangulation of qualitative and quantitative data was undertaken to develop common themes and to summarize the ideas expressed by participants. A total of

18 health care providers participated in our study. Our results demonstrated that bariatric surgery patients often hold unrealistic expectations about surgery, which potentially contributes to the onset of adverse psychological outcomes postoperatively. Participants endorsed certain limitations of the bariatric surgical program at present including a lack of long-term surveillance. The majority of the participants thought that bariatric surgery patients did not deserve to “skip the queue” in wait times to access public mental health services. An overall increase in the province’s capacity to provide accessible public mental health services was deemed an appropriate solution, although not necessarily a feasible one. Facilitating long-term, timely access to mental health services will optimize bariatric surgery patient outcomes postoperatively. These services will not be required by all patients and the logistical and financial challenges of providing these services currently seem too high to consider this as a viable, sustainable solution.

10

Technical factors associated with early sleeve stenosis after sleeve gastrectomy: an analysis of the Metabolic and Bariatric Surgery Accreditation and Quality Improvement Program (MBSAQIP) database. *J. Dang, V. Mocanu, N. Switzer, D. Birch, S. Karmali.* From the University of Alberta, Edmonton, Alta.

Laparoscopic sleeve gastrectomy (LSG) is the most commonly performed bariatric surgery worldwide. Although LSG is a relatively safe procedure, complications such as sleeve stenosis can occur and may be due to edema or ischemia during the early postoperative period. Surgical technique, combined with postoperative edema, may also lead to an early obstruction. Using the Metabolic and Bariatric Surgery Accreditation and Quality Improvement Program (MBSAQIP) database, the objective of this study was to determine the rates and technical factors associated with 30-day sleeve stenosis. The MBSAQIP collects data from 832 bariatric surgery centres in the United States and Canada. Data were extracted from all available years of the database (2015–2017). Primary LSG was included and patients undergoing revisional bariatric surgery were excluded. Multivariable logistic regression analysis was performed to determine technical factors associated with sleeve stenosis. These included bougie size, staple line distance from the pylorus, oversewing and staple line reinforcement. A total of 280 845 patients (79.2% female) were included with a mean age of 44.3 ± 12.0 years and a mean body mass index of 45.1 ± 7.8 kg/m². A total of 0.1% of patients ($n = 262$) developed sleeve stenosis within 30 days. On multivariable analysis, the only technical factor associated with early sleeve stenosis was shorter pylorus distance (odds ratio [OR] 0.831, 95% confidence interval [CI] 0.746–0.928, $p = 0.001$). For every 1 cm increase in pylorus distance, the odds of stenosis decreased by 16.9%. The unadjusted rates of stenosis with a pylorus distance less than 4 cm were significantly higher than with a distance of 4 cm or greater (0.15% v. 0.09%, $p < 0.001$). Overall, early sleeve stenosis is rare and only affects 0.1% of patients undergoing LSG. The only technical factor associated with 30-day sleeve stenosis was stapling distance from the pylorus. Some studies have advocated for decreasing the pylorus distance to 2 cm; however, this appears to be associated with higher rates of early stenosis.

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Analysis of complication and readmission rates after laparoscopic sleeve gastrectomy at a single bariatric surgery centre: a retrospective NSQIP study. *A. McLean, N. Slater, S. Malik.* From the University of British Columbia, Vancouver, B.C.

Laparoscopic sleeve gastrectomy (LSG) is an effective method of weight loss in morbidly obese patients. We analyzed factors of surgical quality (readmissions, complication rates and associated comorbidities) at our institute. Using the National Surgical Quality Improvement Program (NSQIP) database, we retrospectively identified demographics, comorbidities, intra- and postoperative parameters, complications and readmissions within 30 days for all patients undergoing LSG between 2011 and 2018 by our bariatric surgery group. Reason for readmission was determined by chart review. Patients were divided into 3 groups: control, patients experiencing a complication after LSG, and patients requiring readmission within 30 days of LSG. The groups were compared using t tests and χ^2 tests, and SPSS was used for statistical analysis. A total of 181 patients underwent LSG from 2011 to 2018, with an average age of 49.4 ± 10.5 years and body mass index of 46.8 ± 7.7 . Total incidence of complications was 5.5% (10 patients) and the most common complication was urinary tract infection (2.2%). Other complications were pneumonia (1.1%), unplanned postoperative intubation (0.6%), pulmonary embolism (0.6%), staple line bleed (0.6%) and deep vein thrombosis (0.6%). Total 30-day readmission was 4.4% (8 patients) and reasons for readmission included dehydration, colitis, dysphagia, diabetic ketoacidosis and septicemia. Duration of surgery was significantly longer for patients who experienced a complication (70.8 ± 32.4 min v. 95.3 ± 47.3 min, $p = 0.036$) as was length of stay in hospital (2.2 ± 1.6 d v. 4.8 ± 47.3 d, $p = 0.036$). Insulin-dependent diabetes mellitus was a significant predictor of complication (relative risk [RR] 3.7, $p = 0.02$) and readmission (RR 3.7, $p = 0.02$). Complication and 30-day readmission rates at our institute were in keeping with literature values. The most common complication was urinary tract infection. Insulin-dependent diabetes mellitus was significantly associated with a greater risk of both complication and readmission.

12

Management of common bile duct stones in patients after Roux-en-Y gastric bypass: a systematic review. *Z. Mir, N. Hanna, T. Bao, B. Zevin.* From Queen’s University, Kingston, Ont. (Mir, Hanna, Zevin); and McMaster University, Hamilton, Ont. (Bao).

Obesity is a risk factor for developing gallstones. Rapid weight loss after bariatric surgery increases the risk of gallstone formation and related complications. Management of common bile duct (CBD) stones in patients after laparoscopic Roux-en-Y gastric bypass (LRYGB) is challenging because of the altered anatomy of the upper gastrointestinal tract. We performed a systematic review of the literature to examine the reported incidence of complications from, and management strategies for, choledocholithiasis after LRYGB. We searched Embase, CINAHL, Medline and Web of Science databases until early 2018. Title, abstract, full-text screening and data abstraction were performed in duplicate with discordance

resolved by an independent third reviewer. Studies were included if they reported on patients undergoing LRYGB for standard NIH eligibility criteria. Articles were excluded if they reported on non-LRYGB procedures, involved patients younger than 18 years of age, were case reports/series or were unavailable in English. We identified and screened 1787 articles, of which 2 met the selection criteria. In total, 3077 patients underwent LRYGB and 24 (0.8%) developed postoperative complications related to CBD stones (biliary pancreatitis or obstructive jaundice). No patients developed cholangitis. One study did not provide patient demographics; in the other, mean patient age was 44.4 years, mean body mass index was 48.0 kg/m² at the time of bariatric surgery, and the majority were female (81%). Sixteen (67%) out of 24 patients required intervention for CBD stones: 5 (31%) underwent laparoscopic trans-cystic CBD exploration (LTC-CBDe), 9 (56%) underwent laparoscopic trans-gastric endoscopic retrograde cholangiopancreatography (LTG-ERCP), 1 (6%) underwent open CBDe and 1 (6%) underwent percutaneous transhepatic laser-assisted stone fragmentation. One patient failed LTC-CBDe and subsequently received laparoscopic choledochotomy with CBDe. Although the incidence of choledocholithiasis after LRYGB is rare (< 1%), there is little evidence to guide optimal management of this condition. Further work is needed to characterize outcomes and the efficacy of various available management techniques.

13

Improvement and resolution of urinary incontinence after bariatric surgery: a systematic review and meta-analysis. *J. Yu, Y. Lee, K. Tikkinen, M. Pedziwiatr, P. Major, I. Aditya, Y. Krakowsky, A. Doumouras, S. Gmora, M. Anvari, D. Hong.* From McMaster University, Hamilton, Ont. (Yu, Lee, Doumouras, Gmora, Anvari, Hong); the University of Helsinki, Helsinki, Finland (Tikkinen); the Jagiellonian University, Kraków, Poland (Pedziwiatr, Major); and the University of Toronto, Toronto, Ont. (Aditya, Krakowsky).

Current guidelines recommend weight loss through lifestyle interventions for the treatment of urinary incontinence (UI) in patients with obesity. However, the effect of the sustained weight loss induced by bariatric surgery on UI remains unclear. A systematic review and meta-analysis was conducted to evaluate the effect of bariatric surgery on UI in patients with obesity. A search of Medline, Embase, Central and PubMed to June 2018 was performed. Studies comparing UI status before and after bariatric surgery were included. Primary outcomes were the improvement or complete resolution of any UI, stress urinary incontinence (SUI) and urgency urinary incontinence (UUI). Secondary outcomes were validated UI questionnaire scores. The GRADE approach assessed overall quality of evidence. Pooled estimates were calculated using random-effects or proportions meta-analysis and heterogeneity was quantified using the *I*² statistic. Thirty-three cohort studies involving 2910 patients were included with a median follow-up of 12 months after surgery. Bariatric surgery resulted in improvement or resolution of any UI in 56% (95% confidence interval [CI] 48%–63%), SUI in 47% (95% CI 34%–60%) and UUI in 53% (95% CI 32%–73%) of patients.

Moreover, bariatric surgery significantly decreased (*p* < 0.001) questionnaire scores such as Urogenital Distress Inventory (UDI) by 13.4 points (95% CI 7.2–19.6), International Consultation on Incontinence Questionnaire (ICIQ) scores by 4.0 points (95% CI 2.3–5.7) and Incontinence Impact Questionnaire (IIQ) scores by 5.3 points (95% CI 3.9–6.6). Worsening or new onset of UI was present in 3% of patients. Over half of patients with obesity report improvement or resolution of UI after bariatric surgery, but the overall quality of evidence is very low. While these results are promising, further comparative studies examining the benefits of bariatric surgery in obese patients with UI are warranted.

14

Bridging interventions for weight loss prior to bariatric surgery in patients with superobesity: a systematic review and meta-analysis. *R. Malhan, Y. Lee, J. Dang, N. Switzer, D. Birch, S. Karmali.* From McMaster University, Hamilton, Ont. (Malhan, Lee); and the University of Alberta, Edmonton, Alta. (Dang, Switzer, Birch, Karmali).

Bariatric surgery on patients with superobesity (body mass index [BMI] > 50 kg/m²) and super-superobesity (BMI > 60 kg/m²) is technically challenging and carries a higher risk of complications. Bridging interventions have been introduced for weight loss before bariatric surgery in this population. This systematic review and meta-analysis assessed the efficacy and safety of bridging interventions before bariatric surgery in superobese populations. Medline, Embase, Web of Science and Scopus were searched up to September 2018. Studies were eligible for inclusion if they conducted any bridging intervention for weight loss in patients with BMI above 50 kg/m² prior to bariatric surgery. Primary outcome was BMI change before and after bridging intervention. Secondary outcomes included comorbidity status after bridging interventions and resulting complications. Pooled mean differences (MD) were calculated using random-effects meta-analysis. Thirteen studies including 550 patients met inclusion criteria (mean baseline BMI of 61.26 kg/m²). Bridging interventions included first-step laparoscopic sleeve gastrectomy (LSG), intragastric balloon (IGB) and liquid low-calorie diet program (LLCD). There was a significant reduction of BMI after a bridging intervention (MD 12.70, 95% confidence interval [CI] 9.08–16.32, *p* < 0.0001). LSG demonstrated a BMI reduction of 15.18 kg/m² (95% CI 12.88–17.48, *p* < 0.0001) and preoperative LLCD by 9.70 kg/m² (95% CI 4.12–15.28, *p* = 0.0007). IGB did not demonstrate significant weight loss prior to bariatric surgery. Diabetes, hypertension and sleep apnea were resolved or improved in 62.8%, 74.6% and 74.6% of patients, respectively. First-step LSG and LLCD are safe and appropriate bridging interventions that allow for weight loss prior to bariatric surgery in superobese populations.

15

Secondary and tertiary learning curves in bariatric surgery. *S. Seidl, H. Cheab, K. Wong.* From the Central Coast Local Health District, Gosford, Australia.

Laparoscopic sleeve gastrectomy (LSG) is one of the most commonly performed bariatric procedures. Many studies have suggested that the learning curve for a procedure is performed

by 1 surgeon between 50 and 100 cases. However, there has been no longer term study to evaluate further improvements in the learning curve. This study aims to investigate the procedure time in relation to the amount of LSG performed by a single bariatric surgeon. Data of 1100 patients over a 6-year period who underwent LSG by a single bariatric surgeon in our bariatric centre were prospectively collected. Data on patient demographics, duration of operation and postoperative complications were further analyzed. Our data showed that the most significant improvement in operating time occurred within the first 100 cases (average time of 107 min in the first 50 cases v. 87 min in the next 50 cases). However, longer term analysis showed that the surgeon still improved on his operating time even after 700 cases. Overall, our data showed a gradual decrease in duration of operation over the 1100 cases. The rate of short-term complications remained the same throughout the duration of the study. This study shows that the learning curve of a single surgeon as reflected by operative times is continuously improving, long after the conventional initial 100 cases. The implication of this finding is that surgeon volume in bariatric surgery may have a direct correlation to improved patient outcomes. Informed consent of patients should include data on surgeon volume.

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Achalasia following laparoscopic sleeve gastrectomy: a case report. *D. Pace, C. Stockley.* From the Memorial University of Newfoundland, St. John's, Nfld.

Achalasia is a rare motility disorder of the esophagus of unknown cause. In this report, a case of achalasia is presented in a patient who had previously undergone a laparoscopic sleeve gastrectomy. The patient, who had undergone a sleeve gastrectomy 3 years earlier, presented with a 4-month history of dysphagia to both solids and liquids, postprandial vomiting and a 40-pound weight loss. Endoscopy evaluation showed retained fluid in the esophagus with a tight gastroesophageal (GE) junction. A barium swallow study revealed a tight smooth focal stricture at the GE junction along with a dilated esophagus. Manometry showed normal peristalsis in the body of the esophagus with incomplete relaxation of the lower esophageal sphincter consistent with a diagnosis of achalasia. The patient was referred to surgery for further management. Subsequently, the patient underwent an uneventful laparoscopic Heller myotomy. Postoperatively, the patient's symptoms resolved. Only 1 other case of achalasia has been reported in a patient following a sleeve gastrectomy. This case was managed differently with a Heller myotomy along with a gastric bypass.

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Multidisciplinary approach to halving length of stay after bariatric surgery. *H. Cheah, K. Wong.* From the Central Coast Local Health District, Gosford, Australia.

Laparoscopic sleeve gastrectomy (LSG) is currently the most commonly performed bariatric procedure in the world. The length of stay (LOS) for LSG is reported in the literature to be on average 2.8 days. Enhanced Recovery After Surgery (ERAS) protocols are evidence-based methods employed to reduce LOS and decrease surgical complications and read-

missions of patients undergoing surgery. The aim of this study is to analyze the LOS and readmission outcomes of our high-volume bariatric centre without ERAS protocols against published results for ERAS-focused bariatric centres. Data were prospectively collected for all patients undergoing LSG in our bariatric unit under a single surgeon from January 2013 to December 2018 and analyzed. Patient demographics, types of operation, duration of operation, length of stay and postoperative complications were further analyzed. Data for a total of 1100 patients who underwent LSG over the 6-year period were analyzed. Of the 1100, 341 were male and 759 were female. The average LOS was 1.72 days. Over this period, incremental multidisciplinary measures were instituted with regard to perioperative management of LSG patients. There was a significant downward trend of the LOS over the 6-year period (2.45 d in 2013, 2.19 d in 2014, 2.04 d in 2015, 1.99 d in 2016, 1.68 d in 2017 and 1.26 d in 2018). The total number of readmissions in the first 7 days after discharge was 14. No mortality was recorded in the cohort of 1100 patients. A multidisciplinary approach with input from surgeons, anesthetists, nurses and dietitians has halved the LOS for patients undergoing LSG in our unit. Our LOS and readmission rates compare favourably with those of ERAS-focused bariatric centres.

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Prospective analysis of staple line haemostatic materials in stapled bariatric surgery. *H. Cheah, K. Wong.* From the Gosford Private Hospital, Gosford, Australia.

Synthetic buttressing materials are commonly used in stapled bariatric procedures to reduce the risk of staple line leaks and bleeding. Two of the commonly used buttressing materials are Seamguard by Gore and the Endo GIA reinforced reload by Medtronic. The aim of this study is to compare outcomes of the 2 buttressing materials used in stapled bariatric procedures. Data of 122 patients undergoing laparoscopic sleeve gastrectomy by a single surgeon were analyzed. Patient demographics, type of buttressing material used, use of EndoClip on potential bleeding sites and postoperative complications were examined. The use of buttressing material is based on availability of the material, with surgeon preference for Seamguard. Of the 122 cases analyzed, Seamguard was used in 110 patients and Endo GIA reinforced reload was used in 12 patients. The average number of EndoClips used on potential bleeding sites on the staple line was lower in the Endo GIA reinforced group (1.86 v. 3.65, $p < 0.05$). There were no postoperative complications or mortality reported for either group. No patients from either group required blood transfusion. Seamguard and Endo GIA reinforced reloads have been reported to reduce staple line leaks and bleeding. Comparing the 2, the use of Endo GIA reinforced reloads reduces the number potential sites of bleeding on the staple line on the basis of the number of EndoClips used.

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Barriers and facilitators to managing patients with class II and III obesity in primary care: a qualitative study. *B. Zevin, N. Dalgarno, M. Martin, C. Grady, R. Houlden, R. Birtwhistle, K. Smith, R. Morkem, D. Barber.* From Queen's University, Kingston, Ont.

Over 1 million Canadians have class II or III obesity and are eligible to be referred by primary care providers (PCPs) for surgical and/or medical weight loss; however, fewer than 7% are. The purpose of this study was to explore the knowledge, experience, perceptions and educational needs of PCPs and patients in managing obesity and obesity-related comorbidities in primary care. We conducted 6 focus groups with PCPs ($n = 17$) and interviews with 2 patient groups: those referred for medical and/or surgical weight loss ($n = 8$) and patients who were eligible but had not been referred ($n = 7$). Thematic analysis was completed on transcripts using open coding in NVivo. Emergent themes were compared between groups and results were framed by the Barriers to Change Theory, which states that changes are first order (extrinsic in nature, outside implementer's control) or second order (intrinsic in nature, involve changes to practice and beliefs). We identified 3 first-order barriers to change among PCPs and patient groups including resource supports, logistics and lack of knowledge about medical and/or surgical weight loss. Three second-order barriers to change were also identified and included root causes of obesity, motivation and perceptions of surgical weight loss. Given the high prevalence of class II and III obesity, PCPs are now key stakeholders for ensuring patients receive timely management of their obesity. Understanding the experiences and perceptions of patients and PCPs helped determine effective strategies for addressing each type of barrier. Additionally, our results informed the development of a continuing professional development (CPD) intervention to support PCPs in providing quality and evidence-based care to their patients with class II and III obesity. Such CPD interventions can address second-order barriers and help shift negative perceptions associated with management of patients with obesity.

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The Edmonton Obesity Staging System predicts risk of postoperative complications and mortality following bariatric surgery. *S. Skulsky, J. Dang, N. Switzer, A. Sharma, D. Birch, S. Karmali.* From the University of Alberta, Edmonton, Alta.

Bariatric surgery is an evidence-based approach for sustained weight loss in patients with obesity. The most common procedures in North America are the laparoscopic sleeve gastrectomy (LSG) and laparoscopic Roux-en-Y gastric bypass (LRYGB). The Edmonton Obesity Staging System (EOSS) is a tool that assigns people with obesity a score of 0 to 4 according to their obesity-related comorbidities and functional status. Previous research demonstrates that the EOSS predicts overall mortality risk. The objective of this study was to assess the utility of the EOSS in predicting major 30-day postoperative complications following LSG or LRYGB. Primary LSG or LRYGB patients were identified from the Metabolic and Bariatric Surgery Accreditation and Quality Improvement Program data registry. Patients were assigned EOSS scores according to their comorbidities and functional limitations extracted from the data registry. Multivariable logistic regression analysis was conducted to evaluate if EOSS score, age, sex, body mass index (BMI), type of procedure or operative time predicted 30-day major complications. From

2015 to 2017, 430 238 patients (79.4% female) who underwent primary LSG or LRYGB were identified. The relative frequencies of patients by EOSS score were as follows: 0 and 1 (23.9%), 2 (62.8%), 3 (10.5%) and 4 (2.9%). Mean preoperative BMI was 45.4 (SD 7.9) kg/m² and mean age was 44.6 (SD 12.0) years. The overall incidence of 30-day major complications was 3.5%. EOSS scores of 2, 3 and 4 were significantly associated with major complications. The strongest predictors of major complications were EOSS 4 (odds ratio [OR] 2.30, 95% confidence interval [CI] 2.11–2.51, $p < 0.001$) and LRYGB versus LSG (OR 2.03, 95% CI 1.97–2.11, $p < 0.001$). EOSS scores of 3 and 4 most strongly predicted death. In conclusion, the EOSS independently predicts risk of 30-day major postoperative complications and mortality. The EOSS provides utility for bariatric surgeons in staging patients for earlier selection and planning to mitigate perioperative complications.

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The impact of attention-deficit/hyperactivity disorder on bariatric surgery outcomes: systematic review and meta-analysis. *I. Tavakoli, V. Mocanu, A. MacDonald, J. Dang, N. Switzer, D. Birch, S. Karmali.* From the University of Alberta, Edmonton, Alta.

Despite the effectiveness of bariatric surgery, about 10% to 20% of patients regain weight after the procedure. Certain psychiatric illnesses such as attention-deficit/hyperactivity disorder (ADHD) may be directly associated with obesity and affect outcomes following bariatric surgery. However, they are rarely screened for. We carried out a systematic review and meta-analysis to examine the impact of ADHD on bariatric surgery outcomes. A comprehensive literature search for both published and unpublished studies of ADHD and bariatric surgery from 1946 to August 2018 was performed. The search was conducted using the Medline, Embase, Scopus, Cochrane Library and Web of Science databases and conference abstracts. Our search terms included “(ADHD OR attention deficit hyperactivity disorder) AND (bariatrics OR obesity surgery OR gastric bypass OR gastric sleeve OR Roux-en-Y OR RYGB OR sleeve gastrectomy)” and the search was limited to human studies in the English language. A preliminary database search of the literature yielded 104 articles. A total of 5 studies with 492 patients were included in the study. The overall ADHD rate was 20.9%, with reported rates ranging from 7% to 38%. The weighted mean age was 44.0 ± 10.2 years, the weighted sex was 83.6% female and the weighted mean follow-up was 22.2 months. Preoperative weighted mean body mass index (BMI) was 43.7 versus a postoperative weighted mean BMI of 34.7. No statistical significance was observed for mean BMI difference between patients with and without ADHD undergoing bariatric surgery (3 studies; mean difference [MD] -2.66, 95% confidence interval [CI] -7.54 to 2.13, $p = 0.28$). However, statistical significance was observed for postoperative follow-up between patients with ADHD versus patients without ADHD (3 studies; MD -7.28, 95% CI -13.83 to -0.73, $p = 0.03$). Patients with ADHD have a statistically significant reduction in postoperative follow-up versus patients without ADHD. Targeted strategies aimed at improving clinic attendance may minimize recidivism rates.

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The effect of bariatric surgery on migraines: a systematic review and meta-analysis. *J. Lee, J. Dang, N. Switzer, J. Kung, S. Karmali, D. Birch.* From the University of Alberta, Edmonton, Alta.

Recent research has demonstrated a relationship between obesity and migraine headaches. These studies have found that patients with obesity have more frequent and severe migraine headaches than patients without obesity. Furthermore, studies have demonstrated that migraine improvement can occur with significant weight loss. Given that bariatric surgery is the most effective intervention for weight loss and weight-related comorbidities, there is potential for bariatric surgery to improve migraine symptoms. The objective of this study was to conduct a systematic review and meta-analysis to determine the effect of bariatric surgery on migraine headaches. Comprehensive searches were conducted in major biomedical databases from database inception to December 2018 for studies examining the effect of bariatric surgery on migraines. Patients of all ages who had a history of migraines undergoing primary bariatric surgery were included. Primary outcomes included migraine frequency, severity and disability before and after bariatric surgery. Four studies meeting selection criteria were included ($n = 159$). Frequency of migraines was markedly reduced after bariatric surgery, with fewer symptomatic days suffered by patients per month postoperatively (mean difference [MD] -5.56 d, 95% confidence interval [CI] 0.14 to 10.99, $p = 0.04$). The degree of migraine headache-related disability as measured by the Migraine Disability Assessment Scale (MIDAS) was also significantly lower for patients following bariatric surgery (MD -14.72 , 95% CI 10.08 to 19.36, $p < 0.001$). The severity of migraine headache pain before and after surgery was reduced with borderline statistical significance (MD -3.53 , 95% CI -0.12 to 7.17, $p = 0.06$). Overall, migraine severity, migraine frequency and headache-related disability were improved 6 months after bariatric surgery. Although migraines are not a well-documented comorbidity of obesity, their presence may be considered an indication for bariatric surgery. However, this systematic review was limited by a small number of studies, and future high-quality, randomized trials are needed to determine the effect of bariatric surgery on migraine headaches.

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A population-based matched cohort study of mortality after bariatric surgery. *A. Doumouras, A. Mann, D. Hong, M. Anvari, G. Babe.* From McMaster University, Hamilton, Ont.

Mortality after bariatric surgery has been studied previously but cohort selection bias, lack of follow-up and collection of confounders have limited the inference of the results. Using a previously validated population-based methodology with multiple linked administrative databases we aimed to determine the most comprehensive link between bariatric surgery and mortality to date. We matched all patients who underwent bariatric surgery from 2009 to 2016 to controls from a family medicine electronic record database. Patients were matched on age, body mass index (BMI) and sex in a 1:1 ratio. The main outcome was all-cause mortality determined through linkage to government death records. Multiple databases for health care utilization and physician billing were used

to define confounders including comorbidities, previous procedures, socioeconomic status, smoking status, substance abuse, cancer screening and psychiatric history. Cox regression was used to model hazard ratios (HR). Overall, 15 571 surgery patients were matched to 15 571 controls. The median time followed for the cohort was 5.4 years. The overall mortality rate was 1.2% in the surgery group and 2.3% in the control group (absolute risk reduction [ARR] 1.1%, 95% confidence interval [CI] 0.90%–1.51%, $p < 0.001$) with a reduced hazard of death of 50% in the surgery group (HR 0.50, 95% CI 0.42–0.60, $p < 0.001$). Those aged 55 years or older had an ARR of 3.8% lower (6.5% v. 2.6%, ARR 95% CI 2.81%–4.78%, HR 0.44, 95% CI 0.35–0.56, $p < 0.001$) while those with a BMI of 40–50 had a 63% lower hazard of death (95% CI 0.29–0.47, $p < 0.001$). Males (HR 0.49, 95% CI 0.36–0.66, $p < 0.001$) and females (HR 0.51, 95% CI 0.41–0.63, $p < 0.001$) had similar relative benefits but males, owing to a higher risk of death, had a higher absolute benefit (ARR males 2.1%, 95% CI 1.19–2.97, $p < 0.001$). In this population-based matched cohort study, bariatric surgery demonstrated a substantial mortality benefit across gender, BMI and age.

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Safety and outcomes of bariatric surgery performed at an ambulatory site associated with a tertiary care hospital in Canada. *S. Deghan Manshadi, K. Dehghan, C. Reimer, D. Robertson, B. Zevin.* From Queen's University, Kingston, Ont. (Deghan Manshadi, Reimer, Robertson, Zevin); and the University of British Columbia, Vancouver, B.C. (Dehghan).

Over 1.5 million Canadians have class II/III obesity. Bariatric surgery results in resolution of or improvement in obesity-related comorbidities. Currently, many provinces only perform bariatric surgery in accredited tertiary care hospitals with 24-hour access to operating rooms, imaging services and an intensive care unit. Our hospital is accredited to perform bariatric surgery with overnight stay in low- and intermediate-risk patients in an ambulatory site that is affiliated with a tertiary care hospital. Our objective is to report on the safety and outcomes of performing bariatric surgery in this setting. A retrospective chart review of all adult patients (aged ≥ 18 yr) who underwent primary bariatric surgery at our site between September 2016 and January 2018 was completed. Patient demographics, duration of surgery, intra- and post-operative complications, number of transfers to the tertiary care hospital and 90-day postoperative complications, hospital readmissions and emergency department (ED) visits were collected. A total of 198 patients underwent surgery. There were 179 (90%) females, average age 41.3 ± 8.8 years, body mass index of 45.3 ± 5.1 kg/m² and ASA score 3 (2–4). Laparoscopic Roux-en-Y gastric bypass (LRYGB) was performed in 185 (93%) patients and laparoscopic sleeve gastrectomy (LSG) in 13 (7%). The most common preoperative obesity-related comorbidities were obstructive sleep apnea (72.7%), gastroesophageal reflux disease (52.0%), musculoskeletal pain (51.5%) and depression (65.2%). Mean operative time was 120 ± 24 minutes and mean length of stay was 2.1 ± 0.5 days. Six out of 198 (3%) patients were transferred to a tertiary care hospital for a postoperative complication. Within the first 90 days from surgery, 25 (12.6%) patients presented to the ED and 8 (4.0%) required

readmission. No deaths occurred during this time. LRYGB and LSG can be safely performed at an ambulatory site affiliated with a tertiary care hospital, which may result in cost savings to the health care system. Caution should be exercised in performing bariatric surgery at an ambulatory site without a tertiary care hospital affiliation.

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Race and sex predict adverse outcomes following bariatric surgery: a propensity-matched MBSAQIP analysis. *V. Mocanu, J. Dang, N. Switzer, D. Birch, S. Karmali.* From the University of Alberta, Edmonton, Alta.

Bariatric surgery is an effective treatment for obesity. Although bariatric surgery is relatively safe, rates of postoperative complications vary considerably across patient populations. Recent literature has identified race and sex as potential predictors of adverse outcomes; however, these studies are conflicting and warrant further evaluation. Using the Metabolic and Bariatric Surgery Accreditation and Quality Improvement Program (MBSAQIP) database, the objective of this study was to examine the association of race and sex on 30-day bariatric surgery outcomes. The MBSAQIP database identified 427 974 bariatric procedures for the sex cohort and 390 897 procedures for the race cohort. Following 1-to-1 propensity score matching, 86 296 and 74 924 pairs were selected for the sex and race cohorts, respectively. Pairs in both cohorts had similar baseline clinical characteristics. Females had increased rates of intervention (1.46% v. 1.15%; $p < 0.001$), readmission (4.18% v. 3.46%; $p < 0.001$) and serious complications (3.82% v. 3.59%; $p = 0.012$). African-American patients had increased rates of intervention (1.28% v. 1.09%; $p = 0.001$), reoperation (1.28% v. 1.09%; $p = 0.001$), readmission (5.01% v. 3.46%; $p < 0.001$), serious complications (4.15% v. 3.15%; $p < 0.001$) and mortality (0.13% v. 0.05%; $p < 0.001$). In conclusion, both race and sex predict adverse outcomes in propensity-matched bariatric surgery cohorts using the MBSAQIP database. Differences related to these factors should be further explored to optimize patient outcomes following bariatric surgery.

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A survey of primary care physician referral to bariatric surgery: access, perceptions and barriers. *M. El-Bebeiry, J. Choi, K. Clouston, A. Vergis, K. Hardy.* From the University of Manitoba, Winnipeg, Man.

Despite the wide body of evidence demonstrating bariatric surgery as an effective means of long-term health modification, there remains a disconnect between surgical programs and primary care physicians (PCPs). The objective of this study is to assess the perceptions of bariatric surgery in our province. A 32-question, IRB-approved survey was developed among experts in bariatric surgery and vetted by local PCPs. A single round of paper surveys was administered to 1000 PCPs and collected between July and September 2015. Continuous variables were assessed by t test and categorical variables by Fisher's exact test. There were 131 survey responses. A majority (54.2%) of respondents did not feel well equipped to counsel their patients on operative management strategies. PCPs reported counselling an average of $11.6\% \pm 17\%$ of their patients on bariatric surgery. Many respondents (58.3%) thought excess weight loss from gastric bypass to be less than 40% and believed there was less than 50% resolution of diabetes (62.4%), hypertension (72.3%), dyslipidemia (77.8%) and obstructive sleep apnea (60.6%). PCPs who referred patients to the bariatric program (71.8%) reported being more comfortable counselling their patients on bariatric surgical options (56.8% v. 17.1%, $p < 0.001$) as well as being more comfortable with postoperative care (67.4% v. 38.2%, $p = 0.003$). Additionally, these PCPs were more likely to estimate a higher rate of diabetes ($54.4\% \pm 22.6\%$ v. $39.0\% \pm 20.1\%$, $p = 0.003$) and hypertension ($49.4\% \pm 21.0\%$ v. $38.8\% \pm 19.6\%$, $p = 0.03$) resolution after bariatric surgery. The predominant perceived barrier to accessing bariatric surgery was long wait lists (33.3%). PCPs appear to underestimate the significance of bariatric surgery in the treatment of obesity. Further exposure and education related to bariatric surgery may improve the comfort level of PCPs with specialist referral and long-term follow-up of patients. Provincial advocacy is probably required to break access barriers.