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Abstracts

Canadian Association of Bariatric Physicians and Surgeons

01

Intragastric balloon for management of severe obesity: a systematic review. ***E. Yorke, N.J. Switzer, A. Reso, X. Shi, C. de Gara, D. Birch, R. Gill, S. Karmali*. From the University of Alberta, Edmonton, Alta.**

Increasing severity of obesity is associated with high surgical morbidity and increasing rates of 30-day readmissions. A minimal preoperative weight loss of 10% of total body weight is associated with decreasing these complications. Nonsurgical options to achieve preoperative weight loss are gaining popularity. The intragastric balloon (IGB), recently approved by the Food and Drug Administration (FDA), is an endoscopically placed saline-filled balloon that induces satiety. Older models of IGBs were associated with unacceptably high complication rates and inconsequential weight loss, which led to their removal from the market. We aimed to systematically examine the literature to determine the efficacy and safety of IGB therapy for obesity. Given the recent FDA approval of IGBs, an updated review of the primary evidence was needed. A comprehensive search of Medline, Embase, Scopus, the Cochrane Library and Web of Science from 1946 to July 2015 was completed. Thirty-six primary studies (n = 6255) were included in this review. Mean patient age, preoperative weight and body mass index (BMI) were 38.6 ± 4.1 years, 126.7 ± 28.3 kg and 43.1 ± 8.7 kg/m^2, respectively. At the time of balloon removal the mean change in weight, change in BMI and percent excess weight loss (%EWL) were 11.5 ± 10.5 kg, 2.9 ± 4.3 kg/m^2 and 33.9 ± 11.1%, respectively. Mean treatment duration of the IGB was 6.1 ± 1.2 months. The most common complications were nausea/vomiting (28.6%), abdominal pain (15.6%) and gastroesophageal reflux (12.5%). Serious complications were rare: mortality (0.1%), gastric ulcer (0.6%), gastric perforation (0.1%) and balloon migration (0.6%). Early balloon removal occurred in 7.8% of patients, most commonly due to intolerance (48.3%), balloon deflation (9.0%), nausea/vomiting (8.1%) and abdominal pain (7.1%). IGBs are associated with marked short-term weight loss with limited serious complications. IGBs can help achieve preoperative weight loss in higher risk severely obese patients awaiting bariatric surgery.

02

Treating type 2 diabetes with bariatric surgery — a predictive tool. ***J.T. Dang, C. Sheppard, D. Kim, X. Shi, X. Li, C. de Gara, S. Karmali, D.W. Birch*. From the University of Alberta, Edmonton, Alta.**

Bariatric surgery has been shown to induce type 2 diabetes (T2DM) remission in severely obese patients. Most patients achieve complete remission, while others remain diabetic. Previous research has identified preoperative factors such as duration of diabetes and HbA1c. Additionally, predictive tools have previously been created for gastric bypass, but no tool has been published that incorporates different types of bariatric procedures. As such, to accurately inform bariatric teams and patients, a predictive tool is needed to estimate the likelihood of diabetes remission. A retrospective review was performed for all T2DM patients who underwent laparoscopic adjustable gastric band (LAGB) surgery, laparoscopic sleeve gastrectomy (LSG) and laparoscopic Roux-en-Y gastric bypass (LRYGB) from January 2008 to July 2014. Preoperative clinical and biochemical data were collected and analyzed using univariate and multivariate logistic regression analysis to identify predictive factors of diabetic remission. A predictive tool was then created with LASSO (Least Absolute Shrinkage and Selection Operator) and decision-tree modelling. Two hundred and thirty-five patients were included in the analysis, with 45.1% of patients achieving diabetic remission at 1 year. Multivariate logistic analysis showed that LRYGB had the highest odds of remission (odds ratio [OR] 28.7, 95% confidence interval [CI] 6.6–125.9) while LSG had the second highest (OR 4.6, 95% CI 1.1–19.3). Remission rates were 57.7%, 38.1% and 10.7% for LRYGB, LSG and LAGB, respectively. Additionally, shorter T2DM duration (OR 0.91, 95% CI 0.84–0.98), fewer oral hypoglycemic medications (OR 0.53, 95% CI 0.32–0.87) and the absence of long-acting insulin (OR 0.0022, 95% CI 0.000014–0.34) predicted remission in multivariate logistic analysis. Decision-tree and LASSO models were created, with a predictive accuracy of 76.5% and 74.2%, respectively. In conclusion, our decision-tree tool can be helpful to clinicians in predicting which patients will achieve diabetes remission following bariatric surgery and, potentially, in resource allocation.

03

An update on idiopathic intracranial hypertension and bariatric surgery: a systematic review. ***W.Y.L. Sun, N.J. Switzer, T. Smart, J.T. Dang, R. Gill, C. de Gara, D. Birch, S. Karmali*. From the University of Alberta, Edmonton, Alta.**

We aimed to systematically review the literature to determine the efficacy of bariatric surgery for idiopathic intracranial hypertension (IIH). Commonly referred to as pseudotumour cerebri, the syndrome involves increased intracranial pressures with normal cerebral anatomy, with a constellation of classic symptoms including headache, nausea, visual acuity deficits, pulsatile tinnitus and papilloedema. The link between IIH and obesity has been well established in the literature, probably through intra-abdominal pressure transmitted to the craniospinal axis. As bariatric surgery remains the only proven treatment modality for obesity, case reports and case series have pointed to the potential benefit of this type of intervention for IIH. A comprehensive search (limited to English and human) of Medline, Embase, Scopus, the Cochrane Library and Web of Science from 1946 to July 2015 was completed. Title searching was restricted to the following keywords/terms: bariatric surgery/gastric bypass/gastric band/sleeve gastrectomy and intracranial hypertension/pseudotumour cerebri. A total of 121 studies were reviewed for inclusion in the systematic review. Twelve primary studies (n = 39) were included in the systematic review. All

patients had a preoperative diagnosis of IIH. Preoperative BMI was 48.55 kg/m^2, which improved to 33.67 kg/m^2 and 33.94 kg/m^2 at 6 and 12 months, respectively. Lumbar puncture opening pressures dropped from 403 mm Hg preoperatively to 140 mm Hg. Common symptoms of IIH were compared before and after bariatric surgery: headaches (100% v. 10%), visual complaints (62% v. 44%), tinnitus (56% v. 3%) and papilloedema (62% v. 8%). Bariatric surgery appears to lead to marked improvement in IIH. IIH is not a well-publicized comorbidity of obesity but its presence should be considered as an indication for surgical intervention.

04

Cost-effectiveness analysis of bariatric surgery versus medical management for obesity in Canada. ***S. Rieder, D. Simonsen.*** **From Western University, London, Ont.**

This study aims to examine the cost-effectiveness of the 2 most commonly performed weight-loss surgeries, Roux-en-Y gastric bypass and vertical sleeve gastrectomy, against medical management for obesity in Canada. The rate of obesity in Canada has steadily increased over the past 2 decades and is now estimated to be upwards of 25%. Medical management for obesity has been demonstrated to be inferior to surgery for resolution and remission of obesity in other countries. This study aims to provide evidence that bariatric surgery in Canada is both cost-effective and cost-saving. The long-term cost-effectiveness analysis was performed using a Markov model that places both surgical and medical patients into 3 health care states. Probabilities of initial disease burden and short-term costs will be derived from the Ontario Bariatric Network's database. The case-costs of bariatric procedures were taken from the Ministry of Health. The model estimated costs accrued over each cohort's lifetime and compared them using incremental cost-effectiveness ratios (ICERs). The bariatric patients had a dramatic decrease in the amount of weight lost, in the amount of medications taken and in the comorbidities associated with obesity. The Markov model was run for 20 years and the predicted ICER was $5582/QALY for the surgical arm compared with medical management. Bariatric surgery in Canada over a 20-year cycle is much more cost-effective than medical management according to our model. This result parallels much of the current literature in other countries as well. To save additional dollars, access to bariatric surgery must be increased.

05

Sleeve gastrectomy and type 2 diabetes mellitus: a systematic review of long-term outcomes. ***N.J. Switzer, S. Prasad, E. Debru, N. Church, P. Mitchell, R.S. Gill.*** **From the University of Alberta, Edmonton, Alta.; and the University of Calgary, Calgary, Alta.**

There is a strong association between obesity and type 2 diabetes mellitus (T2DM). While short-term results of the laparoscopic sleeve gastrectomy (LSG) and diabetes remission are promising, long-term T2DM resolution rates following the LSG are not well established. The objective of this paper was to systematically review the evidence on the efficacy of the LSG with respect to T2DM resolution. A comprehensive literature search was conducted through Medline, Embase, Scopus, Web of Science, Dare, the Cochrane Library and the HTA database. Conference abstracts and registered clinical trials were also searched, along with Google for other types of grey literature. The search terms used were sleeve gastrectomy, vertical gastrectomy, metabolic surgery and diabetes. Included studies reported 5-year follow-up of T2DM outcomes following the LSG. After the initial screen, 664 abstracts were reviewed; 11 studies (n = 1354) met the inclusion criteria and were included in the systematic review. T2DM patients (n = 402) constituted 29.7% of patients. The mean preoperative BMI was 48.4 ± 10.8 kg/m^2 and 44.6 ± 11.8 kg/m^2 for all patients and diabetic patients, respectively. In diabetic patients, postoperative BMI dropped an average of 15.5 kg/m^2 to 33.2 ± 4.7 kg/m^2 at 5 years. Diabetes prevalence decreased postoperatively to 20.5% at 5 years. The primary outcome of interest, diabetes resolution, occurred in 60.8% of patients. Mean plasma glucose levels and hemoglobin A1c values fell 58.3 mg/dL and 1.6%, respectively, at the 5-year mark. Five-year follow-up data were reported in only 56% of patients. The LSG is an effective long-term metabolic surgery for patients with T2DM, with 5-year resolution rates of approximately 60%.

06

A systematic review and meta-analysis of outcomes for type 1 diabetes after bariatric surgery. ***A. Chow, N.J. Switzer, J. Dang, X. Shi, C. de Gara, D.W. Birch, R.S. Gill, S. Karmali.*** **From the University of Alberta, Edmonton, Alta.**

We aimed to examine the literature regarding the efficacy of bariatric surgery for patients with type 1 diabetes. Bariatric surgery has been shown to improve and facilitate resolution of type 2 diabetes through gastrointestinal hormone modulation and enhancing residual β-cell function. However, few data are available regarding the impact of bariatric surgery in patients with limited residual β-cell function, as in type 1 diabetes. Early small case reports suggest that bariatric surgery leads to a reduction in insulin requirements as well as improvements in body mass index (BMI) and other comorbidities in this population. A comprehensive search of Medline, Embase, Scopus, the Cochrane Library and Web of Science from 1946 to July 2015 was completed. Title searching was restricted to the following keywords/terms: bariatric/gastric bypass/gastric band/sleeve gastrectomy AND type 1 diabetes. Inclusion criteria included human adult subjects with BMI ≥ 35 kg/m^2 and a confirmed diagnosis of type 1 diabetes who underwent a bariatric surgical procedure with indicators of glycemic control reported. Thirteen primary studies (86 patients) were included in the systematic review and meta-analysis. Subjects had a mean age of 41.16 ± 6.76 years with a mean BMI of 42.50 ± 2.65 kg/m^2. There was a marked reduction in BMI postoperatively at 12 months and at study end point, to 29.55 ± 1.76 kg/m^2 (p < 0.00001) and 30.63 ± 2.09 kg/m^2 (p < 0.00001), respectively. Preoperative weighted mean total daily insulin requirement was 98 ± 26 IU/day, which decreased significantly to 36 ± 15 IU/day (p < 0.00001) and 42 ± 11 IU/day (p < 0.00001) at 12 months and at study end point, respectively. An improvement in HbA1c was also seen from 8.46 ± 0.78% preoperatively to 7.95 ± 0.55% (p = 0.01) and 8.13 ± 0.86% (p = 0.03) at 12 months and at study end point, respectively. Bariatric surgery in patients with type 1 diabetes leads to significant reductions in BMI and improvements in glycemic control as reflected by postoperative insulin requirements as well as HbA1c.

07

Bariatric operative reporting: perceptions of quality among Canadian bariatric surgeons. ***S.E. Stogryn*, *K. Hardy*, *A. Vergis*. From the University of Manitoba, Winnipeg, Man.**

Our objective was to evaluate the perceptions of bariatric surgeons regarding the quality of operative reporting in bariatric surgery and a potential need for improvement. A survey was distributed via a secure web-based platform to active bariatric surgeons across Canada. We aimed for representation from every province currently performing bariatric surgery. A modification of the validated Structured Assessment Format for Evaluating Operative Reports (SAFE-OR) was used to evaluate the impression of the quality of narrative dictations (NR) for bariatric surgery and synoptic operative reports (SR) on anchored 5-point Likert scales. Free text fields were provided to allow participant elaboration of opinions and feedback. Comments were collated and reported as themes. Thirty-four Canadian bariatric surgeons were invited with a 71% (24/34) response. We achieved representation of academic and community surgeons from each province across Canada. The most commonly performed procedures were Roux-en-Y gastric bypass and sleeve gastrectomy (96.0% and 100.0%, respectively). The majority (75.8%) of respondents dictate a NR and 20.0% perform a NR from a template. Weighted mean SAFE-OR scores of NRs by surgeons and trainees were mediocre (28.0/40 and 27.5/45, respectively). Lowest scoring items were "description of indications" for surgeons (2.9/5) and "succinctness" and "readability" for trainees (2.8 and 2.5, respectively). Twelve per cent of surgeons had experienced situations where inaccurate operative reporting had led to poor patient care. Opinions reflected the need for a standardized SR to improve operative documentation (mean 3.3/5). Finally, feedback suggested that the reproducible nature of bariatric procedures lends an inherent suitability to a synoptic format. Canadian bariatric surgeons reflected a perception of mediocre quality of NRs for bariatric surgery that could potentially lead to poor patient care. There is a desire to create a validated SR to address these shortcomings.

08

Development of consensus-derived quality indicators for bariatric surgery. ***S.E. Stogryn*, *J. Park*, *K. Hardy*, *A. Vergis*. From the University of Manitoba, Winnipeg, Man.**

Synoptic operative reporting (SR) has become a popular solution to the poor overall quality of narrative reports (NR). Our objective was to systematically develop operative report quality indicators for Roux-en-Y gastric bypass (RYGB) surgery to generate validated parameters by which these reports can be evaluated and improved. A Delphi protocol was used to determine quality indicators for RYGB reporting. Bariatric surgeons from across Canada were recruited along with local physician key stakeholders to participate via a secure web-based platform. Participants initially submitted potential quality indicators. These were grouped by theme. Items were then rated on a 9-point Likert scale in subsequent rounds. Scores of 70% or greater were used for inclusion consensus and 30% or less denoted exclusion. Elements scoring between 30% and 70% were recirculated by runoff in subsequent rounds to generate the final list of quality indicators. Four community and 4 academic bariatric surgeons were invited. All provinces currently performing RYGB were represented. The 4 multidisciplinary invitees included 1 minimally invasive/acute care surgeon, 1 tertiary abdominal radiologist, 1 gastroenterologist proficient in advanced endoscopy and 1 general surgeon with expertise in SR. The 1st round achieved an 83.3% (10/12) response and identified 91 potential items for consideration. Round 2 had a 100% (12/12) response and 69 items reached inclusion consensus. The remaining 22 items were then recirculated. The 3rd round achieved a 100% (12/12) response and resulted in 75 quality indicators reaching final inclusion consensus. This study established consensus-derived multidisciplinary quality indicators for RYGB operative reports. This information will allow further assessment of the quality of NRs and afford the development of a SR that may ameliorate identified deficiencies.

09

Using "customized" care pathways for patients in a multidisciplinary bariatric surgery program to improve resource efficiency: development and implementation of a comprehensive triaging tool. ***K. Lobo Prabhu*, *M.C. Cleghorn*, *A. Mirkolaei*, *A. Diamant*, *S. Robinson*, *S. Sockalingam*, *A. Okrainec*, *T.D. Jackson*, *F.A. Quereshy*. From the University of Toronto and the University Health Network, Toronto, Ont.**

Most bariatric surgical programs use a linear care pathway for preoperative evaluation that includes medical, social work, dietary and psychological assessments, and ultimately surgical consultation. The current model results in system inefficiencies as patients who are unlikely to reach surgery occupy limited resources. Our study aims to develop a predictive triaging tool to create tailored care pathways for patients that better address their individual needs and improve resource utilization. Analysis of retrospective data on 1664 patients was used to develop an intake questionnaire that identified patients at risk of medical and/or psychosocial issues that could delay their progress through the program. Focus groups conducted with medical staff and patients were used to validate the questionnaire. The questionnaire was distributed to patients between March and October 2015. Assessment codes representing priority appointments were assigned to patients based on their responses and used in the scheduling process to alter the care sequence accordingly. Six hundred and fifteen patient intake questionnaires were completed, representing a response rate of 62.8%. The mean age of patients surveyed was 46 years, and 76.6% of patients were female. The majority of patients received a priority assessment code for nursing consultation (46.6%), followed by psychological/psychiatric (20.6%), social work (13.5%), surgical (2.9%) and dietary (1.9%) consultation. Assessment codes were not received by 14.5% of patients, and 26.0% of assigned codes indicated that patients referred were unsuitable for bariatric surgery. This study challenges the concept of a standardized linear care pathway used in bariatric surgery programs. We used an intake questionnaire to identify relevant information for developing customized care sequences. There is a significant opportunity for resource optimization by identifying patients who are ineligible for surgery early in the program to relieve system congestion. This cohort is being prospectively followed to evaluate the impact of using this triaging tool on wait times and late attrition rates.

10

Opportunities for education and training in bariatric surgery: a systematic review. ***S. Alhabdan, H. Alamri, R. Aggarwal.* From McGill University, Montreal, Que.**

Bariatric surgery has quickly become one of the commonest surgical procedures performed in North America. It is a technically challenging specialty that entails a long learning curve. Surgeons in this field either are not formally trained, undertook mini-fellowships or were involved in dedicated fellowship training programs. The objective of this study was to perform a systematic review of educational programs, opportunities and structures with respect to outcomes in bariatric surgery. An electronic search was performed in 3 electronic databases from 1988 to November 2015. Studies examining all aspects of bariatric surgery training and education were included. Some 51 studies were included for review. From 8 papers, comprising 3524 patients, the estimated learning curve for gastric bypass was a median of 100, and a mean of 133 patients. The impact of fellowship training on patients' outcome was investigated in 12 studies. The main determinants of competence were operative time, immediate and postoperative complications, length of stay and percentage excess weight loss. These showed no significant difference in outcomes between surgeons in fellowship and those in practice. Nine papers examined the aspects of bariatric training in residency and involved 18 987 patients, of which 8459 had resident involvement. The majority of residents were seniors, with examination of safety, operative time and complications. A single study showed training residents to be expensive. Non-formal training methods were discussed in 4 studies, including 483 participants, comprising mini-fellowships, surgical master-classes and workshops. Finally, 8 studies examined simulation in bariatric surgery. The majority of training of bariatric surgery occurs in the context of fellowship, with no negative impact on patient outcomes. The estimated learning curve for gastric bypass is approximately 100 patients. In addition to being taught during formal fellowship, bariatric surgery is also being taught during residency. Further opportunities exist with regard to mini-fellowships, workshops and the evolving role of simulation.

11

The impact of a standardized program on short- and long-term outcomes in bariatric surgery. ***L.N.F. Aird, D. Hong, S. Gmora, R. Breau, M Anvari.* From McMaster University, Hamilton, Ont.**

The purpose of this study is to determine if there has been an improvement in short- and long-term clinical outcomes since 2010, when a bariatric network led a province-wide initiative to establish a standardized system of care for bariatric patients. The system includes 9 bariatric centres, a centralized referral system and a research registry. Standardization of procedures has progressed yearly, including guidelines for preoperative assessment and perioperative care. Analysis of bariatric registry data was performed by fiscal year between April 2010 and March 2015. Three-month overall postoperative complication rates and 30-day postoperative mortality were calculated. The mean percentage of weight loss at 1, 2 and 3 years postoperative and regression of obesity-related diseases were calculated. The analysis of continuous and nominal data was performed using ANOVA, χ^2 and McNemar testing. A multiple logistic regression analysis was performed for factors affecting postoperative complication rate. There were 8043 patients included in the bariatric registry between April 2010 and March 2015. Thirty-day mortality was rare (< 0.075%) and showed no significant difference between years. Three-month overall postoperative complication rates significantly decreased with standardization ($p < 0.001$), as did intraoperative complication rates ($p < 0.001$). Regression analysis demonstrated increasing standardization to be a predictor of 3-month complication rate with an odds ratio of 0.59 (95% CI 0.41–0.85, $p = 0.00385$). The mean percentage of weight loss at 1, 2 and 3 years postoperative showed stability at 33.2% ± 9.0%, 34.1% ± 10.1% and 32.7% ± 10.1%, respectively. Sustained regression in obesity-related comorbidities was demonstrated at 1, 2 and 3 years postoperative. Evidence indicates the implementation of a standardized system of bariatric care has contributed to improvements in complication rates and supported prolonged weight loss and regression of obesity-related diseases.

12

A pilot study to investigate the role of intraperitoneal ropivacaine in enhanced recovery after surgery (ERAS) in bariatric patients. ***A. Jarrar, R. Wu, F. Haggar, N. Porte, N. Eipe, A. Neville, J.D. Yelle, F. Mamazza.* From the University of Ottawa and the Ottawa Hospital Research Institute, Ottawa, Ont.**

To evaluate the efficacy of intraperitoneal local anesthetic (IPLA) to achieve enhanced recovery after surgery (ERAS) in bariatric patients, we conducted this pilot study to plan and design a future multicentre clinical randomized controlled trial (RCT). After Health Canada and local research ethics board approval, morbidly obese patients undergoing elective laparoscopic Roux-en-Y gastric bypass (LRYGB) for obesity were recruited to this double-blind, placebo-controlled RCT from a bariatric centre of excellence. After consent, in addition to standard of care protocols, all patients were prepared for the surgery with peak expiratory flow (PEF) and 6-minute walk distance (6MWT) measurements. In the operating room, a standardized surgical and anesthetic protocol was followed and participants were randomly assigned to receive IPLA or normal saline solution. Outcomes included postoperative pain score (POPS), opioid consumption (OC), quality of recovery (QOR40), comparison to their own 6MWT, PEF and feasibility. One hundred and twenty individuals were screened for eligibility; 92 (77%) of these individuals were included and completed the study. Multivariate analysis of the clinical outcomes showed no significant difference between the 2 groups in POPS ($p = 0.49$), OC ($p = 0.68$), PEF ($p = 0.85$), 6MWT ($p = 0.23$) and QOR40 ($p = 0.69$). There were no serious or unexpected adverse events. A sample size of 6788 patients will be required to determine a 30% improvement in reported pain levels. Trial management processes and data collection proved effective. Reasons for agreeing or declining to participate in the study were identified using qualitative interviews. High eligibility and recruitment proportions were achieved in the proposed study of IPLA in LRYGB patients. The required sample size confirms the need for a multicentre RCT. The study confirms that an ERAS-derived bariatric surgery protocol has clinically relevant benefits in terms of preoperative patient preparation and intraoperative protocol standardization.

Canadian Association of General Surgeons

01

Does age matter in morbidity following gastric cancer resection? An ACS-NSQIP analysis. ***T.D. Hamilton, A.L. Mahar, A.B. Nathens, C.H.L. Law, P.J. Karanicolas, N.G. Coburn, J. Hallet*. From Vancouver General Hospital, Vancouver, B.C.; Sunnybrook Health Sciences Centre – Odette Cancer Centre, Toronto, Ont.; and the University of Toronto, Toronto, Ont.**

Evidence on short-term outcomes for gastric cancer (GC) resection in elderly patients is limited by small samples from single institutions. Patient selection remains challenging. We sought to examine the association between advanced age and short-term outcomes of gastrectomy for GC. Using multi-institutional data from the American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP), we identified patients undergoing gastrectomy for GC (2007–2013). Primary outcome was 30-day major morbidity. Outcomes were compared among age categories (<65, 65–70, 71–75, 76–80, >80 years old [yo]). Univariable and multivariable regression was used to estimate the morbidity risk associated with age. Of 3637 patients, 60.6% were elderly (>65 yo). Major morbidity increased with age, from 16.3% (<65 yo) to 20.8% (65–70 yo), 20.7% (71–75 yo), 21.5% (76–80 yo) and 24.1% (>80 yo) ($p < 0.001$). This was driven by higher respiratory and infectious events. Perioperative 30-day mortality increased from 1.2% (<65 yo) to 6.5% (>80 yo) ($p < 0.0001$). After adjusting for relevant clinical variables, age was independently associated with morbidity in the 76–80 yo (RR 1.31, 95% CI 1.08–1.60) and >80 yo (RR 1.49, 95% CI 1.23–1.81) groups. The magnitude of effect of preoperative variables associated with morbidity in elderly patients (>65 yo) did not change when considering higher age cut-offs (70, 75 and 80 yo). A predictive model including age, gender, body mass index, functional status, extent of surgery and cardiovascular, respiratory and diabetes comorbidities was created. Assuming adverse preoperative characteristics, predicted morbidity increased by 18.6% in 75–80 yo and 27.5% in >80 yo (compared with <65 yo) for total gastrectomy, and by 11.6% and 17.2% for sub-total gastrectomy. With optimal preoperative characteristics, it increased by 5.1% in 75–80 yo and 7.6% in >80 yo for total gastrectomy, and by 11.5% and 17.1% for sub-total gastrectomy. Advanced age beyond 75 yo was independently associated with increased morbidity after GC resection. The magnitude of this impact is modulated by preoperative characteristics. Indications for resection in elderly GC patients should be revised according to age-specific morbidity risk.

02

Acute care surgical services: a survey to delineate acute surgical services in British Columbia. ***N. Seyednejad, H. Hwang, D. Konkin*. From the University of British Columbia, Fraser Health Authority, Vancouver, B.C.**

Acute care surgery makes up a major component of general surgery practice in British Columbia. Currently, several modes of delivery exist depending upon hospital infrastructure, including an acute care surgical service (ACSS). A survey was conducted to investigate the current models of care employed by centres across BC and to assess interest in this new model. An online questionnaire was sent out to all general surgeons across BC. Results were collected on an anonymous collection survey database. A total of 61 practising surgeons completed the survey, with the majority being in a community-based practice (70%). The majority (71.7%) of respondents do not have a dedicated ACSS at their hospital. Only 8.5% of respondents practised at a facility with access to the operating suite during daytime hours for unscheduled patients. Of those with an ACSS model, most agree that their quality of life is improved. However, among all respondents, most (76%) felt that their access to the operating room for unscheduled cases was unsatisfactory. ACSS has the potential to improve access to high-quality surgical intervention in a timely fashion with more predictable scheduling for surgeons and improved patient outcomes. The majority of respondents who are involved in an ACSS model felt that their quality of life is improved; however, without daytime access to the operating room, both emergency and elective patients are negatively impacted.

04

Predictors of morbidity and mortality after emergency abdominal surgery: a national study. ***A. Altamimi, M. Hassanain, T. Noub, M. Aljiffry, A. Nawawi, G. Al Saied, M. Riaz, H. Alanbar, A. Altamimi, S. Alsareii, M. Al-Moosa, A. Al-shammari, S. Alnuqaydan, A. Ghzwany*. From King Saud University, Riyadh, Saudi Arabia; King Abdulaziz University, Jeddah, Saudi Arabia; King Fahad Medical City, Riyadh, Saudi Arabia; King Saud Medical City, Riyadh, Saudi Arabia; Najran University, Najran, Saudi Arabia; King Faisal University, Dammam, Saudi Arabia; Qassim University, Alqassim, Saudi Arabia; and Jazan University, Jazan, Saudi Arabia**

With the increasing rate of emergency surgery coupled with a rise in associated complications due to a growing population and more access to hospitals, it became obvious that it was important to study the impact of these complications nationally. A prospective cohort study of 8 centres from the 5 sectors of the country was conducted. All patients undergoing emergency intraperitoneal surgery were included except for those undergoing Caesarean sections. Patients' data were collected for a 14-day period for a minimum of 1 period and a maximum of 3 periods between September 2014 and April 2015. Of the 283 patients, 54.06% were males. Two patients (0.7%) died within 24 hours and 7 (2.47%) within 30 days. We found that 57.59% of the operations were done during the daytime, and the median time from admission to the operation was >48 hours. Seventy-nine (27.91%) of the operations were laparoscopic, and 204 (72.08%) were open. Thirty-seven patients underwent bowel resection, with 21 patients needing stoma. Twenty-nine (10.24%) required reintervention, and 19 (8.12%)

patients had complications resulting in critical care within 30 days of the primary operation. Reported complications were as follows: 11 (3.89%) anastomotic leak, 20 (7.32%) abscess and 36 (13.04%) wound infection. The median length of stay was 3 days. Variables significantly correlated with 30-day mortality were gender ($p = 0.038$), ASA classification ($p < 0.0001$), time from admission to the operation ($p = 0.025$), safety checklist use ($p = 0.0005$), stoma ($p = 0.028$), incision type ($p < 0.0001$), supplementary oxygen ($p = 0.048$), blood transfusion ($p = 0.004$), thrombolytic prophylaxis ($p < 0.0001$), reintervention ($p = 0.0034$), anastomotic leak ($p < 0.0001$), wound infections ($p = 0.034$) and major complications ($p < 0.0001$). Multivariate analysis showed ASA ($p < 0.0001$), major complications ($p < 0.0001$), thrombolytic therapy ($p < 0.0001$) and length of stay ($p < 0.0001$) were significantly correlated with 30-day mortality. Our data showed that ASA score, major complications, thrombolytic therapy and length of stay are associated with 30-day mortality. Further analysis will be done to identify hospital set-ups and practices associated with higher complications and define standards.

05

A trial of life: Does increasing prehospital time impact trauma team activation and patient outcomes in severe blunt trauma? ***T.W. Clements, K. Vogt, S.M. Hameed, N. Parry, A.W. Kirkpatrick, S. Grondin, E. Dixon, J. McKee, C.G. Ball.*** **From the University of Calgary, Calgary, Alta.**

Emergency medical services (EMS) prehospital times vary substantially between regions. The impact of these times on trauma team activation (TTA) and patient survival is unknown. The aim of this study was to identify the impact of EMS prehospital time on resource utilization (TTA) and patient outcomes. A multiinstitutional study from 3 geographically distinct regions (level 1 trauma centres) reviewed all severely blunt injured patients (injury severity score [ISS] > 12) to determine the relationship between prehospital times (30-min increments), hemodynamic instability (sBP < 100), TTA and patient outcomes. Standard statistical methodology was employed. From January 2011 to January 2016, 6881 severely blunt injured patients (mean ISS = 24.6; length of stay = 16.3 days) were evaluated (centre 1 — 3376; centre 2 — 2401; centre 3 — 1104). As the prehospital time interval increased, the overall mortality rate decreased (0–30 min = 24.1%; 31–60 min = 14.7%; 61–90 min = 10.3%; 91–120 min = 10.4%; 121–150 min = 10.2%; 151–180 min = 12.1%; $p < 0.05$). The pattern of decreasing mortality with longer prehospital time was consistent across all 3 regions despite variable overall injury severity (ISS) and prehospital system formats ($p > 0.05$). TTA was variable across time intervals (0–30 min = 51.9%; 31–60 min = 25.4%; 61–90 min = 17.1%; 91–120 min = 26.3%; 121–150 min = 27.1%; 151–180 min = 29.9%; $p < 0.05$) and only variably related to ISS. Hemodynamic instability was predictive of mortality in all prehospital intervals ($p < 0.05$). TTA criteria must improve to select appropriate patients who have a prehospital transport time less than 30 minutes and a high mortality. Patients with prehospital times more than 60 minutes and hemodynamic stability rarely require life-saving interventions and TTA. Longer prehospital times lead to a "trial of life" preselection scenario with decreasing overall mortality regardless of the regional trauma system structure.

06

Quitting surgical specialty residencies — attitudes and factors in Canada. ***S.T. Adams, D.N. Ginther, E.D. Neuls, P. Hayes.*** **From the University of Saskatchewan, Saskatoon, Sask.**

This study sought to determine how many residents in Canadian surgical specialty programs are considering leaving and why. An anonymous survey was administered to all residents enrolled in 9 Canadian surgical disciplines. Association between potential factors and serious consideration of leaving one's program was determined using Pearson's χ^2 test. The response rate was calculated using data from the Canadian Post-M.D. Education Registry (CAPER) website. There were 523 responses (27.6% response rate). One hundred and forty respondents (26.8%) were either somewhat or seriously considering leaving their program, with general surgery reporting the highest rate (32.7%). PGY status, specialty, age, gender, relationship status and the possession of desire to obtain a postgraduate degree were not associated with a desire to change specialty. Residents intending to pursue fellowship training or an academic career were less likely to harbour thoughts of leaving their specialty ($p = 0.003$ and 0.005, respectively). Poor work-life balance and fear of unemployment/underemployment were the top 2 reasons why residents would consider changing specialty (55.5% and 40.8%, respectively), although the reasons cited did not differ between the groups ($p = 0.644$). Those residents considering changing specialty were less likely to enjoy their work but reported that they persisted as they felt they had already invested too much time to change careers ($p < 0.001$). Over a quarter of residents in surgical training programs in Canada harbour genuine desires to abandon their surgical careers primarily for fear of ending up with a poor work-life balance or being unable to find satisfactory employment. Many of the dissatisfied residents appear not to enjoy their work but persist because they feel they have travelled too far to turn back. Efforts to educate prospective residents about the reality of the surgical lifestyle and to optimize employment prospects may improve completion rates.

07

Management of cases of obstructive jaundice. ***S. Malakar.*** **From BMRI Hospital, Bhubaneswar, Odisha, India**

An obstructed common bile duct is treated by various surgeries, such as choledocholithotomy, choledochoduodenostomy, choledochojejunostomy with Roux-en-Y jejunostomy, cholecystojejunostomy with jejunojejunostomy and gastrojejunostomy. Despite best efforts, complications like leakage of anastomosis, ascending cholangitis or intestinal reflux are seen. During the period 1999–2011, 80 cases of obstructive jaundice were treated, as follows: 50 cases of cholecystitis with common bile duct (CBD) stone, 16 cases of cholecystitis with CBD stricture 2 cases of postcholecystectomy stricture of the common hepatic duct (CHD), 4 cases of cholecystocholedochal fistula, 3 cases of postcholecystectomy stone in the CBD, 4 cases of carcinoma of the head of the pancreas and 1 case of pseudopancreatic cyst with CBD stricture. The following procedures were adopted. 1) Cholecystectomy and choledocholithotomy with T-tube drainage where the CBD was 10 mm resulted in a hospital stay of

10–14 days and the need for a T tube for 14 days. 2) Cholecystectomy with choledochoduodenostomy where the CBD was 15–24 mm and a stone was in the CHD/CBD resulted in a hospital stay of 8–10 days and no need for a T-tube, but the duodenum should be healthy. 3) Hepaticojejunostomy with Roux-en-Y jejunostomy where the CHD was 10–12 mm dilated and the stricture was near the porta hepatis resulted in a hospital stay of 14 days and the need for a T-tube drain for 3–5 months. 4) Choledochojejunostomy with Roux-en-Y jejunostomy was done when the stricture was in the distal CBD and 10–15 mm dilated. 5) Cholecystojejunostomy with jejunojejunostomy and gastrojejunostomy was done in 4 cases of advanced carcinoma of the head of pancreas, resulting in a hospital stay of 8–10 days. 6) Cystostomy with cholecystojejunostomy and jejunojejunostomy was done in 1 case of pseudo pancreatic cyst causing stricture of the CBD, resulting in a hospital stay of 8 days and the need for a T-tube drain for 21 days. 7) Choledochoduodenostomy was done for 4 cases of post-cholecystectomy CBD stone. Hence we conclude that 1) cholecystectomy and choledocholithotomy with T-tube drainage is ideal where there is no obstruction at the ampulla of Vater, 2) hepaticojejunostomy with Roux-en-Y jejunostomy is ideal for high up stricture of the CHD and 3) cholecystectomy with choledochoduodenostomy is ideal where the CBD is more than 15 mm and the stone or stricture is in the CHD/CBD or where endoscopic retrograde cholangiopancreatography has failed and the duodenum is healthy.

08

Mentorship in general surgery residency programs in Canada: Where are we and what do we need? *M. Delisle*, *B. McCarthy*, *P. Hebbard*, *J. Rivard*, *D. Wirtzfeld*. From the University of Manitoba, Winnipeg, Man.

Mentorship in surgery positively influences personal development, career success and research productivity. There exists a paucity of data on mentorship in general surgery (GS) residency programs in Canada. An electronic survey was developed, validated and distributed to all GS residents in Canada to obtain their perspective on existing mentorship, its effectiveness and characteristics of ideal mentorship. Data analysis was largely qualitative and χ^2 and ANOVA were used when appropriate. A total of 179 (30%) out of 601 residents returned the questionnaire. The majority (97%) felt mentorship was important but only 67% could identify a mentor. Common reasons for not having a mentor included lack of support from residency programs (50%) and an inability to identify someone (48%). Residents with no mentorship program more frequently reported a lack of qualified mentors as a reason for not having a mentor. Residents more frequently identified more than 1 mentor (45%) and mentors were most commonly an attending (86%). Mentees were generally (79%) satisfied with their mentors. Mentee satisfaction was not significantly associated with having a mentorship program ($p = 0.6$) or mentors being selected rather than assigned ($p = 0.9$). Residents felt an ideal mentor is someone who works in GS or a GS subspecialty (93%), has no influence on their academic training (62%) and is personally selected (55%). Residents most commonly wanted mentoring for professional development (85%) and career guidance (89%). Females and senior residents more commonly wanted mentoring for personal issues. Resources believed to most facilitate a mentoring included protected time for meetings (66%) and a list of available mentors (64%). Residents favoured having a mentoring program that is required but not monitored irrespective of resident training level and program size ($p = 0.5$ and $p = 0.6$, respectively). Implementing a mentorship program tailored to residents' wants and needs will help ensure tangible outcomes and benefits.

09

Normothermic ex vivo perfusion of ischemic kidneys for preservation and recovery. *A. Daters*, *E. Barber*, *M. Rosin*, *B. Ambros*, *R. Gillanders*, *M. Soliman*, *Q. Zhou*, *M. Moser*, *A. Shoker*, *R. Mainra*, *T. Banejee*, *R. Petracek*, *Y. Luo*. From the University of Saskatchewan, Saskatoon, Sask.

To increase the number of organs available for transplant, donation after cardiac death (DCD) is an alternative to donation after brain death. Unfortunately, these organs have a higher risk of adverse events, including delayed graft function. We explore normothermic perfusion as a way to monitor and treat kidney grafts before implantation. Thirteen porcine kidneys were procured after 60 minutes of warm ischemia to simulate DCD. The experimental group was ex vivo machine perfused with oxygenated porcine blood and total parenteral nutrition (TPN) at 34°C. The control group was perfused with kidney perfusion solution (KPS-1) at 4°C. Graft function, perfusion data and serum chemistry were monitored hourly during perfusion. Three kidneys from the experimental group and 1 from the cold perfusion group were excluded for either technical reasons or primary non-function. All the kidneys in the control group ($n = 4$) produced urine for 48 hours, while the kidneys in the experimental group ($n = 5$) produced urine for a mean of 15 hours. There was no difference between groups in the amount of urine produced within the first 24 hours or hourly. The creatinine clearance in the experimental group was substantially better than that of controls over the first and second 6-hour intervals, measuring 4.34 versus 0.06 mL/h ($p = 0.04$) and 2.09 versus 0.21 mL/h ($p = 0.03$), respectively. The fractional excretion of sodium was also lower in the experimental group at 6 hours (17.84 v. 80.16, $p = 0.0003$). There was also a trend at 12 hours that did not reach statistical significance. Porcine kidney grafts assessed during normothermic perfusion showed better functional results than those on cold perfusion. Normothermic perfusion allows for kidneys to be evaluated as candidates for transplantation and also provides time for graft treatments that may be needed. Further research will involve transplanting kidney grafts following normothermic perfusion.

10

Safety and effectiveness of telementoring in surgery: a systematic review. *E. Bilgic*, *S. Turkdogan*, *A. Madani*, *Y. Watanabe*, *T. Landry*, *M.C. Vassiliou*. From the McGill University Health Centre, Montreal, Que.; and Hokkaido University Graduate School of Medicine, Sapporo, Hokkaido, Japan

Dissemination of advanced technologies and surgical procedures relies on successful mentoring relationships. This is not feasible for surgeons who want to integrate new procedures into their practice and who may be geographically distant from appropriate mentors. To bridge this gap, telementoring has emerged as an

alternative to on-site mentoring. The purpose of this systematic review was to evaluate the quality of the evidence supporting the use of telementoring for surgical procedures. A systematic literature search of bibliographic databases and conference proceedings was performed up to March 2015. Studies were included if they reported on the use of a platform to communicate between surgeons during a clinical encounter. Studies reporting only encounters between surgeons and patients, non-clinical telementoring or for the purposes of assessment were excluded. Preliminary results identified 19 762 studies. After screening, 43 were included totalling 959 telementored cases (median 6 [3–20] cases/study). Most studies had strong methodological limitations: 32 (74%) studies had no comparative group and 30 (70%) described their findings without any statistical analysis. Eleven (26%) studies were comparative but none of them were randomized trials. The majority reported no added risk of intraoperative complications, and for the comparative studies, operative times were similar to those for non-telementored cases. Ten (23%) studies reported system failures that included set-up difficulties and loss of Internet connection during telementoring. Two (5%) studies mentioned the importance of mentor-mentee relationships without assessing impact of longitudinal relationships. None of the studies mentioned the costs of implementing the telementoring program beyond the cost of the equipment. The quality of the current evidence is limited, but telementoring is associated with a low risk of complications. There is a need, however, for large-scale, comparative studies that provide evidence for the effectiveness of telementoring. There is also a need to evaluate platforms, cost and the role of the mentor-mentee relationship.

11

Subjective and symptomatic improvement of Graves' opthalmopathy after thyroidectomy in the treatment of Graves' disease. *J. Gorka, N. Singh, F. Christian, G. Caspar-Bell*. From the University of Saskatchewan, Saskatoon, Sask.

Graves' ophthalmopathy (GO) is an incapacitating eye disease that presents as a complication of Graves' disease. It results in debilitating ocular symptoms, marked changes in appearance and, potentially, blindness. GO has a significant impact on health-related quality of life. Studies have failed to demonstrate significant objective improvement in clinical measures of GO after thyroidectomy for Graves' disease. However, subjective improvement parameters after thyroidectomy have not been well studied. In this study, we examine the subjective quality of life (QoL) outcomes in patients with GO to determine if there is an improvement in GO-related and overall quality of life after thyroidectomy. Patients with GO treated with thyroidectomy at our institution from 2009 to 2014 were selected for participation. Questionnaires were distributed to patients meeting inclusion criteria. Retrospective chart review was used to document indication for thyroidectomy, severity of GO as defined by an ophthalmologist, and thyroid stimulating hormone receptor antibody (TRAb) levels. Differences between the pre- and post-thyroidectomy groups were evaluated using paired t tests for questionnaire results and *t* test on log differences for TRAb levels. Forty-one per cent of the questionnaires were returned and included in the statistical analysis. All symptoms of GO showed improvement after thyroidectomy, with statistically significant improvement in bulging eyes ($p = 0.044$) and orbital pressure ($p = 0.011$). There was also a trend toward improvement in general well-being after thyroidectomy; however, this did not reach significance ($p = 0.073$). TRAb levels were significantly decreased after thyroidectomy ($p = 0.008$). Our results indicate improvement of GO-specific symptoms and general well-being in patients with GO treated with thyroidectomy. This observation may be related to the significant decrease in post-thyroidectomy TRAb levels observed in our study, as the presence of the thyroid-stimulating hormone receptors in orbital tissue plays a role in the pathophysiology of GO.

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Evaluation of the use of preoperative venous thromboembolism prophylaxis in surgical oncology patients. *A. Nadler, L. Anewenah, R. Uzzo, K. Krauss, J. Farma*. From the Fox Chase Cancer Center, Philadelphia, Pa.

The purpose of the study was to examine the administration and complications of preoperative chemical venous thromboembolism prophylaxis (pVTE) at an institutional level among surgical oncology patients to help inform policy creation. A retrospective study at a tertiary referral cancer centre was performed. Data were analyzed for all patients undergoing surgery in 2014. Postoperative venous thromboembolism (VTE) prophylaxis practices were not included in the analysis. χ^2 tests were performed. Of 4954 procedures performed in 2014, 1554 received pVTE using heparin 5000 units administered subcutaneously before the procedure. Overall institution administration rate was 31%. Inpatients had a significantly higher administration rate compared with outpatients (47% v. 16%, OR 4.87, CI 4.26–5.57, $p < 0.001$). Twenty-seven patients (0.5%) developed postoperative VTE, of which 10 had received pVTE and 17 had not (OR 1.29, CI 0.59–2.82, $p = 0.524$). For inpatients, 0.9% who had received pVTE and 1.2% of patients without prophylaxis developed postoperative VTE (OR 0.74, CI 0.33–1.64, $p = 0.451$). Return to the operating room for bleeding was observed in 12 patients (0.8%) who had received pVTE compared with 7 patients (0.2%) who had not (OR 3.77, CI 1.48–9.60, $p = 0.003$). For inpatients, 0.9% who had received pVTE and 0.4% of patients without prophylaxis returned to the OR for bleeding (OR 2.45, CI 0.65–7.06, $p = 0.087$). Given that less than a third of surgical patients received pVTE, further analysis is needed to define pVTE indications in surgical oncology patients, to determine if other forms of VTE prophylaxis were used and, if not, factors associated with no administration. Such analysis will help develop institutional and potentially nationwide policy change and quality improvement efforts to address pVTE for surgical oncology patients.

15

Venous thomboembolism in emergency general surgery patients: a single-centre retrospective study. *M. Yang, P.B. Murphy, L. Allen, N. Sela, S. Govind, K.N. Vogt*. Western Ontario Research Collaborative on Acute Care Surgery (WORC-ACS)

There is currently no literature on venous thromboembolism (VTE) risk in emergency general surgery (EGS) patients. We undertook this study to identify the rate of symptomatic VTE, both in hospital and 3 months after discharge, for patients undergoing EGS operations at 2 tertiary care hospitals at a single

academic institution. We conducted a retrospective cohort study evaluating 767 EGS patients who underwent operative intervention from March to December 2014. Data collected included patient demographics, type of procedure, comorbidities (Charlson comorbidity index), risk of VTE (Caprini score), VTE prophylaxis received in hospital, development of symptomatic VTE and mortality. Symptomatic VTE is defined as VTE diagnosed with imaging performed in response to signs and symptoms and not as a result of routine screening. Compliance with VTE prophylaxis was defined as receiving all indicated doses of chemical VTE prophylaxis, with the first dose given within 24 hours of admission. The mean age in our study population was 53 ± 19.7 years, and 52.2% were female. At the time of admission, 10.6% had active cancer. The most commonly performed surgical procedures were as follows: laparoscopic appendectomy (21.5%), laparoscopic cholecystectomy (17.5%), and open colonic resections (11.7%). Of the 767 patients, 18 (2.3%) developed VTE during hospital admission and 12 (1.6%) developed VTE within 3 months after discharge. Of the patients who developed VTE in hospital and after discharge, 6 (33.3%) and 6 (50%) received appropriate in-hospital VTE prophylaxis. Twelve out of 30 (40%) patients who developed VTE were considered low-moderate risk (Caprini score < 5). A single patient (0.13%) suffered a VTE-related mortality. The risk of VTE in patients requiring EGS is significant and persists after hospital discharge. Further studies are warranted on quality improvement with VTE prophylaxis and the role of continued VTE prophylaxis after hospital discharge in EGS patients.

16

Implementing operative dictation templates for general surgery resident training: Is this useful? *S. Ramkumar, N. Ahmed*. From the University of Toronto, Toronto, Ont.

The communicator role is among the 7 CanMEDS roles. We sought to understand and address a deficiency in the training of skills related to operative dictations to general surgery (GS) residents. Operative dictation templates (ODT) were developed and implemented as part of the GS resident curriculum over a 2-year period. Iterative feedback was used to develop the templates and these were implemented at the PGY1 level. A program-wide survey was developed and used to understand residents' level of comfort with templates and residents' perception of the quality of OR dictations before and after their introduction, and the quality of residents. The response rate for survey completion was 56/89 (63%) among eligible GS residents. Respondents included 24 junior residents (43%) and 32 senior residents (57%). ODT were used by 82% of junior residents and 100% of them felt the quality of their dictations had improved. In contrast, 10% of senior residents routinely use the ODT. Overall, 5% of residents felt their dictations are excellent, 60% felt comfortable dictating and 34% of residents felt their dictations were in need of improvement. Thirty-three per cent of residents reported that they never received feedback from staff surgeons about their dictations, while 62% received feedback 1–5 times and 4% received feedback 6–10 times. Finally, 82% of residents felt that skills related to OR dictations should be taught as part of their curriculum. ODT serves as a suitable tool to assist in teaching this important competency to junior surgical trainees. Feedback from staff surgeons is imperative to improve the quality of dictations and to ensure the integrity of the medical record.

17

Obesity may not matter in emergency general surgery patients: an analysis of the association between body mass index and morbidity and mortality. *N. Sela, P.B. Murphy, L. Allen, M. Yang, P. Patton, K. Leslie, N.G. Parry, D.K. Gray, T. Mele, W.R. Leeper, K.N. Vogt*. From Western University, London, Ont.

Obesity is a growing health concern worldwide, and some evidence suggests it may influence elective surgical outcomes. Little evidence exists, however, on the impact of obesity in patients undergoing emergency general surgery. This study investigated whether obese patients undergoing emergency general surgery (EGS) operations experience greater morbidity and mortality compared with patients with a normal body mass index (BMI). This retrospective review evaluated 618 adult patients undergoing EGS operations at a tertiary care hospital between July 1, 2014, and Mar. 31, 2015. Patients were grouped into normal weight (BMI 18–24.9 kg/m^2), overweight (BMI 25–29.9 kg/m^2), obese (BMI 30–34.9 kg/m^2) and morbidly obese (BMI ≥35 kg/m^2) categories. Data were collected regarding baseline demographics, comorbidities (Charlson comorbidity index), length of stay, postoperative complications and mortality. The impact of BMI on mortality and postoperative complications (defined as Clavien-Dindo III–IV) was analyzed using multivariate logistic regression models. A total of 218 patients were normal weight (35.3%), 165 were overweight (26.7%), 129 were obese (20.9%) and 106 were morbidly obese (17.2%). The overall mortality and complication rates were 8.7% and 24.6%, respectively. After adjusting for age, gender and comorbidities, overweight (OR = 1.16, 95% CI 0.72–1.89), obese (OR = 1.03, 95% CI 0.61–1.76) and morbidly obese (OR = 1.20, 95% CI 0.68–2.11) patients had a higher risk of complications compared with normal-weight patients, but this did not reach statistical significance. Obesity also was not a significant risk factor for in-hospital mortality on either univariate or multivariate analysis. Overall 56% of cases were done laparoscopically, and this proportion did not differ based on BMI (p = 0.96). In contrast to findings in patients undergoing elective general surgery operations, higher BMI was not an independent predictor of complications or mortality after EGS operations. Further work is required to determine if the relationship between obesity and morbidity/mortality differs for specific EGS conditions.

18

Three-dimensional printing and medical education: a narrative review of the literature. *M.P. Bartellas*. From Memorial University of Newfoundland, St. John's, Nfld.

Three-dimensional (3D) printing has emerged in the past decade as a promising tool for the world of medicine. The focus of this article is to review how 3D printed models have been used in medical education. PubMed was the article database used, and the search criteria included the terms 3D printing and education. The exclusion criteria filtered out articles that were older than 10 years, were not in English and did not target a human population. There were 90 discovered articles, and 38 articles were determined to be appropriate after reviewing titles and abstracts. Three main themes emerged from this process: general medical

education, surgical education and patient education. The more specific findings can be further divided as follows: using 3D printed models for teaching anatomy and simulation training; and preoperative planning, intraoperative guidance and postoperative evaluation. The general consensus was that 3D haptic modelling was a useful tool for educating trainees, staff physicians and patients. The models helped to increase participants' understanding of anatomy and pathologies and to improve trainees' skill set and confidence. There is much support to continue research in this area and further develop ways in which 3D printing can help improve medical education.

19

Feasibility of adapting the Fundamentals of Laparoscopic Surgery trainer box to endoscopic skills training tool. ***O.M. Crespin, A. Okrainec, A. Kwong, I. Habaz, M.C. Jimenez, T.D. Jackson, J.F. Mosko, L.W.C Liu, L.L. Swamstron, E. Sblomovitz.*** **From the University Health Network, University of Toronto, Toronto, Ont.; and Oregon Health Sciences University, Portland, Ore.**

The SAGES Research Delphi Study prioritized the need to train surgeons and surgical trainees in flexible endoscopy. The Fundamentals of Laparoscopic Surgery (FLS) training box is a well-recognized and validated tool, already accessible to surgical trainees to hone their laparoscopic skills. Seeking a highly available, reusable, low-cost and hands-on modality trainer, we aimed to adapt the FLS training box and tasks for the development of endoscopic skills supplemental to Fundamentals of Endoscopic Surgery (FES). With ongoing consultation from 5 experienced surgeons and gastroenterologists, the set-up of the training system and adaptation of FLS tasks were optimized for endoscopy. Adaptations focused on using as many of the existing components of the FLS training tool as possible to maintain simplicity while allowing for the testing and practice of clinically relevant endoscopic skills. A front attachment panel with different opening options was designed to select the most ergonomic insertion point for an endoscope into the FLS training box. A shaft provides additional support and limits movement of the endoscope at the point of insertion, forcing the utilization of the tip of the scope to perform the task. A platform on the inner surface of the panel permits performance of retroflexion tasks. The endoscopic tower, originally excluded to minimize complexity of the set-up, was eventually included to more realistically represent endoscopic visualization. Six endoscopic tasks were designed, with most using existing components from FLS. An adaptation of the FLS training box has been developed for endoscopic skills with a focus on maintaining simplicity, reusability and low cost. Following validation, this adaptation may act as a training supplementation to the FES program.

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Correcting malrotation in an octogenarian — an end to 8 decades of pain. ***H.Y. Jiang, M.C Niebergall.*** **From the Northern Ontario School of Medicine, Thunder Bay, Ont.**

Recent evidence suggests that the prevalence of malrotation in adults is higher than previously thought. The clinical presentation of adult malrotation is variable and often insidious. The most common symptoms include abdominal pain and vomiting, secondary to volvulus/ischemia and extrinsic compression by Ladd's bands. Adults with malrotation are often overlooked and misdiagnosed as having functional gastrointestinal (GI) disorders, such as irritable bowel syndrome or dyspepsia. We present such a case of chronic malrotation in an 83-year-old man. He has suffered from recurrent, diffuse abdominal pain since childhood. The pain occurs most often postprandially. A previous exacerbation has led to surgical intervention with a presumed diagnosis of a paraduodenal hernia. He presents himself again to the emergency department after another severe episode of postprandial abdominal pain. With proper history, exam and imaging, including CT and upper-GI series, we are able to properly diagnose him as having malrotation without volvulus. A Ladd's procedure is subsequently performed, and it completely resolves his 80 years of pain and significantly improves his quality of life. We believe this is the oldest patient with malrotation reported in Canada. Based on this case, we wish to highlight 3 points. (1) Adult malrotation is more common than previously estimated. Hence, considering it as a differential in patients with recurrent abdominal pain is crucial in avoiding delayed diagnosis. (2) In adults with recurrent abdominal pain, CT is indicated to exclude malrotation. It is the preferred test by some physicians as it provides additional information on volvulus and bowel ischemia. The sensitivity of upper GI series in patients with signs of malrotation is 96% and is also indicated. (3) To minimize future risk of volvulus, surgical management must include widening of the mesenteric root and placing the bowel in a nonrotation position. With operative intervention, nearly 90% of patients attain symptom resolution.

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An innovative reconditioning program for elderly emergency abdominal surgery patients. ***A. McComb, Q. Daviduck, L. Warkentin, T.A. Churchill, M. McNeely, R.G. Khadaroo.*** **From the University of Alberta, Edmonton, Alta.**

Hospitalized patients spend >80% of their time in bed, resulting in rapid muscle wasting. Studies have suggested exercise can prevent hospital-associated muscle wasting; however, current hospital procedures are based around cautious exercise prescriptions. While activity restrictions are placed for patient safety, there is currently no consensus on the level of restriction necessary in the frail patient. Exercise is recognized in its role in reducing the functional decline in aging and should be administered in order to reduce the degree of muscular atrophy in the elderly. The purpose of this study is to compare the functional status of elderly abdominal surgery patients after surgery and to determine how a regularly performed reconditioning program will affect the functional decline associated with bed rest. A prospective cohort of elderly patients were enrolled and physical function was assessed using a 30-second sit-to-stand (STS) on postoperative day 2 (POD2) and at discharge. The intervention group received the reconditioning program and performed the exercises between the 2 STS trials. Control group data show that the least frail patients improved sufficiently for independent living at discharge. Vulnerable patients did not achieve functional levels needed for independent living but improved between POD2 and discharge. The frailest patients failed to achieve independence levels and did not show significant improvement between trials. The STS data from the control group

demonstrate that only 13% of patients were able to achieve the STS score required for independent living, even though the majority of patients were discharged home without the support of additional medical care. Current surgical bed rest practices may be exacerbating functional decline and causing patients to leave the hospital in a reduced functional state due to long periods of inactivity. The reconditioning intervention is currently being implemented to improve the outcomes of this vulnerable population. Preliminary findings will be presented.

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Knowledge retention after informed consent for laparoscopic cholecystectomy. *K. Buttenschoen, J. Scharf, E. Beuker*. From the University of Alberta, Edmonton, Alta.

Physicians must ensure patients understand the information provided while obtaining informed consent. However, if comprehension during the discussion is adequate, how much of the information is retained remotely? Lawsuits occur years after consent has been obtained, as patients allege "they were not told." Our goal is to quantify a decay in knowledge retention following informed consent for laparoscopic cholecystectomy. Patients received information packages and teaching before laparoscopic cholecystectomy. A preoperative quiz assessing the patient's knowledge regarding the details of the procedure and possible risks/complications was then given. Teaching was provided until a score of 90% or higher was achieved. The same quiz was given (without help or teaching) at 4 weeks and 6 months postoperatively. Fifty-three patients were included. The average age was 48 years old. The average quiz scores were 95% (preoperatively), 77% (4 weeks postoperatively) and 74% (6 months postoperatively). Quiz scores were compared by gender, level of education and age. The lowest average score was 65%, 4 weeks postoperatively in patients over 70 years of age. Our study quantifies a decay in knowledge retention following informed consent for laparoscopic cholecystectomy. There was a 22% decrease in quiz scores over 6 months. The decay was quite rapid before reaching a plateau. Thus, patients may quickly forget roughly a quarter of the information provided during the consent process for laparoscopic cholecystectomy. Elderly patients may be particularly at risk. Given that study patients received teaching and additional time during the consent process, one must wonder how the decay in knowledge retention differs in patients not receiving the same attention. Further work could suggest there is a need to revisit current practices of obtaining informed consent and work toward a more standardized approach.

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Better to be fat than skinny: the influence of body mass index on perioperative complications and mortality in emergency general surgery using ACS-NSQIP. *P.B. Murphy, J. Canner, K.N. Vogt, E.R. Haut*. From Western University, London, Ont; and Johns Hopkins University, Baltimore, Md.

The influence of body mass index (BMI) in many medical specialties is paradoxical. It has yet to be investigated in emergency general surgery (EGS) patients. Contrary to the elective surgical setting, in the emergency setting BMI cannot be optimized. The goal of the present study was to determine the independent effect of BMI on morbidity and mortality for patients undergoing the 5 most common EGS operations. Patients undergoing appendectomy, cholecystectomy, colectomy, small bowel resection or lysis of adhesions on an emergent basis were identified in the American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP) database (2011–2014). Perioperative outcomes evaluated included complications, blood transfusions, length of stay, reoperation, readmission and mortality. Conventional BMI categories were used in an explanatory multivariable regression model adjusted for age, sex, race, smoking status, diabetes, cardiopulmonary disease, cerebrovascular disease, steroid use, operative time, ASA class and operative approach (laparoscopic v. open) to determine the association with evaluated outcomes, with normal weight (18.5–25 kg/m^2) as the reference. In total, 114 204 patients underwent 1 of the 5 EGS operations; 35.7% were overweight, obese (26.8%) or morbidly obese (6.1%). Underweight patients (n = 2747, 2.4%) were the least represented but were at the highest risk of complications (28.3%) and death (9.2%), twice and 3 times the rates in normal BMI patients. After adjustment, elevated BMI was associated with higher rates of wound infection for all operations except cholecystectomy. Paradoxically, overweight and obese patients (BMI 25–35 kg/m^2) represent the nadir of mortality of all operations. Patients with a normal BMI undergoing emergency general surgery are the minority. Patients who have a lower than normal BMI have a higher rate of mortality and all complications except wound infection compared with those who are overweight or obese. Marginally elevated BMI may be protective with respect to mortality but not complications compared with normal BMI.

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Laparoscopic Nissen fundoplication versus laparoscopic magnetic gastroesophageal sphincter augmentation: comparison of patient-reported outcomes and costs. *B. Zevin, J.W. Hazey, K.A. Perry*. From the Ohio State University, Columbus, Ohio

Laparoscopic magnetic sphincter augmentation with LINX device is a novel surgical approach for lower esophageal sphincter dysfunction. The objective of this study was to compare patient reported outcomes and in-hospital costs for laparoscopic Nissen fundoplication (LNF) and LINX procedure in patients with symptomatic gastroesophageal reflux disease (GERD). A retrospective case-control study was performed for consecutive patients undergoing LNF and LINX procedure between March 2013 and July 2015 at an academic centre. Pre- and postoperative patient-reported outcomes for symptoms of GERD and quality of life were assessed with the GERD Health-Related Quality of Life (GERD-HRQL) questionnaire and GER symptom score (GERSS). The direct, indirect and total in-hospital cost was obtained for each LNF and LINX procedure. Forty-five patients underwent LNF and 25 patients underwent LINX procedure. Median duration of follow-up was 5 (4–8) weeks. Preoperative DeMeester scores were equivalent between the groups. Preoperatively, patients undergoing LNF had a higher BMI (30.1 ± 4.8 v. 26.8 ± 4.9 kg/m^2, p < 0.01) and more severe symptoms of GERD (GERD-HRQL: 33.5 ± 9.1 v. 26.0 ± 9.3, p < 0.01 and GERSS: 44.3 ± 15.7 v. 34.5 ± 16.3, p < 0.01) than LINX patients. The duration of surgery (90.2 ± 25.1 v. 62.6 ± 21.9 minutes, p < 0.01) and length of hospital stay

(1.2 ± 0.6 v. 0.6 ± 0.6 days, $p < 0.01$) was longer for LNF than LINX. Significant improvement in GERD symptoms was seen after LNF (GERD-HRQL: 33.1 ± 9.4 v. 8.7 ± 11.6, $p < 0.01$ and GERSS: 46.2 ± 15.3 v. 13.3 ± 17.6, $p < 0.01$) and LINX (GERD-HRQL: 26.0 ± 9.3 v. 11.7 ± 12.7, $p < 0.01$ and GERSS: 34.5 ± 16.3 v. 17.6 ± 18.1, $p < 0.01$). The direct ($2920 [2589–3395] v. $8270 [7707–9206], $p < 0.01$), indirect ($3761 [3433–4134] v. $4471 [4098–4946], $p < 0.01$) and total ($6690 [6173–7471] v. $13 161 [12 078 – 13 864], $p < 0.01$) in-hospital cost per LNF case was less than the cost per LINX case. Resolution of GERD symptoms was seen after both LNF and LINX procedure. The direct, indirect and total in-hospital cost per LNF procedure was less than the cost per LINX procedure.

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The diagnostic yield of commonly used investigations in pelvic gunshot wounds. ***M. Schellenberg, K. Inaba, E.M. Priestley, J. Durso, M.D. Wong, L. Lam, E. Benjamin, D. Demetriades*. From LAC+USC Medical Center, University of Southern California, Los Angeles, Calif.**

Patients who sustain pelvic gunshot wounds (GSWs) are at significant risk for injury due to the density of pelvic structures. Currently, the optimal workup for pelvic GSWs is unclear. The study objectives were to determine the diagnostic yield of tests used in the investigation of pelvic GSWs and to develop a diagnostic algorithm. All patients ≥15 years old presenting to a single high-volume, level-1 trauma centre (01/2008–02/2015) who sustained ≥1 pelvic GSWs were retrospectively identified. Patient demographics, clinical assessment, investigations, procedures and outcomes were abstracted. The diagnostic yield of CT scan, cystogram, gross inspection of the urine, urinalysis, endoscopy and digital rectal exam (DRE) in the detection of clinically significant injuries to the pelvis were calculated. Three hundred and seventy patients were included. Patients with peritonitis, hemodynamic instability, an unevaluable abdomen or evisceration were taken to the operating room for immediate laparotomy (n = 138, 37.3%). All others (n = 232, 62.7%) underwent CT scan and further investigations as indicated. The sensitivity, specificity, positive predictive value and negative predictive value of the investigations were as follows: CT scan — 1.00, 0.98, 0.74, 1.00; cystogram — 1.00 for all parameters; gross inspection of the urine — 1.00 for all parameters; urinalysis — 1.00, 0.71, 0.17, 1.00; endoscopy — 1.00, 0.82, 0.75, 1.00; and DRE — 0.77, 0.99, 0.77, 0.99. In the workup of pelvic GSWs, patients with hemodynamic instability, peritonitis, evisceration or an unevaluable abdomen should undergo immediate laparotomy while all others should undergo CT scan. CT-positive patients should be managed for their injuries. If the CT is negative, the likelihood of a clinically significant injury is exceedingly low. If the CT is equivocal for rectal or bladder injury, endoscopy or cystogram should be used to guide definitive management. There is no role for routine urinalysis or DRE. Further prospective validation of these findings is warranted.

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Burnout levels among general surgical residents in Canada. ***S.T. Adams, Z. Rana, F. Christian*. From the University of Saskatchewan, Saskatoon, Sask.**

Burnout is increasingly recognized as an important condition involving excessive physical and psychological exhaustion, coupled with cynicism and disengagement. Evidence exists to suggest that affected physicians not only suffer considerable consequences themselves but also that patient safety and clinical outcomes are negatively affected. This study is intended to identify potentially remediable risk factors for burnout among residents enrolled in general surgery programs across Canada. An online questionnaire was distributed to every general surgery resident in the 15 general surgery residency programs consenting to take part. Questions were asked pertaining to 5 broad domains: resident demographics, working patterns, attitudes toward residency, life experiences and lifestyle/outlook. Respondents' risks of burnout were assessed using the Maslach Burnout Inventory (MBI). The responses and MBI scores were analyzed first using univariate analysis and then using multiple logistic regression (MLR) with $p < 0.05$ being considered significant. One hundred and fourteen completed questionnaires were received (22%). Of these residents, 39 (34%) met the criteria for high risk of clinical burnout. MLR analysis showed that inadequate family time, a personal history of mental health or substance abuse related issues, and moderately to poorly approachable staff were all significantly associated with a high burnout score (OR 4.3 [p = 0.003], OR 6.0 [p = 0.007] and OR 4.6 [p = 0.003], respectively). From the predicted probabilities, residents with none of the above factors have a 10% probability of being at risk of clinical burnout. This increases to up to 40%, 75% and 93% with 1, 2 or all of these risk factors being present. Fully one-third of general surgery residents in Canada are at a high risk of clinical burnout. Residency programs have potentially direct influence over the specific, identifiable risk factors associated with this outcome. Addressing these remediable causes of burnout could benefit residents, staff and, importantly, our patients.

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The effect of antibiotic-impregnated suture material on the incidence of surgical site infection in abdominal closures: a meta-analysis of randomized controlled trials. ***B. Elsolh, L. Zhang, S.V. Patel*. From Queen's University, Kingston, Ont.**

Postoperative surgical site infections (SSIs) are common complications after abdominal surgery. This review aimed to determine if using antibiotic-impregnated sutures for abdominal fascial closure prevents SSIs, hernias and/or dehiscence. Medline and Embase databases (1946–2016) were searched. All randomized controlled trials comparing antibiotic-impregnated sutures to typical sutures for abdominal closure were eligible. Studies were included regardless of operation type (laparoscopic/open; colorectal/vascular/other), incision type (midline/other) or disease pathology (malignant/benign). Studies were reviewed in duplicate for inclusion and data abstraction. If disagreement was found, consensus was obtained with the help of the third author. Results were analyzed using a random effects model to account for expected clinical heterogeneity. Risk of bias was evaluated using the Cochrane Handbooks definitions. Four-hundred and fifty articles were assessed. After review, 5 applicable studies (n = 3239) were included in the meta-analysis. Four studies defined SSI as per the CDC definition, while 1 study used its own clinical definition. All studies routinely used prophylactic antibiotics. There was a high risk of bias in 2 studies, 1 for

high loss to follow-up and the other for not using an intent-to-treat analysis. Overall risk of SSI in the antibiotic-impregnated suture group was 10.4% versus 13.0% in the control group. Pooled results showed no evidence of a difference in SSI between suture types (odds ratio 0.79, 95% CI 0.57–1.09, $p = 0.15$, $I^2 = 44\%$). There was no evidence of subgroup effect by suture type used (PDS v. Vicryl, $p = 0.19$), or by comparing colorectal surgery studies to others ($p = 0.67$). There were insufficient data to determine if antibiotic-impregnated sutures reduced the risk of hernias or dehiscence. Our meta-analysis is the most comprehensive review on the utility of antibiotic-impregnated sutures in abdominal surgery to prevent SSI. We found no evidence to support routine use of these sutures.

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Burnout and career satisfaction among Canadian general surgeons: results of the CAGS National Burnout Study. ***F.T. Hamadani, S. Bhatnagar, S. Balvardi, M. Trepanier, J. Grushka, D. Deckelbaum, O. Court, P. Fata*. From the McGill University Health Centre, Montreal, Que.**

Surgeons with burnout report lack of autonomy, lack of career satisfaction and loss of control over their lives, often leading to early retirement. Burnout in surgeons also leads to high levels of personal distress and treating patients as impersonal objects and is associated with poorer health outcomes. We set out to identify the incidence of burnout and associated characteristics among Canadian general surgeons using validated tools. We conducted an online survey in English and French of the membership of the Canadian Association of General Surgeons (CAGS) with the hypothesis that burnout rates among Canadian general surgeons will be significant, paralleling levels reported in the US and Europe. In total, 251 surgeons with a broad range of demographic, personal and professional characteristics participated. Participants with emotional exhaustion, a low sense of career satisfaction and depression have high proportions of reported burnout (35.9%, 76.5% and 38.6%, respectively) compared with participants with depersonalization and a low sense of personal accomplishment. Low career satisfaction contributes to the highest proportions of reported burnout. Holding the position of program director in the last 5 years and working in an academic hospital have a statistically significant association with burnout. Surgeons with more than 30 years of practice had a lower risk of burnout than surgeons with less than 10 years of practice. Program directors in the last 5 years were also at higher risk of depression. Among surgeons with a low sense of personal accomplishment, working in an academic hospital showed a decreased risk of burnout. This study is the first national cross-sectional survey to assess the rate of burnout, quality of life, career satisfaction and depression among Canadian general surgeons. The findings are similar to studies from the US and Europe and highlight the importance of tackling this syndrome.

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Understanding the surgical care needs and utilization of outpatient surgical care services among homeless patients at the Ottawa Hospital. ***C. Champion, l. Zuccaro, S. Bennett, Y. Ying*. From the University of Ottawa, Ottawa, Ont.**

The surgical care needs of homeless patients are poorly described. The medical and mental health literature demonstrates that these patients have complex health care needs compounded by socioeconomic challenges, with low levels of outpatient care utilization contributing to poor outcomes. It is unclear whether this also applies to surgical care. A descriptive study was undertaken to better understand surgical care needs and outpatient access among homeless patients in Ottawa. Medical records of patients with no fixed address or a shelter address presenting to the Ottawa Hospital emergency department (ED) from January 2013 to December 2014 were screened, and those with surgical referrals were identified. Demographics, referral details, surgical management and outpatient follow-up details were collected and analyzed using descriptive statistics. Surgical referral was initiated in 129 ED visits for 97 patients (79.4% male, mean age 46.7); 18.6% of patients listed no home address, while 79.4% listed a shelter. Most surgical referrals were for traumatic injuries (64.3%), followed by genitourinary (9.3%) and infectious (8.5%) conditions. Surgery was performed in 25.8% of cases, the majority being urgent/emergent (77.8%). The data showed that 59.7% of referrals resulted in a surgical consultation while in hospital, the majority of which (82%) required further outpatient follow-up. The remaining 40.3% were sent directly for outpatient consultation. Overall, 48.6% of patients attended 1 outpatient appointment, and 33.3% completed full follow-up. The likelihood of outpatient appointment attendance was not impacted by referral origin from the surgical service (54.7%) compared with ED physicians (42.3%) ($p = 0.2$, χ^2). Homeless patients requiring surgical care are predominantly males living in shelters who experience traumatic injuries. Current outpatient surgical services do not appear to meet the care needs of this population, as more than half of patients do not attend any outpatient consultations. Alternate approaches to outpatient care must be considered to improve surgical care for these patients.

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Facilitating colorectal cancer screening access through systems analysis: a case study of the Northwest Territories. ***C. Champion, G.G. Alvarez, E. Affleck, C. Kuziemsky*. From the University of Ottawa, Ottawa, Ont.**

Colorectal cancer rates are high with poor disease outcomes in the Northwest Territories. Screening rates for colorectal cancer are low in this part of Canada. Access to colorectal cancer screening is a complex health system problem. Developing screening access solutions requires an in-depth understanding of screening processes and their interactions in order to develop informed health policies. A systems approach to describe health care processes and system-level factors influencing colorectal cancer screening access was undertaken. Semi-structured interviews with health care providers involved in colorectal cancer screening across the Northwest Territories ($n = 29$) were performed from September to December 2015. Interview transcripts were analyzed and exploratory models of colorectal cancer screening processes were developed and translated into quantitative parameters for simulation modelling. Colorectal cancer screening access was defined by patient health care interactions supported by foundational information processes. Multiple models of screening services were identified across the

territory, with varying complexity in care access across different communities. Barriers to screening access included screening initiation, colonoscopy scheduling, screening recall and information silos, and these were found to be influenced by multiple contextual factors including a transient health work force, social health determinants and patient travel. A system dynamics framework describing colorectal cancer screening processes and accompanying data requirements was developed. Colorectal cancer screening access in the Northwest Territories is a complex process influenced by challenging contextual factors in the rural and remote health care environment. Two key aspects of screening access solutions were identified: (1) the need for system trade-offs in restructuring screening processes and (2) the foundational role of information support in screening, which may be supported through territory-wide use of health informatics tools such as electronic medical records. Future system dynamics modelling research may inform territorial health system transformation in colorectal cancer screening including development of a formal screening program and colonoscopy capacity planning.

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A quality assessment of rectal cancer surgery in Northern Alberta. *S. Küpper, S. Ghosh, D. Schiller*. From the University of Alberta, Edmonton, Alta.

The objective of this study was to assess the quality of rectal cancer surgery in the region through pathologic quality indicators, namely total mesorectal excision (TME) grade and circumferential radial margin (CRM) status. A retrospective review was conducted of a prospectively maintained database of all patients diagnosed with rectal cancer between September 2010 and June 2012 within the region. Primary outcomes were grade of mesorectal excision and circumferential radial margin status. Variables assessed included gender, BMI, surgeon volume, surgery site, surgical technique (laparoscopic v. open), perforation (Y/N), distance from the anal verge and T-stage. Univariate and multivariate logistic regression was performed to identify factors associated with TME and CRM status. During the study period, 294 patients underwent operative management. Most procedures were done in a tertiary centre (76%) and were open (86.1% v. 9.5% laparoscopic). Complete or near-complete TME was achieved in 78.5% (incomplete 10.1%, unknown 11.5%). On multivariate analysis, surgeon volume ≤10 and BMI were significant predictors of inadequate TME status. Negative CRM was achieved in 92.1% of cases (positive 6.5%, unknown 1.4%). On multivariate analysis, both T-stage and resection at a non-tertiary site were significant predictors of a positive CRM (p = 0.018 and 0.037, respectively). Resection at a non-tertiary site remained a significant predictor of positive CRM when adjusted for surgeon volume. Our results demonstrate that surgeon volume ≤10 and BMI are significant predictors of inadequate TME. In addition, T-stage and surgery performed at a non-tertiary site are significant predictors of positive CRM. This is in keeping with previously published literature that shows better outcomes in higher volume centres. These data support the ongoing province-wide initiative for development and implementation of a centralized care pathway for rectal cancer in order to optimize outcomes for our patients.

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Breast surgery under local anesthesia is cost saving and preferred by patients. *S. Buac, P. Baruth, M. Bettger, P. Bessegato, E. Saettler, S. Latosinsky*. From Western University, London, Ont.

Although minor breast surgery under local anesthesia is not a novel idea, it is not widely practised by Canadian surgeons. Our pilot study aimed to examine the patient experience and associated cost of breast procedures under local anesthesia without sedation. After institutional approval, consent was obtained from patients seen in the outpatient breast care clinic. Telephone surveys were carried out approximately 1 month following the procedure using a standardized questionnaire. The cost of procedures performed in the outpatient procedure room under local anesthesia versus in the operating room (OR) under general anesthesia was compared by studying nursing time, materials used, anesthesia, OR time, preoperative visits and perioperative care. Between December 2014 and February 2016, 30 procedures were performed under local anesthesia in the outpatient procedure room, and 19 (63%) patients completed surveys. Procedures included 11 wire-guided biopsies, 8 re-excisions for positive margins, 6 duct procedures for nipple discharge and 5 fibroadenoma excisions. Eighteen patients (95%) stated that they would undergo another procedure under local anesthesia. All patients reported adequate pain control during the procedure, and 18 (95%) were completely pain free upon discharge. When asked to rate their overall experience on a scale of 1 to 5, where 1 is very poor and 5 is excellent, the mean rating was 4.5. Of patients who had previously undergone a procedure in the OR, 10 out of 11 (91%) preferred their procedure under local anesthesia. The complication rate was 7%, consisting of 1 hematoma requiring evacuation and 1 surgical site infection treated with oral antibiotics. The average cost of a case under local anesthesia was $65, versus $500 for a similar case under general anesthesia. This small pilot study illustrates that breast surgery under local anesthesia alone is acceptable and preferred by patients at a significant cost savings.

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The effect of technical performance on patient outcomes in surgery: a systematic review. *A.B. Fecso, P. Szasz, G. Kerezov, T.P. Grantcharov*. From the University of Toronto, Toronto, Ont.

The operating room is a high-stakes, high-risk environment. As a result, the quality of surgical interventions affecting patient outcomes has been the subject of discussion and research for years. The objective of this study was to systematically review the literature on the effect of intraoperative technical performance on patient outcomes. Medline, Embase, PsycINFO and Cochrane databases were searched. All surgical specialties were eligible for inclusion. Data were reviewed in regards to (1) the methods by which technical performance was measured, (2) what patient outcomes were assessed and (3) how intraoperative technical performance affected patient outcomes. Quality of evidence was assessed using the medical education research study quality instrument. Of the 12 758 studies initially identified, 24 articles were ultimately included in this review. Seventeen studies assessed the

performance of the faculty alone, 2 assessed both the faculty and trainees, 1 assessed trainees alone and in 4 studies, the level of the operating surgeon was not specified. In 18 studies, a performance assessment tool was used. Patient outcomes were evaluated using intraoperative complications, short-term morbidity, long-term morbidity, short-term mortality and long-term mortality. Twenty-one studies demonstrated that superior technical performance was related to improved patient outcomes. The results of this systematic review demonstrated that superior technical performance positively affects patient outcomes. Despite this initial evidence, more robust research is needed to directly assess intraoperative technical performance and its effect on postoperative patient outcomes using meaningful assessment instruments and reliable processes.

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Readmission is the greatest burden of postdischarge cost to the elderly following emergency general surgery. ***G. Eamer, F. Clement, J. Pedersen, T.A. Churchill, R.G. Khadaroo*. From the University of Alberta, Edmonton, Alta.**

The elderly are the fastest growing population in North America and are increasingly requiring emergency surgery. Increased costs during admission are well established; however, costs following discharge are unknown. Unplanned readmissions are costly and may reflect suboptimal care. We have examined postdischarge costs accrued over 6 months following emergency abdominal surgery in the elderly. A prospective cohort of patients over 64 years of age who underwent acute abdominal surgery at 2 teaching hospitals in Canada were enrolled. Patients completed a validated health resource utilization inventory at 6-month follow-up. Costs were divided into health products, health services and lost productive hours. Predictors of patients' costs were determined with multivariate linear regression. There were 128 respondents with a mean age of 75.1 ± 7.7 years; they were predominantly married, Caucasian and living independently with low frailty. One site's patients were more ill, had a longer length of stay and had more complications. Mean total cost over 6 months was $1521 ± $4301, IQR $90–$880, max $35 055). Multiple linear regression of cost determined cost drivers after adjusting for differences between cities. Readmission is associated with $244 (CI $16–$473, $p = 0.04$) in medical products used after discharge, an $866 (CI $441–$1331, $p < 0.001$) increase in medical products and services and a $2478 (CI $743–$4213, $p = 0.005$) increase in total economic cost. The presence of frailty is associated with a $559 (CI $109–$1009, $p = 0.02$) increase in product and service costs. Increasing body mass index (BMI) by 1 kg/m^2 is associated with a $162 (CI $30–$295, $p = 0.02$) increase in total economic cost. Significant economic cost for older patients following discharge is associated with readmission, higher BMI and frailty. Our study identified patients who accrue high economic cost after discharge from emergency surgery. Reducing readmission rates and limiting progression of frailty through improved surgical care for the elderly could reduce total health care costs and the patients' own financial burden.

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Is patient satisfaction associated with 30-day postoperative outcomes in a population primarily undergoing laparoscopic procedures? ***K. Lobo Prabhu, M.C. Cleghorn, A. Elnahas, A. Tse, F.A. Quereshy, A. Okrainec, T.D. Jackson*. From the University of Toronto and the University Health Network, Toronto, Ont.**

With the movement toward greater transparency in reporting health care outcomes, patient satisfaction has become a priority. Ensuring patient satisfaction with their care plays a key role in delivering quality care. The purpose of this study was to determine the relationship between patient satisfaction and short-term outcomes in patients undergoing general surgical procedures. Satisfaction surveys (using a 5-point Likert scale) were distributed to patients following discharge from the general surgery service at an academic hospital between June 2012 and March 2015. Short-term clinical outcomes were obtained from the American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP) database. Satisfaction ratings were used to divide patients into satisfied (score of 4 or 5) and unsatisfied groups (score of 1 to 3). χ^2 analysis was used to compare these cohorts with respect to the proportion of patients experiencing adverse clinical outcomes. A total of 757 patient satisfaction surveys were completed, representing a 67.5% response rate. The mean age of patients surveyed was 52.2 ± 15.9 years; 60% of patients were female. The majority of patients underwent a laparoscopic procedure (85.8%) and were admitted as inpatients following surgery (72%). The data showed that 91.5% of patients were satisfied with their care and 94.7% would recommend the service. Thirty-day readmission (3.3% v. 12.5% in the satisfied and unsatisfied group, respectively; $p < 0.01$), 30-day minor complications (6.5% v. 17.2%; $p < 0.01$), and 30-day overall complications (9.8% v. 18.8%; $p = 0.03$) were associated with lower patient satisfaction. Prolonged hospital stay (length of stay greater than the sample median) (22.5% v. 31.2%; $p = 0.24$) and 30-day major complications (3.3% v. 1.6%; $p = 0.44$) were not significantly associated with patient satisfaction. Our study found a significant association between patient satisfaction and 30-day readmission and the occurrence of postoperative surgical complications. Given this association, further study is warranted to evaluate patient satisfaction as a health care quality indicator.

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The cost of surgical complications in the Canadian context: a NSQIP Canadian Collaborative analysis and comparison. ***M. Woo, S. Fraser*. From McGill University, Montreal, Que.**

As a consequence of Canadian health care's finite resources, postoperative complications not only negatively affect patient health but also impair the overall provision of care due to additional costs. Three preventable complications are surgical site infection (SSI), urinary tract infection (UTI) and venous thromboembolism (VTE), which are estimated to be 23%, 38% and 16.5% preventable. The National Surgical Quality Improvement Program (NSQIP) is a US initiative, since expanded internationally to include a 30-hospital Canadian Collaborative, dedicated to measuring and enhancing the quality of surgical care by collecting patient outcome data, including the rates of postoperative complications. Using NSQIP and institutional fiscal data, we determined the financial impact of the aforementioned complications to our institution. The mean

costs of SSI-, UTI- and VTE-complicated general and colorectal surgical cases assessed in our 2013 NSQIP sample were determined and compared with those of uncomplicated surgeries to estimate their individual additional financial burden. This estimate and NSQIP data were used to determine overall complication rate and cost for our institution from 2013 to 2015, allowing for comparison with the Canadian Collective. We found postoperative SSI and UTI rates of 8.1% and 2.6% for 2013–2015, significantly greater than the overall Canadian Collaborative rates of 5.9% and 1.5%, respectively ($p < 0.05$). Additional costs for an individual SSI, UTI and VTE were estimated to be $10 655.84, $7811.27 and $13 353.70. Postoperative SSI and UTI therefore cost our institution an estimated $3.96 million over the 2-year period, and based on the literature estimate of preventable fraction they represent potential savings of $1.02 million over that period. This study helped advance our understanding of the economic burden of postoperative complications in the Canadian context. To our knowledge, it is the first such study to use actual financial data from a Canadian institution, making this the most robust Canadian complication cost estimate to date.

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Patterns of personal health information disposal in Toronto area hospitals. ***J.K. Ramjist, A.L. Scott, J.L. Semple, A. Govindarajan, D.R. Urbach, N.G. Coburn, N.N. Baxter.* From the University of Toronto, Toronto, Ont.**

The objective of this study was to assess the presence, amount and sensitivity level of personal health information (PHI) and personally identifiable information (PII) found in common recycling bins throughout staff areas of local hospitals. We conducted a recycling audit of 4 teaching hospitals in Toronto over a 4-week period. At each site, a sample of recycling was collected and sorted from 5 hospital locations: inpatient ward, outpatient clinics, emergency department, physician offices and intensive care units. Recovered items were classified by sensitivity: low if only PII was found and medium or high based on the extent of PHI documented. A medium sensitivity item would contain PII as well as the patient's diagnosis, while a high sensitivity item contains PII, diagnosis and some description of the patient's condition. A total of 520.9 kg of recycling was recovered from the 4 institutions. We found 2013 sensitive items: 711 low sensitivity items that contained only PII, 447 medium sensitivity items and 855 high sensitivity items. The most items were recovered from physician offices (883 items, 43.9%), followed by inpatient wards (629 items, 31.2%), outpatient clinics (245 items, 12.2%), intensive care units (155 items, 7.7%) and the emergency department (101 items, 5.0%). Among medium–high sensitivity items, elements of the patient chart (e.g., a history and physical examination, progress notes) were the most frequently recovered (532 items, 26.4%), followed by diagnostic test requisitions and results (260 items, 12.9%). Paper recycling represents a significant potential source for PII and PHI breaches within health care institutions. Appropriate disposal of printed materials is a necessary element in an effective PHI protection strategy. A costly but effective strategy we witnessed was to shred all paper waste irrespective of the presence of PII or PHI.

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Knowledge, practice and attitude toward VTE risks and prophylaxis among medical staff at 4 teaching hospitals. ***E. Aboelnazar, A. Alhazmi, M. Habib, Y. Alshomrani, M. Althaqafi*. From Umm Al-Qura University, Makkah, Saudi Arabia**

This work was conducted to assess the level of awareness of venous thromboembolism (VTE) risks and prophylaxis among different medical staff and to explore the current practice toward VTE prophylaxis. A cross-sectional study was conducted with different medical staff including nurses, residents, specialists and consultants from different specialties (medicine, surgery, orthopedics and ICUs) at 4 different teaching hospitals from January 2016 to February 2016. A total of 314 medical staff responded. Data were collected by using a survey regarding their practice and level of awareness about VTE prophylaxis, risk factors and contraindications. In our populations, 41.5% were nurses, 29% were residents, 21.5% were specialist and 7.7% were consultants. We found that 68.5% of medical staff were following their hospital policy regarding VTE prophylaxis, 15.9% were following the American College of Chest Physicians (ACCP) guidelines, 5% were following other guidelines and 10.6% were not following any guideline. Low molecular weight heparin (LMWH) and intermittent pneumatic compression were the most common choices for VTE prophylaxis. Our data showed that 57.8% of medical staff believed that using VTE prophylaxis could eliminate the risk of VTE while 42.2% believed it couldn't. The majority (56.7%) chose to stop the prophylactic dose of LMWH a day before surgery or any invasive procedures, while 43.3% chose to stop the prophylactic dose of unfractionated heparin (UFH) 4–6 hours before surgery or any invasive procedure. Risk factors and contraindications to oral anticoagulant use were all documented. Our study updates our knowledge of VTE prophylaxis among medical staff. This information is important to standardize and improve our practice, which may reduce the occurrence of VTE.

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Prophylactic anticoagulation in the postoperative phase for elective laparoscopic splenectomy patients: a cost-effectiveness analysis. ***N. Dharampal, W.H.A. Ryu, E. Debru, I. Datta, J. Spetz*. From University of Calgary, Calgary, Alta., and University of California, San Francisco, Calif.**

Thromboembolic adverse events constitute major post-surgical complications in patients undergoing elective laparoscopic splenectomy. Specifically, portal vein thrombosis (PVT) affects up to 35% of patients and can lead to portal hypertension, gastroesophageal varices and catastrophic gastrointestinal bleeding. A growing body of evidence has argued for mitigating the risk of this complication through standardized prophylactic anticoagulation with low molecular weight heparin (LMWH) in the immediate postoperative period. However, the adaptation of this practice has been inconsistent, with many surgeons opting for expectant management. The objective of this study was to examine the cost-effectiveness of prophylactic anticoagulation with LMWH versus expectant management in patients who undergo elective laparoscopic splenectomy. Economic analysis using a hybrid

Markov decision tree was conducted for postoperative management for prevention of PVT. We compared the cost-effectiveness of prophylactic anticoagulation with LMWH versus clinical observation with expectant management. A systematic review of literature was performed to obtain data on prophylaxis and treatment effectiveness, adverse event rates and health utilities in quality-adjusted life years (QALY). The cost of each treatment option was determined through literature review and the Canadian Institute for Health Information Patient Cost Estimator. The Markov model included a 3% annual discount rate. Uncertainty of cost and effectiveness was evaluated with sensitivity analysis. After elective laparoscopic splenectomy, prophylactic anticoagulation was dominant over expectant management. Prophylactic anticoagulation saved $2589.55 and increased 5.74 QALYs per patient. In sensitivity analyses, the prophylaxis strategy using LMWH remained least costly unless the drug acquisition cost of dalteparin increased to $100 from $12.50 per dose or the absolute risk reduction decreased to 4% from 20%. Prophylactic anticoagulation of postoperative patients undergoing laparoscopic splenectomy is the most effective and cost-efficient option compared with expectant management.

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The use of computed tomography for parathyroid adenoma localization: a systematic review and meta-analysis. ***W.P. Kluijfhout, L.E Rotstein, I. Suh, J.D. Pasternak*. From the University Health Network and the University of California, San Francisco, San Francisco, Calif.**

The use of 4-dimensional computed tomography (4D-CT) facilitating parathyroid localization and minimally invasive parathyroidectomy is replacing conventional sestamibi scintigraphy in some centres. The number of contrast phases needed for optimal performance is unclear, though more phases are associated with increased radiation exposure. Classic 4D-CT consists of pre-contrast, arterial, venous and delayed phases while other centres perform only 2 or 3 of these. We performed a systematic review and meta-analysis to determine the optimal number of contrast phases and effectiveness at localization. A search of the Embase, PubMed and Cochrane Library databases was performed to identify studies from January 2000 to September 2015 investigating the diagnostic value of CT for parathyroid localization in primary hyperparathyroidism. Performance of CT was expressed in terms of sensitivity and PPV with pooled proportion using a random-effects model. Factors affecting diagnostic performance were investigated by subgroup analysis including number of contrast phases. Twenty-six studies evaluating 1820 patients with hyperparathyroidism who underwent CT before resection were identified. The pooled sensitivity of CT for localization of parathyroid disease to the correct quadrant was 73% (95% CI: 68%–78%), and it was 84% (95% CI:78%–89%) for lateralization to the correct side. Data to calculate PPV were available in 19/26 studies and showed a pooled PPV of 82% (95% CI: 77%–87%). Analysis of contrast phases showed that adding a second phase raised sensitivity significantly from 67% (95% CI: 58%–76%) to 79% (95% CI: 71%–87%); however, adding a third phase did not result in better performance with a sensitivity of 78% (95% CI: 70%–87%). This is, to our knowledge, the first meta-analysis investigating all CT protocols for the detection of parathyroid adenomas. We found good overall performance, though increased CT phases were not seen to increase the sensitivity and are associated with substantially more radiation. The best outcomes for the amount of radiation were seen with a CT protocol consisting of 2 contrast phases.

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Appendicitis in the pediatric population: effect on subsequent pregnancy rates. ***J. Coffey, K. Vogt, C. Vinden, A. McClure, J. Winick-Ng, S. Jones*. From Western University, London, Ont.**

The association between appendicitis and subsequent fertility is unclear. We set out to determine if the fertility rate was different in a cohort of females between the ages of 8 and 15 years who underwent appendectomy for acute appendicitis compared with an age-matched cohort of patients who did not undergo appendectomy. A population-based retrospective matched cohort study using the Institute for Clinical Evaluative Sciences databases and time to event analysis was undertaken. Exposure was appendectomy for either non-perforated or perforated appendicitis between 1991 and 2001, as recorded in the Canadian Institute for Health Information discharge abstract database (CIHI-DAD) (n = 6659). This group was compared with a cohort (1:4 match exposed: unexposed) who had not undergone appendectomy (n = 26 603). The follow-up period ranged from 13 to 23 years. The primary outcome was evidence of pregnancy as recorded in the CIHI and Ontario Health Insurance Plan (OHIP) databases. Secondary outcomes were as follows: live births; infertility and proxies of infertility. Standard database exclusion criteria were applied. The cohort who had an appendectomy for appendicitis had higher rates of fertility and evaluations/treatment for infertility: pregnancy rate of 55% versus 50% ($p < 0.0001$), percentage of live births of 41% versus 37% ($p < 0.0001$) and infertility rate of 3.7% versus 2.8% ($p < 0.0001$) compared with the matched cohort. One thousand eight hundred patients were diagnosed with a perforated appendicitis; they had lower rates of markers of fertility and a higher rate of seeking evaluations and/or treatment for infertility compared with those with a non-perforated appendicitis: pregnancy rate of 47% versus 57% ($p < 0.0001$), percentage of live births of 35% versus 43% ($p < 0.0001$) and infertility rate of 3.9% versus 3.7% ($p < 0.0001$). In conclusion, our results suggest appendicitis does affect pregnancy and fertility and the effect is different with a perforated appendicitis. Further analysis is being undertaken to ensure matching of the cohorts.

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Practice does not always make perfect: need for selection curricula in modern surgical training. ***M. Louridas, P. Szasz, A.B. Fecso, M.G. Zywiel, P. Lak, A.B. Bener, K.A. Harris, T.P. Grantcharov*. From the University of Toronto and Ryerson University, Toronto, Ont.; and the Royal College of Physicians and Surgeons of Canada, Ottawa, Ont.**

The objectives were to assess novice trainees' learning patterns for the acquisition of surgical skills across a range of open and laparoscopic tasks of variable difficulty, including the degree of consistency in learning patterns and the ability to reach technical competence. Evidence suggests that not all surgical trainees are

able to reach technical competence despite ongoing practice. Sixty-five preclinical medical students participated in a training curriculum with standardized feedback over 40 repetitions of the following laparoscopic and open technical tasks: peg transfer (PT), circle cutting (CC), intracorporeal knot tie (IKT), one-handed tie and simulated laparotomy closure. Data mining techniques were used to stratify the students into 4 learning clusters. Performance was compared between groups, and learning curve characteristics unique to trainees who have difficulty reaching technical competence were quantified. Top performers (22%–35%) and high performers (32%–42%) reached proficiency in all tasks. Moderate performers (25%–37%) reached proficiency for all open tasks but not all laparoscopic tasks. Low performers (8%–15%) failed to reach proficiency in 4 of 5 tasks including all laparoscopic tasks (PT 7.8%; CC 9.4%; IKT 15.6%). Participants in lower performance clusters demonstrated sustained performance disadvantage across tasks, with widely variable learning curves and no evidence of progression toward a plateau phase. Most students reached proficiency across a range of surgical tasks, but low-performing trainees failed to reach competence in laparoscopic tasks. With increasing use of laparoscopy in surgical practice, screening potential candidates to identify the lowest tier performers may be beneficial.

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Antibiotic utilization among older adults on an acute care general surgery service. ***A.S. Pollmann, J.G. Bailey, P.J. Davis, P.M. Johnson*. From Dalhousie University, Halifax, N.S.**

While antibiotics play an important role in the treatment of many diseases that affect older adults, the potential for inappropriate use of these drugs is high. This may be particularly problematic on acute care surgical services where there is high patient turnover, frequent handovers and rotating surgeon coverage, and residents play a central role in patient care. The objective of this research was to describe antibiotic utilization among older patients admitted to a busy acute care surgical service at a tertiary care teaching hospital. Detailed patient-level data regarding diagnosis, allergies, comorbidities, treatments and antibiotic use were retrospectively collected for all patients aged ≥70 years who were admitted to an acute care surgical service between July 2011 and September 2012. Antibiotic utilization (perioperative prophylaxis and treatment) was evaluated for appropriateness based on published guidelines and local resistance patterns. During the study period 452 patients (median age = 78, range 70–103) were admitted to hospital. The most common diagnoses were small bowel obstruction (16.6%), acute cholecystitis (11.1%) and lower gastrointestinal bleed (8.0%). Of the 247 patients who underwent non-elective abdominal surgery, 51.0% received appropriate antibiotic prophylaxis. The most common drug errors were incorrect dose (30.8%) and incorrect timing (20.0%). Overall, 201/452 patients received therapeutic antibiotics for their underlying disease process and 36.3% received appropriate first-line drug therapy. The most common therapeutic drug errors were administration of second- or third-line drugs without indication (68.8%), antibiotics given but not indicated (13.3%) and additional antibiotics required (11.7%). There was considerable variation in the duration of treatment for patients with the same diagnoses. Inappropriate antibiotic use was common among older patients admitted to an acute care surgery service. Quality improvement and assurance initiatives are needed to ensure that patients receive optimal care in this complex hospital environment.

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Venous thromboembolism prophylaxis following colorectal cancer surgery — a Canadian survey. ***J. Lee, N. Amin*. From McMaster University, Hamilton, Ont.**

Patients undergoing colorectal surgery for malignancy are at increased risk of developing venous thromboembolism (VTE). This increased risk of VTE persists for several weeks following surgery. The incidence has been estimated to range from 30% to as high as 80% in the absence of appropriate prophylaxis. Clinical guidelines for postoperative VTE prophylaxis have been established and, overall, recommend an extended 4-week prophylaxis for high-risk patients. However, they lack comprehensive recommendations for colorectal cancer surgery and previous studies in Australia and the United Kingdom have demonstrated that 45% and 68%, respectively, of colorectal surgeons did not recommend extended prophylaxis. The practice of VTE prophylaxis among general surgeons in Canada has not been investigated. This study will survey Canadian general surgeons who perform colorectal cancer surgery. The Delphi process, a technique used to anonymously survey select cohorts and develop a consensus on specific issues, will be used and it is anticipated that 3 iterations of surveys will be required to reach a consensus. Questionnaires will be distributed via LimeSurvey to surgeons listed in the Canadian Association of General Surgeons' database. A task group of colorectal surgeons across Canada will further discuss the common elements identified in the 3 iterations of surveys and work to arrive at a final consensus. The primary objective of this study is to assess the practice of VTE prophylaxis following colorectal cancer surgery. The secondary objectives are to identify factors that influence clinical decision-making and to establish a national consensus. It is anticipated that knowledge gained through this study will help guide VTE prophylaxis for patients undergoing colorectal surgery for cancer and provide pilot data for a feasibility study to investigate the cost-effectiveness of extended VTE prophylaxis.

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Feasibility of same-day discharge following POEM for esophageal dysmotility disorders. ***D. Hong, M. Anvari, M. Cadeddu*. From McMaster University, Hamilton, Ont.**

Peroral endoscopic myotomy (POEM) is increasingly being used for esophageal motility disorders. A potential benefit over standard surgery is the less invasive nature of POEM with resultant quicker hospital discharge. Our objective was to assess the feasibility of same-day discharge following POEM. All patients with esophageal dysmotility disorders were enrolled in a research ethics board approved study. Preoperative evaluations included manometry, 24-hour pH testing and endoscopy. POEM was performed on the anterior esophageal wall dividing only the circular muscle fibres. All patients underwent a routine water-soluble contrast study 3–5 hours following POEM. Discharge criteria included normal contrast study, ability to tolerate oral fluids, good pain control on regular acetaminophen and nutritional

consultation. Twelve patients underwent the POEM procedure. Ten patients had a diagnosis of achalasia, 1 patient was treated for nutcracker and 1 was treated for jackhammer esophagus. Mean operative time was 136 minutes (95–174 minutes). Two patients developed a mucosal tear that was repaired and 1 patient developed significant pneumoperitoneum that resolved without treatment. Ten patients (83%) were discharged the same day. Same-day discharge following POEM is safe and feasible.

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Identifying novel biomarkers to predict mortality in abdominal sepsis. ***T. Chan, M.S. Bleszynski, A.K. Buczkowski.*** **From University of British Columbia, Vancouver, B.C.**

The objective of this study was to identify and evaluate novel biomarkers that predict in-hospital mortality in patients with abdominal sepsis undergoing source control surgery. A prospective observational cohort of 52 adult patients meeting the 2012 Society of Critical Care Medicine criteria for systemic inflammatory response syndrome (SIRS), severe sepsis or septic shock of abdominal source was studied. Whole blood and peritoneal fluid samples were collected in the operating room at the time of source control surgery. Concentrations of biomarkers (pg/mL) were determined using a Luminex multiplex panel of 13 candidate biomarkers (Il-5, Il-6, Il-8, Il-10, Il-17, RANTES, MIP-1α, MCP-1, HGF, IFN-γ, Il-1RA, TNF-α and Il-2R). ROC curves were used to evaluate the accuracy of discrimination between survivors and non-survivors (AUC > 0.80) and determine optimal cut-off levels for biomarker concentrations (sensitivity > 0.80). Median patient age was 61 years. Physiological and Operative Severity Score for the enUmeration of Mortality and Morbidity (POSSUM)-predicted overall mortality was 15%; observed mortality was 19.2%. The distribution of patients with SIRS, severe sepsis and septic shock was 52%, 11.5% and 36.5%, respectively. Serum concentrations of MIP-1α, Il-6, HGF, Il1-RA, Il-2R and Il-8 distinguished between survivors and non-survivors with an AUC > 0.8, as well as high sensitivity (83%–100%) and negative predictive value (95%–100%). Preoperative serum concentrations of MIP-1α, Il-6, HGF, Il1-RA, Il2-R and Il-8 are sensitive in predicting in-hospital mortality in patients undergoing surgery for abdominal sepsis, with a high likelihood of patient survival if below the cut-off concentration.

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Observation versus pleural drainage for management of occult pneumothoraces in adult trauma patients: a systematic review and meta-analysis. ***S. Knowles, M. Livingstone, K. Vogt, D. Roberts, A. Kirkpatrick, N. Parry.*** **From Western University, London, Ont.**

Occult pneumothoraces (OPTX) are now more frequently diagnosed in trauma. However, the appropriate management of OPTXs remains debatable. We sought to systematically review outcomes reported in randomized controlled trials (RCTs) of observation versus pleural drainage of OPTXs in adult trauma patients. We searched Medline, Embase, the Cochrane Library and the grey literature for RCTs comparing observation and pleural drainage (both tube thoracostomy and percutaneous catheter) for OPTXs in adult trauma patients. Outcomes of interest included the following: OPTX progression, respiratory failure, length of stay (LOS) in the intensive care unit (ICU) and hospital, mortality and complications. Review Manager 5 was used for the quantitative pooling of data. Summary measures used were risk ratio with 95% confidence intervals (CIs) for dichotomous data and mean difference with 95% CIs for continuous data. Data were pooled using a random effects model. From the 1947 studies identified, 3 RCTs met the inclusion criteria (n = 169). Not all of the studies measured the outcomes of interest. The incidence of pneumonia (RR 1.24; 95% CI 0.58–2.65) as well as the LOS in the ICU (–0.31 days; 95% CI –2.41 to 1.79 days) and hospital (0.98 days; 95% CI –2.92, 4.88 days) were similar between the observational and pleural drainage groups. The risk of progression of PTX was higher in the observation group (RR 8.62; 95% CI 1.64–45.28). The current review would suggest that pleural drainage might be indicated to prevent PTX progression. With respect to other outcomes, such as LOS and pneumonia, observation and pleural drainage seem to be comparable OPTX management strategies. However, there exists a paucity of evidence on this topic and not all patient important outcomes have been considered.

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Relational coordination and burnout in a tertiary acute care surgery service. ***E.E. Joy, H.M. Yoon, F. Farrokhyar, D. Hong.*** **From McMaster University, Hamilton, Ont.**

General surgery has shifted the care of acutely ill patients with the implementation of acute care surgery (ACS) services to improve the care process, patient safety and surgical education. There are little data exploring how an ACS service impacts resident well-being and experience. Our objective is to characterize resident well-being and experience on a tertiary ACS service by a means that will inform specific domains requiring improvement. Relational coordination is a survey-based metric that is validated in the health care setting and that satisfies our stated requirements. Higher levels of relational coordination have been associated with improved job satisfaction. A single-site ACS service was surveyed for the level of relational coordination among care providers. A Maslach burnout inventory was completed by residents to further characterize their experience on the service. Ten groups of care providers responded: staff surgeons (8), senior residents (4), junior residents (5), nurses (29), medical students (6), physician assistants (2), a pharmacist (1), a dietitian (1), a social worker (1) and physiotherapists (2). The overall response rate was 56%. One hundred per cent of surgical residents surveyed responded. Cronbach's α was calculated for all groups of care providers that had more than 2 respondents. Residents reported their lowest levels of relational coordination with physiotherapists and social workers. Considering the entire service, staff surgeons and medical students were considered to have the lowest levels of relational coordination. The burnout inventory revealed that all surgical residents suffer from high levels of occupational burnout. Improving communication and relationships between staff surgeons and medical students and the remainder of the ACS service will probably improve the level of relational coordination of the whole service. Specific interventions to improve the level of relational coordination between residents and physiotherapists and social workers should be implemented. Levels of burnout among residents should be reassessed after implementing the above interventions.

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Complication rates for percutaneous enteral tube insertion: How are we doing? ***R. Zener, K. Wanis, A.C. Istl, J. Kachura, S. Latosinsky, D. Wiseman*. From Western University, London, Ont.**

The purpose of this study was to establish the 30-day mortality and complication rates of percutaneous radiologic gastrojejunostomy and gastrostomy in adult patients at our centre and compare the complication rates with those reported in the literature. All consecutively inserted percutaneous fluoroscopically guided gastrojejunostomy (GJ) and gastrostomy (G) tubes placed in adults by interventional radiology from 2011 to 2014 at a single academic tertiary care centre were retrospectively reviewed. Procedure-related mortality was determined. Complications within the 30-day post-procedure period were classified as major or minor based on the Society of Interventional Radiology standards of practice. Mortality and complication rates between GJ and G groups were compared with Fisher exact test ($p < 0.05$). In total 559 percutaneous enteral tubes were placed (473 GJ and 86 G). The 30-day complication rate was 12.3% overall ($n = 69$), 10.7% for minor complications ($n = 60$) and 1.6% for major complications ($n = 9$). Of patients who developed complications, 69.6% ($n = 48$) were head and neck cancer patients. Three patients required a laparotomy secondary to their complication. The 30-day complication rate was significantly higher for the GJ group compared with the G group (13.5% v. 5.8%, $p = 0.049$). There was a trend toward a higher 30-day minor complication rate (11.8% v. 4.7%, $p = 0.057$) in the GJ group compared with the G group. Four procedure-related deaths occurred, all secondary to intra-abdominal sepsis, resulting in an overall procedure-related mortality rate of 0.7%. No significant difference was found in the major complication rate (1.7% v. 1.2%, $p = 1.0$) or procedure-related mortality (0.6% v. 1.2%, $p = 0.49$) between GJ and G groups respectively. The major complication and procedure-related mortality rates from percutaneous fluoroscopically guided feeding tube insertion at our centre are low and these rates are congruent with the literature. GJ tube insertion was associated with a higher overall complication rate, likely due to more minor complications.

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Chronic anisakidosis discovered during a Whipple procedure: a case report. ***M.-P. Godbout, Y. Collin, A. Paré, M. Chababi-Atallah, A. Bégin*. From Sherbrooke University, Sherbrooke, Que.**

Anisakidosis is a parasitic infection caused by the ingestion of raw fish containing Anisakis larval nematodes. Although common in Japan (>2000 cases annually), it has rarely been reported in Canada (4 cases). An association between gastrointestinal cancer and anisakidosis has been suggested. Chronic inflammation and the parasite's tropism toward vulnerable mucosa have been advocated as potential risk factors. We report the first case of anisakidosis discovered in conjunction with cholangiocarcinoma. A 63-year-old Caucasian woman was brought to the emergency department with a history of cholangitis secondary to common bile duct stenosis suspicious for cholangiocarcinoma. A biopsy revealed a low-grade dysplasia. The patient completed a 14-day course of ciprofloxacin and was scheduled for a Whipple procedure. A staging CT scan revealed a gastric mass with features of gastrointestinal stromal tumour. The submucosal gastric mass was included en bloc with the Whipple procedure. An incidental jejunal mass was also resected. Pathological examination disclosed an adenocarcinoma of the distal common bile duct with duodenal infiltration. The suspicious gastric mass was an eosinophilic granuloma attached to an Anisakis simplex. The jejunal mass was also a granuloma (unattached to a parasite). The patient's recovery was complete and no cancer recurrence was observed 4 years later. This is the first reported case of Anisakis simplex associated with cholangiocarcinoma to our knowledge. The scarcity of both pathologies in our population leads us into deeper questioning about the potential association of this parasite with hepatobiliary cancer as we know other species (e.g., Opisthorchis viverrini) are recognized risk factors.

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Patient satisfaction with the implementation of an enhanced recovery after surgery (iERAS) program. ***E.A. Pearsall, M. McKenzie, M.A. Aarts, R.S. McLeod* on behalf of the iERAS Group. From the University of Toronto, Toronto, Ont.**

The objective of this study was to understand patient satisfaction with the iERAS program implemented in 15 academic hospitals. All patients enrolled in the iERAS program received a patient education booklet that included an open-text page for patients to comment on their satisfaction with the program. The open-text comments were analyzed through thematic analysis. Overall, 129 of 2927 (4.4%) provided comments on the iERAS program. Most patients felt the booklet was helpful and allowed them to be active participants in their recovery by providing clear goals and expectations. Most patients found the booklet to be motivating, informative and easy to understand. With regards to specific recommendations, most patients felt that walking postoperatively was very useful in accelerating their recovery, particularly with regards to alleviating pain and gas. Some patients felt that chewing gum was beneficial while others did not. Most patients found that being provided solid food on postoperative day 1 was "too much, too soon" and felt pressured to eat more than they were comfortable with. A few patients who had had previous surgeries commented that the iERAS program hastened their recovery. Suggestions for improvements in the program included providing more detailed information on postoperative recovery including information on bowel function, common complications and discharge planning. Lastly, a few patients commented on institutional barriers such as miscommunication among health care professionals, the need for staff to be more engaged in early mobilization, and inadequate pain control. While most patients were satisfied with their care in the iERAS program, patient feedback has led to development of a post-surgery booklet to provide more information on postoperative recovery and discharge needs. In addition, the preoperative booklet will be modified to provide a clearer description of patient controlled diets. Lastly, this information will be used to provide education to staff.

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Outcomes in management of retained hemothorax in trauma. ***J.J. Choi, K.N. Vogt, N.G. Parry*. From Western University, London, Ont.**

The standard of care in the treatment of hemothorax in trauma has been tube thoracostomy. However, there may exist a subset of patients with small-volume hemothorax that may not need immediate drainage. Outcomes in this population have not been previously investigated. We hypothesize that small-volume traumatic hemothorax may be safely managed without need for immediate drainage. A quality assurance study was performed to characterize our institutional experience with retained hemothorax. A retrospective review of all patients with blunt or penetrating trauma with a diagnosis of hemothorax was conducted over a 1-year time period from January 2015 to December 2015. Twenty-six patients were identified as having hemothorax not initially treated with tube thoracostomy. Nineteen patients (73.1%) were male. Mean age was 58.6 years (18–86). The mechanism of injury was blunt in all patients, and all patients underwent chest computed tomography scan. The injury severity score was greater than 15 in 17 patients (65.4%). At the time of injury, 2 patients were on therapeutic anticoagulation and 1 was on clopidogrel; 1 patient did require chest tube insertion. Twenty-four patients had small-volume hemothorax and 2 had large-volume hemothorax. Fifteen patients had concurrent pneumothorax, with 12 of those being on the ipsilateral side to the hemothorax. Five of 26 patients (19.2%) did eventually require chest tube insertion. Three were for increasing hemothorax, 1 was for increasing pneumothorax and 1 was for iatrogenic hemothorax from central line placement. Both patients who had large-volume hemothorax on admission required tube thoracostomy. There was 1 death from catastrophic brain injury. In conclusion, small-volume traumatic hemothorax may be safely observed. Close clinical and radiographic follow-up is recommended.

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Duty hour restrictions negatively impact motivators for surgical resident learning. ***M.Y.L. Li, K.M. McKendy, E. Bilgic, J.L. Lie, C.L. Mueller*. From McGill University, Montreal, Que.**

Motivation is vital for learning and intrinsic motivation has been linked to many educational benefits, such as enhanced knowledge retention and increased perseverance. Recently, duty hour restrictions (DHRs) have drastically altered the resident training experience. Neither the quality of motivation nor the impact of DHRs on training motivation have been studied in surgical residents. We sought to clarify these issues. Semi-structured interviews were conducted with 10 university-affiliated general surgery residents at all levels of training. Participants were selected by stratified sampling and were recruited until response exhaustion was achieved. Open-ended questions were developed by committee to maximize exploration of the target topics and minimize redundancy. The responses were analyzed using grounded theory. Residents largely endorsed intrinsic motivators as the reasons they sought mastery and persevered despite hardship, such as interest in their chosen specialty, enjoyment from working in a team and satisfaction from making independent decisions. Achieving operative competence and providing patient care were most often cited as the greatest sources of motivation for surgical training. Feeling underappreciated and perceiving a lack of progression in technical skills were most often cited as demotivating. When asked specifically about DHRs, these were overwhelmingly viewed negatively by residents. DHRs were most frequently described as leading to fragmentation of teamwork, decreased operative exposure and decreased patient ownership. Surgical residents are largely driven by intrinsic motivators and DHRs have negatively impacted several key elements that enhance motivation. These findings may inform resident scheduling decisions to improve motivation among surgical trainees.

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Senior resident colonoscopy performance in a Canadian general surgery training program. ***R.P. Kelly, P. Johnson*. From Dalhousie University, Halifax, N.S.**

Colonoscopy is a core component of general surgery practice. While there is currently considerable interest in endoscopy quality assurance and training for surgical residents, little is known about the colonoscopy volumes and outcomes achieved by general surgery trainees. The purpose of this research was to describe the colonoscopy experience of senior general surgery residents at a Canadian tertiary care teaching hospital. Between September 2014 and March 2016, data regarding colonoscopy volume, colonoscopy completion (cecal intubation or anastomotic visualization) and polypectomy volume were prospectively collected for all PGY3, PGY4 and PGY5 residents who completed a 3-month rotation on a colorectal surgery service. Scope completion rates and polypectomy volume were compared between PGY5 and PGY3/4 residents. During the study period 14 residents rotated on the colorectal surgery service (PGY5 = 7, PGY4 = 4, PGY3 = 3) and the average number of colonoscopy procedures performed per resident was 39. The number of scopes performed by the PGY5 residents (mean 42, range 18–82) was similar to that of the PGY3/4 residents (mean 36, range 10–63) ($p = 0.615$). The scope completion rate was higher among 5th year residents compared with the 3rd and 4th year residents, 83% versus 65%, respectively ($p = 0.023$). The average number of polyps removed per trainee was 21. There was no difference in the polypectomy volume between the PGY3/4 residents (mean 14, range 3–27) and the PGY5s (mean 28, range 13–42) ($p = 0.051$). Overall, the volume of colonoscopy procedures performed by senior residents was lower than expected and there was considerable variation among trainees. While the outcomes for the PGY 5 residents appear favourable, it is unclear if this represents an adequate assessment of competency given the low volume of procedures for some trainees.

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Process mapping as a framework for performance improvement in emergency general surgery. ***K. DeGirolamo, K. D'Souza, J. Zhang, B. Drake, M. Zurberg, T. Hong, R. Mah, A. Bisaillon, K. Mayson, E. Joos, J. Sutherland, S.M. Hameed*. From the University of British Columbia, Vancouver, B.C.**

Emergency general surgery conditions are often thought of as being too acute and unpredictable for the development of standardized approaches to quality improvement (QI). However, process mapping, a concept that has been applied extensively in manufacturing, has been used to understand opportunities for improvement in complex health care processes. This study uses process mapping to deconstruct the surgical care of patients presenting to emergency general surgery (EGS) services with acute small bowel obstruction (SBO). The American College of Surgeons Emergency General Surgery Quality Improvement Program (EQIP) pilot database was used to identify patients presenting to a single, large teaching hospital over a 6-month period (Mar. 1, 2015, to Sept. 1, 2016), for the nonoperative or operative management of SBO. The EQIP database and chart and electronic health records were used to create process maps for each patient from the time of onset of symptoms to the time of outpatient follow-up. These process maps were evaluated to identify important process issues and their potential impact on clinical outcomes. Sixty patients with SBO (36 nonoperative, 24 operative) were identified. Operative SBO had a complication rate of 27.8%. The processes of care from the time of presentation to the time of follow-up were highly elaborate and variable in terms of duration; however, the sequences of care were found to be consistent. Data visualization strategies were used to identify bottlenecks in care and demonstrated substantial variability in terms of operating room access. Complication rates in the operative care of SBO are high and represent an important QI opportunity in general surgery. Process mapping can identify common themes, even in acute care, and suggest specific performance improvement measures. At our centre, we are directing plan-do-study-act (PDSA) cycles and developing standardized orders and approaches based on process map inputs.

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Are video-rating skills a reflection of technical skills? ***N. Gawad, G. Martel, F.K. Balaa, J. Mamazza, N. Kolozsvari, A. Neville, I. Raiche*. From the University of Ottawa, Ottawa, Ont.**

Prior study suggested that residents with lower technical skill scores tend to overestimate skill when rating videos of surgical performance, and over years of training their video-rating scores approach those of staff surgeons. Attempting to clarify these preliminary findings, this study sought to determine if residents with superior technical skills have more accurate video-rating skills. General surgery residents (n = 25) from PGY1 to PGY5 laparoscopically dissected a gallbladder in an ex-vivo porcine simulation model. Each video was independently evaluated by 2 trained staff surgeons blinded to the resident's identity and training level, using a modified global operative assessment of laparoscopic skills (GOALS) instrument. Each resident also evaluated an anonymous archived video of the same procedure as did 4 trained staff surgeons to create a gold standard comparison score. The accuracy of the residents' video-rating was established as the difference between the residents' and surgeons' scores, and this was compared with technical skills. Resident technical skills scores ranged from 5 to 19 out of 20 (mean 12.8 ± 2.48). Resident video-rating scores varied from staff scores by up to 8 points. Best fit was obtained using a quadratic equation, and polynomial regression demonstrated a correlation between accurate video-rating and technical skills (r = 0.46, p = 0.07). There was no correlation between resident training level and video-rating skills. This study demonstrates a trend toward more accurate video-rating skills with increasing technical skill among surgical residents. These findings justify further exploration of the predictive value of video-rating skills with respect to technical skills.

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Variation with structures of care among hospitals performing colorectal cancer surgery in Ontario. ***C.C. Chrystoja, J.K. Ramjist, N.N. Baxter, M. Simunovic, R. Sutradhar, L. Lix, D.R. Urbach*. From the University of Toronto, Toronto, Ont.**

Many patients who develop colorectal cancer require surgery, and the quality of surgical care they receive varies substantially. Our objective was to describe the structures of care for colorectal cancer surgery in Ontario across hospital types. We developed a survey of structures of care constructs: organization (dimensions: physician and nurse staffing, clinical unit structure), technology (dimensions: diagnostic imaging, interventional therapeutics, intraoperative and postoperative monitoring) and coordination of care (dimensions: supervision-based and peer interaction-based feedback). A surgical and nursing leader from each of 120 hospitals that perform colorectal cancer surgery were invited to complete the electronic survey. Factor analysis was used for item reduction. The association of the normalized weighted average of the aggregate construct and dimension scores with hospital type was assessed in ANOVA models. Complete data were available for 55 hospitals. Academic hospitals had the highest scores for constructs (organization mean score 56.7% ± 15.8%, technology 78.5% ± 17.6%, coordination of care 90.0% ± 20.7%), followed by large non-academic hospitals (organization 46.5% ± 18.4, technology 49.1% ± 22.0%, coordination of care 85.4% ± 19.4%). Small hospitals had the lowest scores for constructs (organization 18.2% ± 15.0%, technology 11.1% ± 7.0%, coordination of care 46.9% ± 38.6%). All constructs differed by hospital type ($p < 0.001$), as did all dimensions ($p < 0.05$) outside of clinical unit structure (p = 0.25). Academic and large non-academic hospitals had similar organization (p = 0.07) and coordination of care structures (p = 0.60), which differed from those of small hospitals ($p < 0.001$). There are large differences in structures of care between academic, large non-academic and small hospitals. The largest differences were in technology among all hospital types, while organization and coordination of care structures differed most between small and other hospital types.

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Review of nonoperative management of acute uncomplicated appendicitis in the Saskatoon Health Region. ***E. Barber, E. Neuls, N. Ginther, S. Mueller*. From the University of Saskatchewan, Saskatoon, Sask.**

The gold standard of treatment of acute appendicitis has historically been appendectomy; however, recent literature shows nonoperative management to be an effective alternative with recurrence around 20% and less morbidity. We sought to determine whether nonoperative management of acute uncomplicated appendicitis in our health region results in similar rates of failure,

recurrence and complications compared with existing data. A retrospective chart review was performed on all adult patients admitted to our health region over a 2-year period (2011–2013) with acute appendicitis and who did not undergo appendectomy within the first 48 hours of admission. Those with radiographic evidence of perforation, abscess or phlegmon were excluded. The primary outcome was failure of nonoperative management. Failure was defined as undergoing appendectomy at least 48 hours after admission or recurrence resulting in readmission within 2 years. Secondary outcomes were complications of appendicitis, appendectomy performed on subsequent admission, diagnosis of chronic appendicitis, and total length of stay in hospital. A total of 91 charts were reviewed, of which 55 met the criteria for acute uncomplicated appendicitis confirmed by imaging. Conservative management failed in 22/55 (40.0%) of cases, with 7/55 (12.7%) undergoing appendectomy at least 48 h after admission and 15/55 (27.3%) having recurrence and readmission. Chronic appendicitis was subsequently diagnosed in 5/55 (9.1%), and 21/55 (38.2%) ultimately underwent appendectomy. Complications including perforation, abscess and delayed diagnosis of underlying appendiceal cancer occurred in 6/55 (10.9%). The average length of stay on initial admission was 3.4 days. Compared with a recent meta-analysis, our experience with nonoperative management of acute uncomplicated appendicitis demonstrates similar rates of overall failure and complications and higher rates of recurrence requiring readmission. Conservative management remains a controversial subject, and appropriate patient selection is paramount. Future study will compare these outcomes with those of patients who underwent early appendectomy.

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Transition to independent surgical practice and burnout among general surgeons. ***M. Firdouse, J. Escallon, S. deMontbrun, T.D. Cil.* From the University of Toronto, Toronto, Ont.**

Surgical trainees must successfully complete residency before they can start independent practice. This transition period from trainee to staff surgeon is often stressful and may contribute to the development of burnout. The purpose of this study was to understand issues that new graduates face during this transition and to assess their levels of burnout. An email invitation was sent to recently graduated (2009–2014) general surgeons across Canada. The survey consisted of 55 questions covering aspects of the transition to independent surgical practice. The Maslach Burnout Inventory – Human Services Survey (MBI-HSS) was also administered. Descriptive statistics were performed. A total of 630 recent general surgery graduates were contacted; 44 (7%) emails bounced back. Ninety-one of the remaining surgeons responded to the survey (16%). There was an even gender distribution, with 43 responses from men and 44 from women (2 did not disclose). The majority (60%) felt that the operating skills they gained during their residency training were appropriate for independent practice. However, 42% of the respondents were not comfortable in their abilities to handle the business aspect of practice and 24% were not confident in billing their services. With respect to burnout, 18% of the respondents identified themselves as currently experiencing burnout and 24% indicated they had experienced burnout in the past. However, based on the MBI-HSS scoring guide, 92% (n = 82) of the respondents had burnout. Respondents had high scores on the emotional exhaustion (92%) and personal accomplishment subscales (67%). These data show that there are many areas in which new surgical graduates are not comfortable when starting practice, particularly with respect to business matters. Our respondents had a high degree of burnout in this career stage. A transition to independent practice program may be beneficial for recent general surgical graduates. Furthermore, greater emphasis must be placed on addressing burnout in surgery.

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Effect of implementation of acute care surgery on outcomes in fulminant *Clostridium difficile* colitis. ***E. Lau, P. Murphy, K. Lung, B. Kidane, T. Mele*. From Western University, London, Ont.**

Clostridium difficile infection (CDI) is the leading cause of nosocomial diarrhea. Of those with CDI, 2%–8% progress to fulminant *C. difficile* colitis (fCDC). Recent data suggest that prompt surgical treatment may improve outcomes. Implementation of acute care surgery (ACS) has been shown to improve timeliness of care, but its effect on fCDC has not been studied. This study aims to examine the effect of implementation of an ACS service on outcomes of surgery in fCDC. We performed a retrospective review of patients who underwent surgical intervention for fCDC at our institution from April 2009 to February 2016. The post-ACS group included patients treated at a site with ACS at the time of CDI confirmation. Data collected included patient demographics, time from CDI confirmation to surgical consult and colectomy, disease severity score (DSS) and in-hospital mortality. Mann–Whitney U and χ^2 tests were performed with α 0.05. Twenty-eight patients were identified. Median time (interquartile range in parentheses) from CDI confirmation to surgical consult was 1 (2) day; that from surgical consult to colectomy was 1 (3) day. Median DSS at the time of CDI confirmation was 7 (6), 8 (5) at the time of surgical consult and 9 (6) at the time of colectomy. There was no significant difference in time from CDI confirmation to surgical consult and colectomy, and in DSS at various time points when comparing pre-ACS and post-ACS implementation. In-hospital mortality in the pre-ACS group was 46.7% compared with 38.5% in the post-ACS group, a finding that was not statistically different (p = 0.66). Early colectomy was significantly associated with in-hospital mortality (p = 0.01). This study did not identify a significant impact of ACS implementation on the timing of surgical treatment and in-hospital mortality in fCDC. The importance of prompt surgical treatment on survival was again highlighted. Future studies on potential barriers to timely surgical treatment may improve outcomes in fCDC.

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Coexistence of primary GEJ adenocarcinoma and pedunculated gastric gastrointestinal stromal tumor (GIST): a case report. ***A. Alkaaki, B. Abdulhadi, M. Aljiffry, M.O. Nassif, H. Al-Maghrabi, A. Maghrabi*. From King Abdulaziz University, Jeddah, Saudi Arabia.**

Gastrointestinal stromal tumours (GISTs) are the most common mesenchymal tumour of the gastrointestinal (GI) tract, although they account for only 0.1%–3% of all GI malignancies. They can arise anywhere along the GI tract, with a preferred gastric location. GISTs usually arise from the stomach wall and extend inward toward the mucosa or outward toward the serosa. Pedunculated GIST is a unique pattern of growth that has been rarely reported. GIST and other primary GI tract neoplasms are distinct tumours originating from different cell layers. Concurrent occurrence of GIST and gastroesophageal junction (GEJ) neoplasm is extremely rare. We report a case of a 55-year-old gentleman with adenocarcinoma in situ at the GEJ and an incidental finding of synchronous pedunculated gastric GIST. Intraoperative wedge resection of a large pedunculated mass at the greater curvature of the stomach with negative margins was encountered along with transgastric submucosal resection of the GEJ polyp. Pathological examination confirmed synchronous GEJ adenocarcinoma in situ and a high-grade gastric GIST.

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Postoperative day 1 neutrophil-to-lymphocyte ratio as a predictor of 30-day outcomes in bariatric surgery patients. ***M. Da Silva, A. Elnabas, M.C. Clegborn, T.D. Jackson, A. Okrainec, F.A. Quereshy*. From the University of Toronto, Toronto, Ont.**

The neutrophil-to-lymphocyte ratio (NLR) is a marker that reflects systemic inflammation and organ dysfunction. Its use as a prognostic marker to predict complications following surgery has been recently described in the literature. However, NLR as a prognostic factor in bariatric surgery has not been evaluated. Therefore, the objective of our study was to evaluate the use of a high postoperative day 1 (POD1) NLR as a predictor of 30-day outcomes in patients undergoing bariatric surgery. We performed a retrospective chart review of 792 patients who underwent bariatric surgery at our institution between March 2012 and May 2014. Data were collected from electronic patient records and administrative databases used for quality improvement. POD1 NLR values were obtained from complete blood counts along with a variety of 30-day clinical outcomes. Univariate and multivariate analyses were conducted to determine if POD1 NLR ≥ 10 was associated with 30-day outcomes. This threshold was chosen because of its previous application in gastrointestinal surgery. A total of 737 patients were included in the study. We performed 653 Roux-en-Y gastric bypass surgeries (88.6%) and 84 sleeve gastrectomy surgeries (11.4%). All surgeries were performed laparoscopically. A total of 86 (10.9%) complications occurred, 47 (5.9%) of which were considered major. After covariate adjustment, POD1 NLR ≥ 10 was found to be significantly associated with overall complications (OR 1.98, 95% CI: 1.01–3.87), major complications (OR 3.71, 95% CI: 1.76–7.82), reoperation (OR 3.63, 95% CI: 1.14–11.6) and prolonged postoperative length of stay (OR 3.70, 95% CI 2.2–6.22). POD1 NLR was independently associated with 30-day outcomes following bariatric surgery. This easily obtained inflammatory marker may be used to help identify patients at a higher risk of developing early complications.

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Use of indocyanine green (ICG) angiography in blunt trauma: a new technique for intraoperative evaluation of bowel viability ***A.P. Santos, C. Tallant, D. Galvan*. From Texas Tech University Health Science Center, Amarillo, Tex.**

Intraoperative laser angiography, using indocyanine green (ICG), is a vascular imaging method that can be used intraoperatively to visually assess blood flow. ICG angiography provides real-time assessment of tissue perfusion that can be correlated with clinical outcomes, which can in turn guide surgical decision-making. This technique has yet to be studied in trauma, more specifically blunt trauma with questionable bowel injury. Currently clinical judgment remains the most commonly used intraoperative method for determining surgical decision-making. However, based on this case, we believe ICG angiography could provide a more objective method for determining perfusion of bowel following blunt trauma. A 45-year-old female was brought in as a restrained driver in a high-speed motor vehicle collision. She had episodes of hypotension responding to fluid resuscitation. Her abdomen was diffusely tender to palpation with rebound tenderness and a positive seatbelt sign. FAST exam was positive for free fluid. The patient was taken for an emergent exploratory laparotomy. A litre of blood was evacuated. A large mesenteric hematoma was present with possible devascularization of the small bowel; however, it was difficult to assess due to the size of the hematoma. The SPY Elite system was used and detected a well-demarcated region of devascularization in a portion of the small bowel, measuring 60 cm. The devascularized section was resected and left in discontinuity for a second-look operation. During the second-look operation the bowel continued to appear viable. Continuity was reestablished and the incision was closed. The patient was discharged home on postoperative day 4 following an uneventful recovery. ICG angiography provides real-time assessment of tissue perfusion that can be correlated with clinical outcomes, which can aide surgeons during surgical decision-making. This could provide an objective method for determining perfusion of bowel following blunt trauma.

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Needle break: complication and management of intra-osseous vascular access. ***A.P. Santos, R. Conkin, K. Dowd*. From Texas Tech University Health Science Center, Amarillo, Tex.**

Obtaining vascular access is very essential in the resuscitation process of trauma and critically ill patients; however, this can often be challenging. The International Liaison Committee on Resuscitation, Advanced Cardiovascular Life Support (ACLS) and Advanced Trauma Life Support (ATLS) all recommend intra-osseous access for infusions of crystalloids or blood until alternate venous access is achieved. We report a case of a trauma patient who benefitted from intra-osseous access but had complication due to breakage of the needle at the hub. We successfully removed the retained needle by intraoperative extraction using a crown drill bit under fluoroscopic guidance after bedside attempts to remove the foreign body failed.

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Associations between the day of the week of surgical admissions or procedures and postoperative mortality: a systematic review and meta-analysis. ***S.A. Smith, J.M. Yamamoto, D.J. Roberts, K.L. Tang, P.E. Ronksley, W.D. Buie, J.T. James*. From the University of Calgary, Calgary, Alta.**

Numerous studies have suggested that health care outcomes may vary by the day of the week or time of the day that care is provided. The objective of this study was to systematically examine associations between the day of the week that surgical admissions and procedures occur and postoperative mortality. We performed a systematic review and meta-analysis including studies that either (1) reported on mortality following urgent or emergent operations stratified by weekend versus weekday admission or (2) reported on mortality following elective operations stratified by the day of the week of surgery. Two independent investigators searched PubMed, Embase (1950 – October 2015) and references of relevant articles for studies meeting our inclusion criteria. Odds ratios (ORs) and corresponding 95% confidence intervals (CIs) for short-term mortality (≤90 day or inpatient mortality) were pooled using DerSimonian and Laird random-effects models. Of 3451 citations identified, 18 met the criteria for inclusion in the systematic review. Weekend admission, relative to weekday admission, was associated with significantly higher odds of short-term mortality among patients who underwent urgent or emergent surgery (11 studies; n = 1 073 928 patients; OR = 1.25; 95% CI = 1.08–1.45; I^2 = 84.5%). The pooled odds of short-term mortality following elective surgery was sequentially higher for each day of surgery from Monday to Friday (5 studies; n = 5 134 986 patients; Monday OR = 1.00 [reference]; Tuesday OR = 1.05 [95% CI = 0.98–1.12; I^2 = 17.5%]; Wednesday OR = 1.13 [95% CI = 1.06–1.19; I^2 = 8.6%]; Thursday OR = 1.20 [95% CI = 1.15–1.24; I^2 = 0%]; Friday OR = 1.23 [95% CI = 1.03–1.48; I^2= 78.9%]). Mortality is higher after admission for urgent or emergent surgery on the weekend compared with weekdays and increases in a graded manner after elective surgery for each day of the week from Monday to Friday. Our results suggest that institutions should explore ways to structure delivery of perioperative care to mitigate weekend versus weekday differences.

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Compliance with urinary catheter removal guidelines leads to improved outcome in enhanced recovery after surgery (ERAS) patients. ***A. Okrainec, M.A. Aarts, J.C. Victor, E.A. Pearsall, M. McKenzie, L. Gotlib-Conn, O. Rotstein, S. McCluskey, R.S. McLeod, on behalf of the iERAS group, University of Toronto, Toronto, Ont.***

Although enhanced recovery after surgery (ERAS) pathways have been shown to improve outcome in patients undergoing colorectal surgery, there is uncertainty about the benefit of individual recommendations. The objective of this study was to determine whether compliance with urinary catheter recommendations leads to decreased length of stay (LOS) and decreased urinary tract infections (UTIs) and urinary retention. All patients having colorectal surgery at 15 academic hospitals were included. Patient, preoperative, intraoperative, postoperative and outcome data were collected prospectively. In our iERAS program, we recommend that catheters following colonic and rectal operations should be removed at 24 and 72 hours, respectively. Between September 2012 and April 2015, 2927 patients (1395 females; mean age 62 years) were enrolled. In total, 1897 (64.8%) patients had colonic or small bowel resections while 1030 (35.2%) had rectal resections. Overall, 53.2% of patients had their catheter removed in compliance with the guidelines (44.3% after colonic resections and 69.5% after rectal resections). For colonic operations, 1% of patients who were guideline compliant had a UTI compared with 4.1% of uncompliant patients (RR 0.20, 95% CI 0.07–0.58, p = 0.003). For rectal operations, 3.5% of patients who were compliant had a UTI compared with 9.6% of patients who were uncompliant (RR 0.37, 95% CI 0.20–0.68, p = 0.001). Overall the median LOS in compliant patients who underwent colonic operations was 4 days compared with 5 days in uncompliant patients (RR 0.73, 95% CI 0.66–0.82, p < 0.001). Patients undergoing rectal operations who were compliant also had a statistically significant reduced LOS of 5 days compared with 8 (RR 0.54, 95% CI 0.49–0.59, p < 0.001). The rate of urinary retention was not statistically significantly different in either group (p = 0.25 for both groups). Early removal of urinary catheters is associated with decreased LOS and should be considered an integral part of an ERAS pathway.

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Evolving management of fluid resuscitation in trauma patients: a single institution experience. ***D. Jones, J. Nantais, S. Yazdani, P. Vegas, S. Rizoli, J. B. Rezende-Neto*. From University of Toronto, Toronto, Ont., and Dalhousie University, Halifax, N.S.**

There is increasing evidence of adverse effects with aggressive crystalloid use in trauma patients. We aimed to assess if large volume (≥5L) administration of crystalloids within 24 hours of injury causes increased mortality, in-hospital complications or mechanically ventilated days. A retrospective review of adult trauma patients admitted to a level 1 trauma centre between December 2011 and December 2012 was completed. Patient demographics, clinical and laboratory values, as well as fluid and blood products administered in the first 24 hours of injury were analyzed. Outcomes included in-hospital mortality, complications and ventilator-days. Multivariate analyses were performed to investigate the association between the administration of large crystalloid volumes with outcomes while controlling for selected clinical variables. A total of 970 patients were included in the analysis. Of these, 27% received ≥5L crystalloid, 12% had in-hospital complications and 35% required mechanical ventilation. The median age was 46 years, and 73% were males. The median injury severity score was 17, and the overall mortality rate was 7%. Several variables were independently associated with mortality (p < 0.05), including high-volume crystalloid use, older age, higher injury severity score (ISS) and lower temperature at presentation. Variables independently associated with in-hospital complications (p < 0.05) were older age, longer ICU stay and platelet transfusion. Higher risk of requiring mechanical ventilation was seen with high-volume crystalloid resuscitation, higher

ISS, development of in-hospital complications and lower presenting temperature. High-volume crystalloid resuscitation is associated with increased mortality and longer time ventilated but not with in-hospital complications such as pneumonia and sepsis. Based on these data, we recommend judicious use of crystalloids in the resuscitation of trauma patients, with early use of blood products in cases of suspected hemorrhage.

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Evolving approach for the management of endoscopic perforations. ***J.J. Choi, T.S. Mele, C.M. Schlachta*. From Western University, London, Ont.**

Traditionally, colonic perforations during endoscopy were repaired by surgical interventions. Advances in new endoscopic technologies have provided alternative treatment options. In this study, we evaluate the role of endoscopic repair of colonic perforations. A retrospective review of all patients who underwent colorectal colonoscopy between April 2007 and February 2014 at 2 tertiary care centres and 1 outpatient endoscopy hospital was conducted. We identified 59 999 patients who underwent colorectal endoscopy. Thirty-four patients (0.06%) had bowel perforation. Of these patients, 8 out of 54 567 (0.01%) had perforation during screening colonoscopy and 26 out of 5432 (0.48%) during therapeutic colonoscopy. Diagnosis of the perforation was made at the time of endoscopy in 71% of patients, within 24 hours in 24% and after 24 hours in 6%. Of the perforations, 74% were full-thickness defects while 24% were partial-thickness defects deep to the submucosa. The most common cause of perforation was during navigation of the colon (59%), followed by endoluminal mucosal resection (15%), biopsy of colon mucosa (12%) and snare polypectomy (9%). Eleven (32%) patients were managed with endoscopic repair at the time of injury, while 23 (68%) were managed with immediate surgical repair. All patients who underwent surgical repair had full-thickness perforations, while 2 (18%) patients who underwent endoscopic repair had full-thickness perforations. No patient in the endoscopic repair group went on to have subsequent surgical intervention. There was no statistical difference in post-procedure complications between the 2 groups ($p > 0.05$). Length of hospital stay was 9.8 days in the endoscopic repair group compared with 21.3 days in the operative repair group ($p = 0.01$). Both groups had 1 mortality with no statistical difference. In conclusion, endoscopic repair of colonic perforations appears to be a viable alternative to surgical repair.

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Independent heath facility meets Cancer Care Ontario and Canadian Association of Gastroenterology guidelines for endoscopic procedure wait times while meeting quality indicators. ***E.E. Joy, F. Kegal, S. Simunovic, A. Allard-Coutu, L. Klotz, S. Shahsavar, A. Coates, N. Sne*. From McMaster University, Hamilton, Ont.**

The Canadian Association of Gastroenterology (CAG) recommendations for acceptable wait times for consultation and endoscopic evaluation of patients with digestive symptoms and their subsequent survey to access of care suggest clinicians across Canada continually fail to meet the assigned times. In order to expedite workup and referral pattern for patients suspected to have signs and symptoms suggestive of underlying colorectal cancer, Cancer Care Ontario (CCO) developed a new set of guidelines to achieve this. Independent health care facilities (IHFs) have been set up across Canada in order to help reduce wait times and expedite endoscopic evaluations. To date no study has been conducted to test the ability of IHFs to meet the CCO and CAG endoscopic wait times. We conducted a retrospective review of a prospective database at a large-volume urban IHF to look at wait times from general practitioner referral to endoscopic assessment in patients with digestive symptoms with special emphasis on patients suspicious for harbouring colorectal cancer (CRC). The secondary outcome was the IHF's ability to meet standard quality indicators for endoscopic procedures as defined by CCO. There were 3211 endoscopies performed with a median wait time of 46 days to endoscopy. Forty-one per cent of the cases met the recommendation for endoscopic evaluation as defined by the CCO guidelines. For patients deemed to require urgent referrals the median time to consultation was 8 days and 23 days to colonoscopy. For the remaining indications, median time to referral was less than 26 days and less than 43 days to colonoscopy. Secondary outcomes demonstrated that all quality indicators were met by the endoscopists. Complication rates were recorded and were well below suggested literature rates. This is the first study that illustrates the ability of IHFs to meet current CCO and CAG guidelines for endoscopic procedures without compromise in quality performance.

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Phyllodes tumour: margins and local recurrence. ***A. Perry, E. Hawkes, K. Jakate, S. Ogunbiyi, J. Simpson, A. Scheer, R. George*. From University of Toronto, Toronto, Ont.**

A wide resection margin for Phyllodes tumours has been advocated to avoid local recurrence (LR). Recent breast cancer guidelines support narrow margins including "no tumour on ink," showing fewer re-excisions and equivalent LR. A similar approach may apply to Phyllodes tumours (PT). The objective of this study was to assess margin status and recurrence rates in Phyllodes tumours. Sixty-six patients, mean age 43.4 (20–71), were identified. Tumours were benign in 54 cases (82%), borderline in 8 cases (12%) and malignant in 4 cases (6%). Mean tumour size was 4.3 cm (0.8–23 cm). All benign and borderline cases had lumpectomies. Two of 4 malignant cases had mastectomy. Mean follow-up was 38 months (1–77 months). Ten patients had involved margins that were not revised. One of these recurred at 47 months. There were no other LR, including 31 patients who had clear margins of 1 mm or less. A close negative margin is not associated with LR in this series. LR only occurred in the setting of a positive margin ($p = 0.15$, Fisher exact test).

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Using texting for clinical communication in surgery: a survey of academic staff surgeons. ***M. Firdouse, K. Devon, A. Kayssi, J. Goldfarb, P. Rossos, T.D. Cil*. From University of Toronto, Toronto, Ont.**

Instant text messaging or texting is being increasingly used within the health care system for patient care and clinical communication. The objective of this study was to understand texting practices and attitudes toward this mode of communication among academic staff surgeons in various specialties. A 29-item survey was sent to all staff surgeons (n = 206) in general surgery, vascular surgery, plastic surgery and urology at a large academic institution. Sixty-two surgeons (30%) participated, with an even distribution between specialties; the average age was 49 (29–67 years). Over 75% used an Apple iOS, 95% had phones that were password protected and 42% of phones were encrypted. When conveying urgent patient-related information, staff surgeons preferred calling other staff surgeons (n = 32, 62%) and trainees (n = 30, 59%). However, when discussing routine patient information, participants preferred to email other staff surgeons (n = 28, 55%) but preferred texting trainees (n = 32, 63%). The majority of participants found texting as a mode of communicating patient data to be fast (n = 34, 65%) and convenient (n = 36, 69%); it also allowed for simultaneous transmission of information to multiple recipients (n = 33, 64%). Many felt that texting enhances patient care (n = 35, 72%) and enhances the educational experiences of trainees (n = 24, 50%). Half of the respondents did not know if their hospital had any policy regarding sharing patient information via text messages, yet the majority of participants agreed that texting patient-related information should be regulated by either a hospital policy (n = 35, 74%) or legislation (n = 26, 57%). Our data showed a strong preference for text messaging among surgeons, especially with trainees. However, the majority of participants acknowledged safety and security concerns. Future efforts should be directed toward educating clinicians regarding hospital text messaging policies and developing secure instant messaging applications for use in this setting.

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Surgical emergencies in patients with colorectal cancer (CRC): an analysis of processes and outcomes. ***R. Al Shebbi, B. Drake, Y. McConnell, M. Hameed*. From the University of British Columbia, Vancouver, B.C.**

Patients presenting with urgent surgical complications of colorectal cancer (CRC), such as obstruction, bleeding or perforation, may have unique vulnerabilities and face issues of access to timely primary care and definitive surgical intervention, compared with patients presenting for surgery with uncomplicated CRC. Hence, urgent CRC patients may face higher rates of complications. This retrospective cohort study describes CRC patients presenting with surgical complications, in terms of demographic and comorbid risk factors and short- and long-term outcomes and examines the impact of processes of care on outcomes. The study was conducted in 2 phases. (1) A comparative study was conducted of CRC patients with urgent and non-urgent presentations using National Surgical Quality Improvement data from a large teaching hospital. (2) Processes of care were analyzed for CRC patients with urgent presentations only, using billing and electronic health records data. In the comparative analysis, 75% of emergent cases had American Society of Anesthesiology (ASA) classes 3 and 4, compared with 41.4%% in the non-emergent group. Disseminated disease was detected in 13.6% of the emergency group, compared with 5.6% in their elective counterparts. Rates of postoperative complications including surgical site infection and postoperative pneumonia were higher in the emergent group (11.4% and 6.8%, respectively). Thirty-day mortality was 13.6% in the emergent group, compared with 1.3% in elective cases. In more detailed analyses of processes of care in urgent surgical intervention, 36% of patients had at least 3 preoperative risk factors. Mean duration of emergency CRC surgery was 164 minutes, and duration of surgery predicted prolonged hospital length of stay (p = 0.007). In general, patients with CRC who underwent emergency surgery were sicker and had higher rates of postoperative complications and mortality. More care should be directed to this group of patients, including better preoperative optimization, in order to improve their outcomes.

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Variability in management of acute calculous cholecystitis: an institutional survey. ***P. Paci, P.A. Kaneva, J.F. Fiore Jr., M.C. Vassiliou, L.S. Feldman*. McGill University and the McGill University Health Centre, Montreal, Que.**

Although the literature and expert consensus support early cholecystectomy as definitive management in acute calculous cholecystitis (ACC), variations in management practices persist. The purpose of this study was to identify practice variations within a single institution, including the decision for operative management or percutaneous cholecystostomy and management of concomitant biliary obstruction. A web-based survey was sent to faculty members and senior residents (≥PGY3) of a Canadian university-affiliated general surgery division. The faculty represent surgeons with various subspecialty interests who also take general surgery/acute care surgery call. The 18-item survey was divided into 3 sections: demographics, management based on 8 clinical scenarios, and perceived logistic barriers. Clinical scenarios varied in terms of severity of ACC, patient age and comorbidities, and risk of concurrent choledocholithiasis. From 92 potential respondents, 40 faculty members and 26 senior residents responded to the survey (72% response rate). Of these, 86% had performed at least 1 emergency cholecystectomy in the past year. For mild ACC, 92% of respondents agreed with early cholecystectomy as optimal management. However, for mild ACC in a comorbid patient (ASA3), this decreased to 65%, with the remainder opting for a "cool down" period (21%) or cholecystostomy tube (14%). For mild ACC in an elderly healthy patient, only 66% opted for early cholecystectomy, with 24% favouring nonoperative management and 10% favouring placing a cholecystostomy tube. There was a range of preferences when the presentation included intermediate risk of choledocholithiasis, where guidelines recommend intraoperative cholangiogram (IOC) or preoperative endoscopic ultrasonography (EUS) or magnetic resonance cholangiopancreatography (MRCP): 33% opted for endoscopic retrograde cholangiopancreatography (ERCP), 18% opted for preoperative MRCP or EUS and only 27% chose to perform an IOC. Variations in opinions about best management of ACC were identified within a Canadian university-affiliated general surgery division. While management was consistent with guidelines for straightforward cases in healthy patients, increasing variability was seen as case complexity and patient comorbidity increased.

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A serious game skills competition increases voluntary usage of and proficiency with a virtual reality laparoscopic simulator during first-year surgical residents' simulation curriculum. ***M.E. El-Beheiry, G. McCreery, C.M. Schlachta*. From Western University, London, Ont.**

The objective of this study was to assess the effect of a serious game skills competition on voluntary usage of a laparoscopic simulator among first-year surgical residents in a standard simulation curriculum. With research ethics board approval, informed consent was obtained from first-year surgical residents enrolled in an introductory surgical simulation curriculum. The class of 2013 served as a control cohort, following the standard curriculum, which mandates completion of 6 laparoscopic simulator skill tasks. For the 2014 competition cohort, the only change introduced was the biweekly and monthly posting of a leader board of the top 3 and 10 fastest peg transfer times. Entry surveys were administered assessing attitudes toward simulation-based training and competition. Cohorts were observed for 5 months. There were 24 and 25 residents in the control and competition cohorts, respectively. The competition cohort overwhelmingly (76%) stated that they were not motivated to deliberate practice by competition. Median total simulator usage time was 132 minutes (IQR = 214) in the competition group compared with 89 (IQR = 170) in the control cohort. The competition cohort completed their course requirements significantly earlier than the control cohort ($\chi^2 = 6.5$, $p = 0.01$). There was a significantly greater proportion of residents continuing to use the simulator voluntarily after completing their course requirements in the competition cohort (44% v. 4%; $p = 0.002$). Residents in the competition cohort were significantly faster at peg transfer (181 ± 71 v. 231 ± 54 seconds; $p = 0.02$) and significantly improved on their completion time by 45 ± 63 seconds (paired t test, $p = 0.007$). A simple serious game skills competition increased voluntary usage of and performance on a laparoscopic simulator, despite a majority of participants reporting they were not motivated by competition. Future directions should endeavour to examine other serious gaming modalities to further engage trainees in simulated skills development.

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Emergency versus elective surgical management for patients with colorectal cancer: a systematic review on patients' characteristics, processes and outcomes. ***R. Al Shebbi, Y. McConnell, E. Joos, N. Garraway, M. Hameed*. From the University of British Columbia, Vancouver, B.C.**

Emergency conditions in patients with gastrointestinal (GI) malignancies can be life threatening. According to the literature, 30% of patients with colorectal cancers (CRC) present with surgical emergencies including intestinal obstruction, perforation and bleeding. Surgical interventions in these patients are believed to carry high risks of morbidity and mortality. A systematic review was needed to study the characteristics of CRC patients presenting with surgical emergencies and compare them with those of electively managed CRC patients. An additional goal was to analyze differences in processes of care and outcomes in both groups. An updated database search was performed for literature published in English, using MeSH terms and keywords. Primary outcomes of interest were postoperative morbidity, mortality and disease-related survival. Eventually, 11 articles were selected to be included in the review. Papers were assessed for methodological validity using the Newcastle–Ottawa Quality Assessment Scale. Of the included papers, 54.5% were retrospective cohort studies, and 81.8% of the studies used regression models in their analyses. The mean number of patients included in the papers was 3567 (min = 145, max = 30 790). The total sample was 50.2% male. Most of the included studies reported a mean age of more than 60 years. The mean follow-up period was 399.5 days. Analysis revealed that the emergency CRC group had more comorbidities (95% CI, 1.42, $p = 0.0001$), higher American Society of Anesthesiology (ASA) classes (95% CI, 1.33, $p = 0.00001$) and more advanced disease (95% CI, 1.09, $p = 0.00001$) than the elective CRC group. Furthermore, they had higher rates of postoperative complications (95% CI, 4.6, $p = 0.00001$) and mortality (95% CI, 5.38, $p = 0.00001$). Surgical complications in patients with CRC are not uncommon. They carry higher risks of postoperative adverse outcomes compared with elective CRC patients. This highlights the importance of directing more attention toward emergency CRC patients in terms of better preoperative optimization and resuscitation, in order to improve their outcomes.

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The effect of rater training on the reliability and validity of technical skill assessments. ***R. Maniar, A. Vergis, L. Gillman, K. Hardy, J. Park*. From the University of Manitoba, Winnipeg, Man.**

Rater training (RT) has been shown to improve the psychometric properties of observational assessment tools in other disciplines but has not been well studied in relation to surgical skills. This study sought to determine the effect of RT on the reliability and validity of technical skill assessments. Forty-seven Royal College certified surgeons from a variety of surgical specialties were randomized to either RT or no training groups. A brief frame-of-reference training video was administered to the RT group. Participants assessed videos of 10 trainees performing a suturing and knot-tying task with 3 assessment forms: a visual analog scale (VAS), a task-specific checklist and a global ratings scale (GRS). A delayed assessment of the same 10 videos was performed 2 weeks later. Inter-rater reliability (IRR), construct validity and test-retest reliability were assessed. All forms showed evidence of construct validity, with higher scores being associated with increased odds of senior training level. Trained raters had a trend toward improved validity, with higher odds ratios for training level in the RT group. There were no significant differences in inter-rater or test-retest reliability between training groups. Test-retest reliability was higher for trained as compared with untrained raters for the VAS (0.71 v. 0.62), checklist (0.53 v. 0.46) and GRS (0.77 v. 0.66). However, confidence intervals were wide and overlapped. Although a significant effect of RT was not shown, there were significant trends toward improved reliability and validity after training on all 3 assessment forms. Our study may have been underpowered to detect a true difference between training groups. Continued effort to improve reliability and validity is needed for technical skill assessments, even for the most

extensively validated assessment tools. Although RT may represent a way to improve these properties, further study is needed to determine the most effective methods of training.

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LINX magnetic esophageal sphincter augmentation versus Nissen fundoplication for gastroesophageal reflux disease: a systematic review and meta-analysis. ***D. Skubleny, N.J. Switzer, R. Gill, X. Shi, D. Birch, C. de Gara, S. Karmali*. From University of Alberta, Edmonton, Alta.**

The LINX magnetic sphincter augmentation system is a novel surgical technique with short-term evidence demonstrating efficacy in the treatment of medically refractory or chronic gastroesophageal Reflux Disease (GERD). Currently, the Nissen fundoplication is the gold standard surgical treatment for GERD. We are the first to systematically review the literature and perform a meta-analysis comparing LINX to the Nissen fundoplication. A comprehensive search of electronic databases (e.g., Medline, Embase, SCOPUS, Web of Science and the Cochrane Library) using search terms "gastroesophageal reflux or heartburn" and "LINX or endoluminal or magnetic" and "fundoplication or Nissen" was completed. All randomized controlled trials, non-randomized comparison studies and case series with greater than 5 patients were included. A total of 327 titles were identified through primary search and 200 titles or abstracts were screened after removing duplicates. Meta-analysis was performed on multiple postoperative quality of life outcomes, procedural efficacy and patient procedural satisfaction. Five primary studies identified a total of 854 patients, of whom 355 and 499 underwent Nissen fundoplication and LINX, respectively. LINX was statistically superior to Nissen in preserving patients' ability to belch (90.6% v. 58.1%, $p < 0.00001$) and ability for emesis (95.5% v. 55.4%, $p < 0.0001$). There was no significant difference between LINX and Nissen in postoperative dysphagia (48.7% v. 40.1%, $p = 0.23$), gas/bloating (17.6% v. 36.5%, $p = 0.15$), need for endoscopic balloon dilation (23.4% v. 3.3%, $p = 0.11$), proton pump inhibitor elimination (86.5% v. 84.4%, $p = 0.87$) and satisfaction with procedure (87.2% v. 91.8%, $p = 0.11$). Magnetic sphincter augmentation appears to be an effective treatment for GERD, with short-term outcomes comparable to the more technically challenging and time-consuming Nissen fundoplication. Long-term comparative outcome data past 1 year are needed in order to be fully comfortable with this conclusion.

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Opportunities and challenges of the electronic medical record for undergraduate surgical education. ***M.H. El-Beheiry, K. Coriolano, A. Butter*. From Western University, London, Ont.**

In academic hospitals, there is concern that an electronic medical record (EMR) may negatively impact undergraduate medical education. The purpose of this study was to assess the challenges to medical students and educators of the recent introduction of a complete electronic ordering system. After institutional review board approval, 2 separate surveys were created to assess student and educator perceptions of clinical learning and its barriers through the new electronic ordering system. A 5-point Likert scale was used to assess satisfaction level, with 1 being very dissatisfied and 5 being very satisfied. Forty-eight educators (25 residents, 23 faculty) and 64 students (39 third year, 25 fourth year) completed their surveys. Educators were nearly very dissatisfied with the EMR as a clinical teaching tool for surgical clerks (mean 1.66 ± 0.85). They also felt the didactic EMR training program was very poor at teaching involvement of students in the ordering process (1.68 ± 0.94). Students' satisfaction was also very low, particularly regarding learning admission (1.94 ± 1) and postoperative orders (2.0 ± 1.08), and prescription writing (1.96 ± 1.04). While students observing order entry was the most used educational strategy among educators (67%), students ranked it as the worst strategy. The top-ranked strategies by students were supervised order entry on the educator's account and doing mock written orders. EMR inefficiency/redundancy (87%) and lack of time (72%) were the most common barriers cited by educators. Finally, 85% of educators were enthusiastic about teaching students but 64% experienced decreased enthusiasm after implementation of the EMR. The EMR ordering system is seen as a barrier among educators and students. Additionally, teaching strategies among educators are at odds with student preferences. Improving the efficiency of the educator-student interaction within the EMR and better educator training may alleviate these issues. Additionally, order-writing modules for students could be created to practise order writing on their own time.

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Estimated unmet need for surgery in rural Tanzania. ***G. Knapp, A. Ernest, R. Traynor, M.C. Hoogerboord*. From the Dalhousie University, Halifax, N.S.; the University of Dodoma, Dodoma, Tanzania; and the Nova Scotia Health Authority, Halifax, N.S.**

There exists a significant shortfall in access to timely, high-quality surgical services in many low- and middle-income countries. The aim of this study is to quantify the volume of surgery in rural Tanzania and generate a robust estimate of unmet need. The total surgical volume for 2 rural regions in central Tanzania (Iringa and Dodoma) was retrospectively gathered from Jan. 1 to Dec. 31, 2015. Procedure type, patient age and gender were collected from operating theatre logbooks from public and private institutions. Unmet need was calculated by subtracting the total surgical volume across both regions (i.e., the met need) from the best estimate of total need specific to eastern sub-Saharan Africa (6145 procedures per 100 000). This normalized ratio was then extrapolated to provide an estimate of unmet need for all of rural Tanzania (population 40 564 382). A total of 17 561 (i.e., 580.56 per 100 000) procedures were performed by 149 surgical providers in Iringa and Dodoma regions. Non-physicians comprised 44.3% of the total surgical workforce. The 3 most common procedures were Caesarean section (58.14%), open reduction internal fixation (5.19%) and laparotomy (4.39%). Based on a normalized ratio of 580.56 per 100 000, the estimated total surgical volume for rural Tanzania is 235 000 procedures. The unmet need is 5564.44 procedures per 100 000. An additional 2 257 180 procedures are therefore required to meet the annual surgical needs of the population. We estimate that the service gap in rural Tanzania is 5564.44 procedures per 100 000. The case mix represents a nascent surgical delivery system and suggests a large unmet need for elective and specialized surgical service delivery.

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Double-gloving practice and attitudes among staff surgeons and surgical residents. ***M.E. Lipson, R. Deardon, N. Switzer, C. de Gara, C.G. Ball, S.C. Grondin*. From the University of Calgary, Calgary, Alta.; and the University of Alberta, Edmonton, Alta.**

Staff surgeons (SS) and surgical residents (SR) are at risk for percutaneous injury and contamination. Despite recommendations for routine double gloving in the operating room, current literature suggests that many SS and SR do not routinely double glove. An electronic survey was conducted to assess rates and explore attitudes toward double gloving among SS and SR at 2 tertiary care centres in Canada. Data were analyzed using logistic regression to assess differences in double gloving between groups of respondents. There were 203 SS and 156 SR responses for a response rate of 34% (359/1045). Ninety-two per cent of SS and 75% of SR report having had a needlestick injury in the past. SR were more likely than SS to ever wear double gloves in the operating room (72% SS, 85% SR, $p = 0.01$) and were more likely to do so routinely (SS 45%, SR 61%, p = 0.01). SS were more likely to never double glove compared with SR (SS 27%, SR 15%, $p = 0.01$). There was no difference in likelihood of routine double gloving between males and females. Reduced tactile feedback (85%), decreased manual dexterity (81%) and discomfort/poor fit (81%) remain important or very important as perceived barriers to double gloving. High-risk patients encourage double gloving in respondents (SS 49%, SR 81%), who do so for increased protection. Interestingly, SS from 1 centre were more likely to routinely double glove (62% v. 47%, $p = 0.04$) than from the other. SR are more likely to double glove than SS. Reduced tactile feedback, decreased manual dexterity and discomfort/poor fit remain important barriers to the routine use of double gloving among SS and SR. Causes for differences in staff double gloving rates between centres remains unknown; increased education on the benefits of double gloving may increase double glove usage.

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Margins in conservative surgery for breast cancer: the experience of a community hospital. ***J. Labrecque, A. Synnott, R. Villiard, P. Koch, C. Racicot, L. Windisch, P. Lemieux, M. Pyarali, E. Martel*. From Centre Hospitalier Régional de Lanaudière, St-Charles-Borromée, Que.**

The rate of positive margins following partial mastectomy for breast cancer varies from 20% to 40% and entails a significant number of re-excisions. Recently, a randomized controlled trial describing shaving of the surgical cavity showed a significant reduction of positive margins without influencing cosmetic outcome. We retrospectively reviewed the clinical charts and pathology reports of all patients undergoing partial mastectomy for infiltrative cancer and ductal carcinoma in situ (DCIS) between Jan. 1, 2013, and Dec. 31, 2014, at a regional hospital centre. The objective of our study was to determine the rate of positive margins and the rate of re-excision at our institution in order to evaluate if we should change our surgical approach and adopt the shaving of the surgical cavity routinely. We performed 225 partial mastectomies on 219 patients during the study period. Forty-one (18.2%) patients had positive margins and 29 (12.9%) underwent at least 1 additional surgical procedure. Factors associated with positive margins were axillary lymph node involvement, infiltrating lobular carcinoma histology and associated DCIS. The median volume of the surgical specimens was 122 cm^3. The rate of positive margins at our hospital and the relatively high median volume of the surgical specimens do not justify a change in our technique to include shaving of the surgical cavity routinely for partial mastectomies. This approach could be performed on selected patients with pathological features associated with positive margins.

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ERAS in a medium-sized community hospital. ***W. Moussa*. From Cornwall Community Hospital, Cornwall, Ont.**

Enhanced recovery after surgery (ERAS) is a set of perioperative protocols that expedites recovery from surgery. It includes preoperative, operative and postoperative measures. ERAS was initially applied in bowel surgery but is now being applied in GI, urologic, thoracic and orthopedic surgery. We present an overview of the ERAS protocols and the rationale for each. We also present a personal series of 50 cases done over the past 4 years at a medium-sized community hospital by 1 surgeon. There were 42 uncomplicated colonic resections, 1 emergency small bowel resection and 7 anterior resections. The average length of stay in days for colonic resections was 4.8 (range 1–10), and for anterior resections it was 6.1 (4–10). There were 3 readmissions. Pathological margins were negative except for 3 cases. The number of lymph nodes harvested averaged 19.3 (2–49). Complications are listed. We conclude that ERAS protocols are feasible in most hospitals and that satisfactory outcomes are achievable.

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Local access to surgery in rural communities: a survey of general surgeons in Western Canada. ***N. Zondervan, G. Holler*. From the University of Calgary, Calgary, Alta.**

Every year hundreds of patients are forced to leave their communities and travel great distances to receive surgical care. Medical travel costs the public health care system hundreds of millions of dollars and removes a patient from their community supports. The objective of this study was to identify factors that limit the delivery of surgical care and impede the recruitment of general surgeons to rural communities while also seeking to identify potential strategies to improve local access. Using a cross-sectional study design, rural hospitals were defined as having a simplified general practice rurality index (GPRI-S) score of 10 or more. Physicians providing hospital-based general surgery care in rural hospitals were identified through their respective provincial medical colleges. All general surgeons practising in rural Alberta, Saskatchewan and British Columbia as well as the Yukon and the Northwest Territories were then invited to participate in a Likert scale based online survey. A portion of these physicians were then asked if they were willing to participate in a Skype or telephone semi-structured interview to explore their perspectives in greater depth. These interviews were then coded and analyzed for recurrent themes through content analysis. Preliminary data indicated that many rural general surgeons believe that there are insufficient general surgeons to meet the needs of

their local community and periods of time when their community was without surgical services. They also reported difficulty accessing the expertise of a subspecialist and believe there could be better integration of care between rural and urban sites. Many felt that new graduates did not have sufficient exposure to community surgery and did not have adequate mentorship to encourage entering rural practice. They felt that residency programs were sacrificing generalized training for subspecialized training and graduates frequently lacked the breadth of skills needed for rural practice.

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The role of family physicians with enhanced surgical skills in rural Canada. *C.M. Kennedy, D. Zamar, Z. Masarova, B. Batchelor, C.S. Johnston, N. Caron*. From the University of British Columbia, Vancouver, B.C.; and the Northern Health Authority, Prince George, B.C.

This study quantifies the scope and trend of surgical services provided by family physicians with enhanced surgical skills (FP-ESS) and itinerant specialist surgeons in 1 rural, northern Canadian town. Data on surgical procedures performed at the rural hospital by FP-ESS, specialists and dental surgeons (DDS) with discharge dates between Apr. 1, 2001, and Mar. 31, 2015, were obtained from the health authority's discharge abstract database. Data analysis was performed using R software. There were 10 205 surgeries performed in the operating room at the rural hospital. Of these, 8258 (81%) were daycare and 1947 (19%) were inpatient ($p < 0.0001$). The mean age was 35 years. The total number of daycare and inpatient procedures performed by FP-ESS, specialists and DDS differed significantly ($p < 0.0001$). FP-ESS performed 47% of total surgeries in this time period (4836 surgeries), with 70% of these surgeries being daycare surgeries (3383) and 30% being inpatient surgeries (1453). Specialists performed 43% of total surgeries (4398 surgeries), with 89% of these surgeries being daycare (3911) and 11% being inpatient (487). DDS performed less than 10% of the surgeries (971: 964 daycare, 7 inpatient). There were significantly more elective surgeries (9410, 92%) performed compared with urgent (795, 8%) ($p < 0.0001$). FP-ESS performed most of the urgent surgeries (678, 85%), with itinerant specialists and DDS performing 14% (109) and 1% (8), respectively ($p < 0.001$). In 2010–2015, the rural hospital provided 819 hours of surgery per year, approximately 30% of which were performed "after hours." The average resource intensity weight (2010–2015) was lower at the rural hospital compared with the neighbouring referral centre for the most common inpatient procedures performed in the rural hospital, especially for Caesarean section ($p < 0.0001$) and uterine interventions ($p < 0.0018$). This study demonstrates the value of a network surgical model of rural surgical services and the role specialists and FP-ESS play in this collaborative practice.

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The role of groin ultrasound imaging in the management of inguinal hernias. *R. Tong, E. Debru, R. Gill, P. Mitchell, N. Church, A. Reso*. From the University of Calgary, Calgary, Alta.

Groin ultrasound (US) imaging has been shown to have high sensitivity and specificity for the diagnosis of inguinal hernias. It is used by primary care physicians in the diagnosis of inguinal hernias before surgical consultation. There is limited evidence as to whether it significantly affects surgical management. The aims of this study were 2-fold. Our first aim was to measure the frequency that groin US scans are ordered before surgical consultation and evaluate the role of such imaging in the decision to proceed with surgery. Second, we estimated the financial cost incurred by this preoperative test. A retrospective data analysis was performed on 400 consecutive patients. A chart review was used to determine the number of groin US performed within 1 year before surgical consultation. The frequency of groin US affecting surgical management was then calculated and defined as US positive, clinical exam negative, and proceeded to surgery. Billing data from Alberta Health and Wellness were used to determine the total number of hernia surgeries performed annually in Alberta and to calculate the annual cost of groin US scans. In our sample of 400 patients (male: 89.2%; mean age of 55.4 ± 16.3 years), 75% of patients and 72.8% of groins examined had a groin US performed within 1 year before their general surgery inguinal hernia consultation. Of the groin US performed, 1.7% affected surgical management. Thus, in Alberta, our annual cost estimate of groin US scans that did not affect surgical management was $1 625 191.28. Primary care physicians frequently order groin US scans before inguinal hernia consultations to general surgeons. However, these scans rarely affect surgical decision-making as surgeons rely mostly on clinical evaluation. The cost associated with routine groin US is significant. Guidelines outlying indications for the appropriate utilization of groin US imaging will reduce health care costs.

Canadian Association of Thoracic Surgeons

01

The use of an electronic discharge summary to provide real-time thoracic surgical outcomes. ***A.J. Graham, W. Ocampo, D.A. Southern, A. Falvi, D. Sotiropoulos, B. Wang, R. Vito, W. Ghali, S. McFadden*. From the University of Calgary, Alberta Health Services Information Technology, Calgary, Alta.**

Real-time data are required for quality improvement in thoracic surgery. An electronic discharge summary with embedded data collection fields specifying surgical procedure and short-term outcomes contained within the hospital electronic health record was developed. The data are automatically transferred to a web-based reporting system in "real time." We wished to determine the accuracy of this electronic real-time data collection system (ERD) by comparing the completeness of record capture, the proportion of short-term outcomes (complications) captured and the accuracy, to administrative data (Admin) and the gold standard of chart audit. All surgical procedures performed from Jan. 1, 2014, to Feb. 28, 2014, were audited by an objective trained abstractor using the complete medical record. Data were collected to determine the nature and number of procedures and complications. All data collected from the audited charts were compared with those generated by the ERD and Admin database. The ERD captured 71/72 (99%) of charts. Comparing the presence or absence of any complications between ERD and chart audit demonstrated a sensitivity of 87.5%, a specificity of 97.9% and a Kappa of 0.872 (95% CI: 0.750–0.994). A total of 32 complications were found and 100% agreement was found regarding the specific type of complication between ERD and chart audit. Comparing the presence or absence of any complications between Admin data and chart audit demonstrated a sensitivity of 45.8%, a specificity of 95.8% and a Kappa of 0.471 (95% CI: 0.256–0.686). We found that an electronic discharge summary with embedded data fields with automatic web-based reporting system can provide accurate real-time data of surgical outcomes and is superior to administrative data. Thus, the electronic real-time data collection system can provide real-time clinical measurement to support quality improvement projects in thoracic surgery.

02

A rare Canadian case of traumatic bilothorax successfully managed nonoperatively. ***S. Sun, G. Pagliarello*. From the Northern Ontario School of Medicine, Thunder Bay, Ont.; and the University of Ottawa, Ottawa, Ont.**

Bilothorax is an exceedingly uncommon condition that can be classified as a pleurobiliary or bronchobiliary fistula. Pleurobiliary fistulae are traditionally managed through tube thoracostomy drainage and definitive early transabdominal closure of any diaphragmatic defects. More recently, therapeutic endoscopic retrograde cholangiopancreatography (ERCP) has also been described in cases to help establish a more favourable biliary drainage tract. We present a recent experience at a Canadian centre that was managed minimally invasively. A previously healthy 18-year-old male was admitted for 2 stab wounds, 1 of which entered his right posterior axillary line immediately underneath his costal margin, causing a large liver laceration that resolved nonoperatively. On the seventh day following admission, he developed mild dyspnea in the context of hyperbilirubinemia and a chest x-ray revealed a right-sided pleural effusion. A pigtail catheter was inserted and drained frank bile. Hepatobiliary iminodiacetic acid (HIDA) scanning confirmed focal biliary leakage into the right thorax. Pleural drainage decreased gradually, and the catheter was removed 5 days after insertion. His serum bilirubin and repeat chest imaging remained stable, and he was discharged 2 days later. Owing to their rarity, there is no consensus on the optimal management for thoracobiliary fistulae. They have classically been treated with early and aggressive surgical intervention. We report a case of bilothorax that resolved with percutaneous tube thoracostomy alone. This obviated the need for more invasive operative or endoscopic measures and unnecessary morbidity in a young patient.

03

Volume of air leak in the early postoperative period can predict prolonged air leak. ***D. French, F. Shamji, S. Sundaresan, J. Villeneuve, A. Seely, D. Maziak, S. Gilbert*. From the University of Ottawa, Ottawa, Ont.**

Early identification of patients who will develop a prolonged air leak (PAL) after lung resection could help optimize chest tube management and allow judicious allocation of health care resources. Digital pleural drainage systems can measure and record airflow. The objective of this study was to identify patients who developed a PAL using intrapleural airflow data. Prospective intrapleural airflow data from patients who underwent lung resection were analyzed. Air leak duration was defined as the interval from the end of surgery until the absence of a sustained airflow signal ≥40 mL/minute for 12 hours. PAL was defined as air leak duration >5 days. Using an automated method each signal was classified as either PAL or no PAL. The volume of airflow in the first 12 hours was computed and compared for each class of signal. A receiver operator characteristic (ROC) curve was plotted and sensitivity and specificity were computed for multiple volume thresholds. Of the 67 patients included in the analysis, 43 (64%) patients never developed an air leak, 16 (24%) patients had an air leak that resolved within 5 days and 8 (12%) patients had a PAL. The mean volume of airflow in the patients who did developed a PAL was 46 800 mL, while it was 3700 mL in patients who did not develop a PAL ($p < 0.001$). The area under the area (AUC) of the ROC is 0.94 (95% CI: 0.88–0.99). Using different thresholds, the sensitivity and specificity were computed as follows: 1055 mL (sensitivity = 1, specificity = 0.73), 5530 mL (sensitivity = 1, specificity = 0.85) and 10 706 mL (sensitivity = 0.75, specificity = 0.88). The volume of airflow measured in the first 12 hours after a pulmonary resection can predict patients who will develop a PAL. Further investigations are needed to validate these findings on a larger set of airflow signals.

05

Smoking cessation education for surgical residents: challenges in driving change. ***G. Eamer, S. Turner, H. Lai, K. Meador, E.L.R. Bédard*. From the University of Alberta, Edmonton, Alta.**

Tobacco smoking is a leading cause of preventable death in North America; a brief smoking cessation intervention from a physician is known to be effective in reducing smoking rates. We previously found residents felt cessation counselling was important but fewer performed it, with worse performance by surgical residents compared with other specialty groups. Health promotion is a key component of both the Accreditation Council for Graduate Medical Education (ACGME) and the CanMEDS competencies. We hypothesized that smoking cessation training would increase resident counselling interventions. We conducted a smoking cessation training session for surgical residents at a large residency training centre (n = 134). A pre-lecture survey was distributed to all residents attending our smoking cessation lecture; 64 residents in attendance returned their survey. Thirty-six completed a follow-up electronic survey 6 weeks later. Both surveys contained questions related to basic demographics and 5-point Likert scale questions focused on past training, attitudes and cessation counselling techniques. Pre-post analysis using Student t test was performed. Following our intervention, there was a significant increase in perceived benefits from role models (3.69 to 4.03, p = 0.04) and recognition for counselling efforts (3.28 to 3.71, p = 0.02) along with increased recognition of their role in smoking cessation (3.97 to 4.26, p = 0.04). Our training session did not increase surgical residents' likelihood of performing smoking cessation counselling; however, it was associated with changes in some related attitudes. Changing smoking cessation counselling habits with a single intervention may not be effective. A concerted career-long effort will probably be required. Limitations include a low follow-up survey response rate. A 6-month follow-up is planned to investigate maintenance of attitudinal changes.

06

Intraparenchymal malignant mesothelioma: a rare case of an isolated intrapulmonary variant. ***J. Taylor, C. Russell*. From Memorial University, St. John's, Nfld.**

Malignant mesothelioma is a primary neoplasm that ordinarily presents with a diffuse growth pattern. In addition to the more commonly known diffuse form, a localized variant has also been described. These localized solitary tumours are microscopically consistent with diffuse malignant mesothelioma; however, they occur as isolated nodules. Localized mesothelioma has been described within pleura, peritoneum as well as pericardium. Rarely, a localized mesothelioma may originate from an intraparenchymal source without involvement of serosal membranes. We report the case of a relatively healthy 64-year-old female with no known asbestos exposure incidentally found to have a 6 cm lung lesion on work-up for palpitations. From CT imaging the lesion was concerning for bronchogenic carcinoma; biopsy was consistent with undifferentiated non-small cell lung cancer. On staging investigations the tumour was localized to the left upper lobe with concern for extension to the pericardium. Final pathology of the lesion, surgically excised via left upper lobectomy, was found to be an intrapulmonary variant of a localized malignant mesothelioma. From review of the literature localized malignant mesothelioma from an intraparenchymal origin is a rare presentation with only a small series of cases reported worldwide.

07

Evaluating impact of surgeon self-evaluation and positive deviance on postoperative adverse events following major thoracic surgery. ***J. Ivanovic, F. Mostofian, S. Gilbert, D.E. Maziak, F.M. Shamji, R.S. Sundaresan, P.J. Villeneuve, A.J.E. Seely*. From the University of Ottawa and the Ottawa Hospital, Ottawa, Ont.**

Atrial fibrillation (AFIB), prolonged air leak (PAL), complicating pulmonary resection, and anastomotic leak (AL), complicating foregut procedures, represent common and serious postoperative adverse events (AEs) following thoracic surgery. Previous work showed that individualized performance audits (enabling peer comparison to group averages) motivate surgeons to improve their practice, and continuous quality improvement seminars based on positive deviance (CQI/PD) allow identification of best performers and collegial discussions of best practices; the impact has yet to be determined. Our objective was to quantify the impact of surgeon self-evaluation and CQI/PD seminars on postoperative AEs following major noncardiac thoracic surgery. This is a retrospective uncontrolled before-and-after study based on prospectively collected thoracic morbidity and mortality data. Using an interactive software application, audits were available anytime for thoracic surgeons (n = 6), and for all major lung and foregut procedures (n = 1084) from April 2013 to January 2016. CQI/PD seminars (n = 8) were held quarterly from September 2013 to December 2015. We analyzed impact using univariate statistics and comparing varying time windows (6, 9 and 12 months) before and after implementation. Rigorous electrolyte replenishment was recommended to prevent AFIB; results showed nonsignificant decrease in all time periods, with the greatest decrease at 6 months (10.1% to 6.7%; p = 0.36). Increased use of cautery when separating lung fissures, limiting re-inflation pressure on operated lung (<10–12 cm H_2O) and limiting use of postoperative chest-tube suction were recommended to reduce PAL; results showed nonsignificant decreases at 6 and 9 months and a significant decrease at 12 months (18.9% to 11.7%; $p < 0.05$). Wrapping anastomoses with omentum, testing anastomosis intraoperatively and routine postoperative proton-pump inhibitors were recommended to reduce AL; results showed nonsignificant decreases at 6 and 9 months, with the greatest decrease at 6 months (11.1% to 8.3%; p = 0.82). We observed that surgeon self-evaluation and CQI/PD seminars have the potential to reduce postoperative AEs. Our experience was that this program also favourably impacted on a collective divisional quality-focused surgical culture.

08

Minimally invasive transhiatal rendezvous esophagectomy: a novel approach for treatment of mid and proximal esophageal carcinoma. ***N. Seyednejad, A. Ashrafi, S. Ong, R. Finley, J. Bond*. From University of British Columbia, Vancouver, B.C.**

The 2 most frequently performed operative approaches for an esophagectomy are the transthoracic and transhiatal techniques. The morbidity associated with laparotomy and thoracotomy can be reduced by applying laparoscopic approaches to the operative techniques. Here, we describe our case series of a minimally invasive laparoscopic transhiatal approach with a cervical anastomosis for benign and malignant esophageal disease. A case series of 7 patients undergoing minimally invasive transhiatal procedure for esophageal disease at a single high-volume thoracic surgery centre were collected between 2013 and 2016. Perioperative and intraoperative data were collected for all patients. Six of the patients received an esophagectomy for esophageal carcinoma (adenocarcinoma or squamous cell carcinoma) while 1 patient had an esophagopleural fistula after pneumonectomy. There were 4 males and 3 females with an average age of 72 years (range 44–93 years). Mean operative time was 227 minutes (3.8 hours). There was 1 conversion to open esophagectomy due to difficult anatomy. The advantages of this approach include less anesthetic time, which clinically translates into decreased rates of postoperative ventilation, fluid requirements and operative efficiency. There is no need for intrathoracic dissection, allowing the conduit wall to be well supported. In addition, a neck anastomosis allows for prevention of the potentially significant morbidity associated with an intrathoracic anastomotic leak. This approach compares similarly with other methods when looking at parameters such as nodal dissection and blood loss. However, the approach is limited by the size of the tumour, as bulky tumours are difficult to remove at the neck. Minimally invasive transhiatal rendezvous esophagectomy has been proven to be as safe in this single high-volume thoracic surgical centre as other minimally invasive surgical approaches. This technique may provide clinical advantages compared with traditional operative techniques. Further comparative studies are needed to conclusively demonstrate the advantage of this minimally invasive technique.

09

The effect of colchicine administration on postoperative pleural effusion following thoracic surgery — a randomized, double blind, placebo-controlled feasibility pilot study. ***J. Agzarian, A. Bessissow, S. Srinathan, L. Schneider, P.J. Devereaux, J. Neary, W. Dechert, L. Gandy, C.J. Finley, W.C. Hanna, C. Schieman, Y. Shargall.*** **From McMaster University, Hamilton, Ont.**

With potent anti-inflammatory effect, colchicine was previously found to be effective in preventing postoperative pericardial effusion following cardiac surgery. The purpose of this pilot randomized controlled trial is to assess the effect of colchicine on the volume of postoperative pleural drainage, duration of chest tube in situ and length of stay following lung resection. Between April 2014 and April 2015, 100 patients undergoing lung resection at 2 tertiary care centres were randomized to either colchicine (n = 49) or placebo (n = 51), as part of a feasibility double-blind study assessing colchicine for prevention of perioperative atrial fibrillation. Patients received either colchicine 0.6 mg or placebo orally twice daily for 10 days, with the first dose given 4 hours before surgery. Pleural drainage volumes were recorded in 8-hour intervals until chest tube removal as per a standardized, predefined protocol. Univariate analysis demonstrated that the 2 groups were comparable with regards to certain baseline characteristics of cancer stage, comorbidities, surgical approach and extent of resection (51% open procedures; 86% anatomic resections), but not for sex, coronary artery disease and hypertension. Analysis of total drainage volumes demonstrated a statistically significant difference in favour of the colchicine group (583.8 v. 763.3 mL, p = 0.039). This finding remained consistent across the time intervals assessed. The volume of pleural drainage at 1-hour post-op was significantly less in the colchicine group (92.9 v. 156.6 mL, p = 0.008) and remained lower at the 40-hour interval (550.9 v. 741.3 mL, p = 0.039). There were no differences in time to chest tube removal (6.8 v. 5.9 days, p = 0.585) or hospital length of stay (7.4 v. 6.9 days, p = 0.641) or with regards to major bleeding, infection or adverse events. Perioperative administration of oral colchicine is potentially effective in diminishing the amount of pleural drainage after lung resection. A full-scale, prospective, placebo-controlled randomized trial is needed to assess the clinical significance of perioperative colchicine administration.

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Are 2 surgeons better than 1 for esophagectomies? ***K. Lung, R.I. Inculet, E. Fréchette, D. Fortin, R.A. Malthaner.*** **From Western University, London, Ont.**

The objective of this study was to identify whether the participation of 2 board-certified thoracic surgeons (TS) in a total esophagectomy procedure for esophageal cancer decreases operative time and improves outcomes compared with a single surgeon (SS). The study was a single-institution retrospective cohort study of all esophagectomy procedures performed for cancer in adults from 2006 through 2015. Multiple linear and logistic regressions were used for the primary outcome of operative time and the secondary outcomes of lymph nodes excised, margin status, severe adverse events (Clavien-Dindo stage IIIb or higher) and survival. Potential confounders included age, gender, Charlson index, smoking, body mass index, ASA, neoadjuvant therapy, technique, location and previous surgery. Regression with propensity scores was used for 30-day mortality and proportional hazards Cox regression was used for overall survival. In all 355 total esophagectomy cases were performed by 4 surgeons, with 182 cases (51%) done by TS and 173 (49%) by a SS. Of these, 231 (65%) were transhiatal, 43 (12%) Ivor-Lewis, and 81 (23%) McKeown esophagectomies. Seventy-five per cent were successfully completed using minimally invasive techniques. One hundred and nine cases (31%) underwent neoadjuvant chemoradiation. Univariate analysis demonstrated a shorter operative time of 32 minutes for TS compared with a SS (95% CI: –51 to –13 minutes; p = 0.0009). Multiple regression yielded a shorter operative time of 21 minutes for TS (95% CI: –32 to –10 minutes; p = 0.0002). There was no difference in lymph node yield, margin status, adverse events, 30-day mortality or overall survival. When total esophagectomies are performed by 2 surgeons compared with a single surgeon operative time is reduced but important patient outcomes are not improved.

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Minimally invasive versus open esophagectomy for esophageal cancer: surgical outcomes and survival analysis. ***N. Ahmadi, A. Crnic, A.J. Seely, S.R. Sundaresan, P.J. Villeneuve, D.E. Maziak, F.M. Shamji, S. Gilbert.*** **From the University of Ottawa, Ottawa, Ont.**

Surgical resection remains a critical component of curative-intent esophageal cancer treatment. Minimally invasive esophagectomy (MIE) has been increasingly performed worldwide. The aim of this study was to compare MIE to open esophagectomy (OE) with regard to perioperative and oncologic outcomes. This is a retrospective review of consecutive patients who underwent esophagectomy for esophageal cancer from 2001 to 2015. Summary statistics were calculated by operation type (MIE v. OE) and Kaplan–Meier methods were used to compare survival. Cox regression analysis was used to assess the impact of operation type on disease recurrence, adjusting for cancer stage, neoadjuvant therapy and total lymph nodes resected. Of 296 esophagectomy patients, 75% (222/296) had an OE procedure and 25% (74/296) had MIE. The groups were comparable with respect to median age (MIE = 64 years [IQR: 54–73]; OE = 65 years [IQR: 57–72]; $p = 0.4$), male gender (MIE = 78% [58/74]; OE 84% [188/222]; $p = 0.2$), median BMI (MIE = 25 kg/m^2 [IQR: 23–30]; OE = 26 kg/m^2 [IQR: 21–28]; $p = 0.3$), adenocarcinoma histology (MIE = 79% [53/67]; OE = 82% [172/211]; $p = 0.7$), tumour location in lower esophagus (MIE = 88% [65/74]; OE = 87% [193/222]; $p = 0.5$) and R0 resection (MIE = 72% [33/46]; OE = 78% [155/200]; $p = 0.4$). Cancer stage distribution was comparable among MIE and OE groups (stage III = 58% in MIE v. 43% in OE; $p = 0.26$). MIE was associated with shorter median length of stay (MIE = 10 days [IQR = 8–15]; OE = 17 days [IQR = 11–27]; $p < 0.001$), significantly less intraoperative mean blood loss (53 mL v. 327 mL; $p < 0.001$) and higher median number of resected lymph nodes (MIE = 30 [IQR: 21–40]; OE = 13 [IQR: 7–19]; $p < 0.001$). Multivariate analysis demonstrated a decreased risk of any recurrence in MIE patients at a median follow-up of 20 ± 32 months (OR: 0.32; CI: 0.11–0.90). Overall median survival was superior for the MIE group but the difference was not statistically significant (MIE = 52 ± 6 months; OE = 30 ± 4 months; $p = 0.12$). MIE is associated with significantly less intraoperative blood loss and shorter length of postoperative hospital stay. MIE is associated with improved lymphadenectomy and lower risk of recurrence. There was an observed trend toward longer median survival in the MIE group.

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A cross-sectional pilot survey assessing advance care planning among seriously ill thoracic surgery inpatients in an academic teaching hospital. ***C.K. Wen, C. Schieman, T. Schnurr, D. Nguyen-Do, L. Schneider, D. Cook, A. Woods, L. Mbuagbaw, Y. Shargall, C.J. Finley, W.C. Hanna, J. You.*** **From McMaster University, Hamilton, Ont.**

Recent research into the quality of advance care planning (ACP) of seriously ill hospitalized patients in medical settings found that ACP is often "too little, too late and of poor quality." Little is known about ACP in surgical settings. In contrast to medical patients, surgical patients may have recently considered highly invasive procedures; advance directives are routinely suspended for anesthetics; and surgeons may be less willing to accept treatment de-escalation, perceiving incongruence between surgical care and end of life (EOL) care. The objective of this pilot study is to determine the feasibility of assessing the quality of ACP among seriously ill thoracic surgery patients and to assess the concordance of expressed preferences about use/non-use of life-sustaining treatments as documented in the medical record. We approached consecutive patients admitted to a thoracic surgery inpatient ward with advanced thoracic malignancies or life-threatening complications thereof, and an associated family member. We conducted in-person interviewer-administered surveys using validated questionnaires on the quality of ACP with patients and family members when possible, independently. Patients' charts were reviewed to abstract goals of care orders in effect at the time of the interviews. To date, 14 of 20 (70%) planned questionnaires have been completed, including 10 of 12 patients (83%) and 100% of family members approached. Five patients fulfilling eligibility criteria were not approached at their physician's discretion. Preliminary findings suggest that patients have often considered EOL issues personally; however, ACP discussions in hospital have been limited, as has documentation of goals of care preferences in the medical records. This study demonstrates that it is feasible to study ACP with seriously ill patients on a thoracic surgery ward. Further research is warranted to understand the optimal timing of eliciting ACP preferences, barriers and solutions to establishing goals of care, and suitable strategies to honour patients' wishes in the thoracic surgical setting.

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Postoperative morbidity not found to play a role in disease recurrence following curative intent resection for lung cancer. ***L. Baker, Z.H. Zhang, J. Ivanovic, C. Anstee, S. Gilbert, D. Maziak, S. Sundaresan, F.M. Shamji, J. Villeneuve, A. Seely.*** **From University of Ottawa, Ottawa, Ont.**

A significant proportion of patients (~25%–40%) undergoing curative intent surgical resection for lung cancer recur with metastatic disease. The association between postoperative adverse events and disease recurrence remains controversial as large-series prospective data are lacking. We therefore sought to characterize the effect of postoperative adverse events on disease recurrence following curative intent lung resection surgery. Using the Thoracic Morbidity and Mortality Classification System, postoperative adverse events were prospectively collected for all thoracic surgical cases conducted at our institution (January 2008 to July 2011). Patient demographics, comorbidities, surgical resection and recurrence status were retrospectively attained. Patients who died within 90 days of their resection were excluded from the study. Surgical resections after July 2011 were excluded to allow for a minimum of 4 years to assess for recurrence. Univariate analyses of the association between postoperative adverse events and oncologic recurrence was conducted. Of the 447 eligible patients who underwent curative intent resection of their lung cancer, the overall adverse event rate was 40.9% (183/447), and 25% (110/447) were found to have disease recurrence. Evaluating all adverse events, no significant difference in incidence of disease

recurrence was found in patients with or without postoperative adverse events (24.0% v. 25.0%, $p = 0.818$). Major infectious adverse events (pneumonia, empyema, bacteremia; incidence 34 [7.6%]), minor infectious adverse events (wound infection, urinary infection; 14 [3.1%]) and pulmonary adverse events (pneumonia, empyema, acute respiratory distress syndrome [ARDS], atelectasis and prolonged air leak; 108 [24.2%]) were not associated with increased incidence of recurrence. There was no statistically significant difference observed between severity of adverse events as per the TM&M classification and incidence of disease recurrence. In contrast to our hypothesis, postoperative adverse events in patients undergoing curative intent lung cancer resection were not associated with oncologic recurrence. Larger multicentre studies are required to determine if this lack of association persists.

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Pneumonectomy outcomes at a level 1 thoracic surgery centre and community teaching hospital in Ontario. ***V. Gupta*, *B. Kidane*, *A. Helmi*, *C. Compeau*, *M. Blitz*, *M.A. Ko*. From the University of Toronto, Toronto, Ont.**

Pneumonectomies are the most morbid pulmonary resections. Recently, a population-based cohort study in Ontario reported a 4.4% in-hospital mortality rate and an additional 6.4% 90-day postdischarge mortality rate. Our objective was to determine the rate of in-hospital and 90-day mortality in pneumonectomies performed at a community teaching hospital, as well as identify patient-, procedure- or practice-level factors that are associated with increased mortality or respiratory complications. A retrospective cohort study was performed including consecutive pneumonectomies performed at a community teaching hospital from 2002 to 2015. Fisher exact and Mann–Whitney *U* tests were performed to assess for factors associated with mortality or complications. Fifty-three pneumonectomies were performed during the study period, of which 64.2% ($n = 34/53$) were left-sided. The majority (96.2%, $n = 51/53$) were for cancer, with 37.2% being stage IIIA ($n = 19/51$). Intra-pericardial dissection was required in 37.7% ($n = 20/53$) while 7.5% ($n = 4/53$) were extra-pleural pneumonectomies. Preoperative chemoradiation was used in 9.8% ($n = 5/51$). In-hospital mortality occurred in 7.5% ($n = 4/53$) of patients whereas only 1 (1.9%) additional death was found in the 90 days after discharge. Respiratory complications, atrial fibrillation, infectious complications and bronchopleural fistulae occurred in 11.3% ($n = 6/53$), 17.0% ($n = 9/53$), 9.4% ($n = 5/53$) and 3.8% ($n = 2/53$) of patients, respectively. Postoperative transfusions were significantly associated with higher in-hospital mortality ($p < 0.001$) and respiratory failure ($p = 0.04$). In-hospital mortality, 90-day mortality or complications were not significantly associated with age, sex, preoperative lung function, comorbidity score, intraoperative ventilatory parameters or postoperative fluid balance. Our findings suggest that the in-hospital mortality rate at our community teaching hospital is higher than reported in the population-based Ontario-wide study but that our 90-day mortality rate is lower. Postoperative transfusion appears to be a significant risk factor for both respiratory failure and in-hospital mortality. Quality improvement strategies can focus on postoperative transfusion practices as a point of intervention.

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Salvage resection after high-dose radiation therapy for NSCLC. ***C. Mann*, *E. Vallieres*, *A.S. Farivar*, *R.W. Aye*, *B.E. Louie*. From the Swedish Medical Center and Cancer Institute, Seattle, Wash.**

Patients with locoregionally advanced non-small cell lung cancer are often treated with definitive radiation therapy (RT) and concurrent or sequential chemotherapy (C). Persistent or recurrent disease may be considered for salvage surgery. However, the role of salvage lung resection in this setting remains controversial due to uncertainties over feasibility, patient selection and optimal surgical approaches. Small series of so-called salvage surgeries have been reported but most have included patients resected after induction therapy and as such should not be considered salvage resections. We sought to review our experience with true salvage resection. We retrospectively analyzed a series of salvage lung resections from Jan. 1, 2004, to Dec. 31, 2015. Salvage was defined as a curative-intent anatomic lung resection (at least lobectomy) occurring a minimum of 3 months after completion of radiation or chemoradiotherapy (CRT). We analyzed prognostic, intraoperative and postoperative factors to determine feasibility, patient selection and outcomes in this complex and challenging patient population. Twenty-eight patients were identified (16 males, 12 females; median age 65 years). Mean interval between the end of radiation treatment and surgical resection was 19.2 months. Mean radiation dose delivered was 63.8 Gy (range 45–130). There were no intraoperative deaths but 3 perioperative deaths (days 8, 21 and 39). Major intraoperative complications occurred in 3 (10.7%) patients: superior vena cava obstruction (1), aortic injury requiring arch reconstruction (1) and significant pulmonary artery injury (1). Significant postoperative complications occurred in 11 (39.3%) patients. Complete pathologic response was identified in 3 patients. Data for disease-free (DFS) and overall (OS) survival and prognostic factors for poor outcomes are being collected and will be reported. True salvage pulmonary resection is a technically challenging procedure. It can, however, be performed with acceptable risks and outcomes in carefully selected patients.

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Surgery-related readmissions within 1 year of esophagectomy. ***B. Kidane*, *J. Peel*, *Y. Shen*, *F. Allison*, *T.K. Waddell*, *G.E. Darling*. From University of Toronto, Toronto, Ont.**

Esophagectomy results in complications that can persist beyond index admission. Hospital readmission can occur beyond the 90-day horizon often reported. This has implications on quality of life and resource utilization. Our objective was to determine the extent of surgery-related readmissions within 1 year of esophagectomy as well as to identify factors associated with higher readmission. We conducted a retrospective cohort study of consecutive esophagectomies at a tertiary Canadian centre (1999–2014). Fisher exact, Mann–Whitney *U*, *t* tests and multivariable logistic regression were used to identify factors associated with higher same-hospital readmission. Demographic, socioeconomic and medical/surgical factors were assessed. There were 520 esophagectomies with in-hospital mortality of 6% ($n = 31$). Of those surviving to discharge, 34.4% of patients ($n = 168$) had ≥1 surgery-related

readmission within 1 year of discharge. The most common causes were dysphagia/stricture (25%, n = 42) and surgical site infection (11%, n = 19). On univariable analysis, higher Charlson comorbidity score (p = 0.03), higher index length of stay (p = 0.05) and occurrence of respiratory complications (p = 0.04) or anastomotic leak (p = 0.05) were associated with higher risk of readmission. Living in a region further from the index hospital was associated with lower risk of same-hospital readmission (p = 0.01). On multivariable analysis, higher comorbidity score (OR = 1.64 [1.05–2.56], p = 0.03) and occurrence of respiratory complications (OR = 1.87 [1.12–3.01], p = 0.02) or anastomotic leak (OR = 1.73 [1.00–3.01], p = 0.05) were independently associated with a higher risk of same-hospital readmission. Resection type, minimally invasive surgery and demographic/socioeconomic factors were not associated with readmission risk. Our findings suggest a high rate of same-hospital readmission within 1 year of esophagectomy. Patients living further away from the index hospital had a lower rate of same-hospital readmission; thus, the true rate of readmission is probably higher as these patients are probably being readmitted at local hospitals. Further study is needed to assess whether closer follow-up of patients with respiratory complications or anastomotic leaks may help to reduce readmission rates.

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Development of a cost-effective in situ thoracic surgery crisis simulation model. ***J. Bierer, E. Memu, A. Tran, R. Leeper, D. Fortin, E. Fréchette, R.I. Inculet, R.A. Malthaner*. From Western University, London, Ont.**

Surgical training simulations are being widely adopted as integral components of residency programs but many are composed of expensive animal or mannequin models. Our vision was to develop a cost-effective training simulation scenario in a functional operating room (OR) (in situ) that includes the full surgical team. In addition to fostering competent technical skills, our simulation training would also focus on effective interprofessional communication and teamwork skills and would identify latent safety threats (LST). The simulation scenario consisted of an acute life-threatening post-pneumonectomy airway obstruction by residual tumour. The model included a thoracic OR with the patient represented by an inexpensive modified Laerdal airway mannequin. A customized shareware vital sign simulator projected vitals on OR screens, controlled in real time by the simulation operator. Four thoracic surgeon consultants and 3 residents were assessed for their team interactions with 6 nurses from the recorded scenarios using the validated Non-Technical Skills for Surgeons (NOTSS) and the TeamSTEPPS 2.0 scales. A 15-minute debriefing was done afterwards to identify LST and obtain simulation feedback using the Method-Materials-Members-Overall (MMMO) questionnaire. Several LST were identified, which included missing and redundant equipment and knowledge gaps in participants' roles. The MMMO overall simulation experience score was high at 4.7/5. Consultant surgeons scored higher than residents on all domains in the NOTSS (range: 3.7 to 3.9 v. 2.7 to 3.7) and TeamSTEPPS (range: 3.8 to 4.6 v. 2.8 to 3.4) scales, demonstrating potential for improvement for the trainees. A novel and inexpensive Canadian in situ thoracic surgery crisis simulation model was developed and used to identify latent safety threats and reinforce team training behaviours in a high-risk clinical setting.

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Identifying preoperative predictors of prolonged length of stay following pulmonary resection with curative intent for malignancy. ***Z.H. Zhang, F. Mostofian, J. Ivanovic, S. Gilbert, D.E. Maziak, F.M. Shamji, S. Sundarensan, P.J. Villeneuve, A.J.E. Seely*. From the Ottawa Hospital, Ottawa, Ont.**

The Thoracic Mortality and Morbidity (TM&M) is an objective prospective surgery adverse event (AE) data collection system. It identifies thoracic surgery complications from grades I to V based on the level of intervention required. The impact of TM&M on prolonged length of stay (PLOS) is unknown. We aim to identify perioperative factors independently associated with PLOS in pulmonary resection patients. This is a retrospective cohort study on prospectively collected TM&M data. Additional data on demographics, comorbidities, preoperative investigations and cardiopulmonary assessment, pathological staging, operative characteristics and LOS were retrospectively reviewed on all patients who underwent pulmonary resection with curative intent for malignancy at our division (January 2008 to July 2015). PLOS was defined as LOS > 75th percentile. Univariate and multivariate logistic regression analyses were performed to identify predictors of PLOS. Of 1041 patients, 467 (67.8%) were female, 341 (42.2%) were <65 years old and 233 (28.9%) had PLOS. LOS ranged from 1 to 66 days, median normal LOS was 4 days and median PLOS was 11 days. In total, 416 (40.0%) patients had 1 or more complications. Multivariate analysis identified significant (p < 0.05) predictive factors of PLOS to be (odds ratio; 95% CI) — increased extent of pulmonary resection: pneumonectomy (2.60; 1.33–5.18); any TM&M complication: grade I (5.94; 3.31–10.66), grade II (5.32; 3.54–8.00); grade III (11.59; 6.99–19.22), grade IV (25.60; 8.62–76.01). Hosmer-Lemeshow goodness-of-fit test was p = 0.42. TM&M, including all grades of AEs, was found to be associated with increased risk of PLOS. To date, the impact of minor complication has been controversial, and this study shows that even a grade I complication significantly increases the likelihood of PLOS by 5.9 times. PLOS and its identified predictors can be used for quality comparison between surgeons, reducing hospital inpatient costs and improving quality of care.

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Robotic-assisted thoracoscopic lobectomy versus video-assisted thoracoscopic lobectomy for early-stage non-small cell lung cancer: a health-care resource utilization analysis. ***M.N. Kaur, F. Xie, A. Shiwcharan, L. Patterson, T. Dalimonte, Y. Shargall, C.J. Finley, C. Schieman, C. Fahim, W.C. Hanna*. From McMaster University, Boris Family Centre for Robotic Surgery and St. Joseph's Healthcare, Hamilton, Ont.**

The objective of this study is to compare robotic-assisted thoracic surgery (RATS) and video-assisted thoracic surgery (VATS) for lung cancer with respect to health care resource utilization. All patients who underwent RATS (n = 46) or VATS (n = 144) between April 2014 and March 2015 at a single institution were identified. Data were extracted from a prospective database for demographic (age, gender, body mass index, comorbidities and smoking history), clinical (lung function, operative and

perioperative variables, complications) and resource utilization variables. Cost analysis was performed according to Funding Reform and Case Costing guidelines. Continuous variables were compared using a t test and categorical variables were compared using a χ^2 test with a level of significance p value < 0.05. All costs are in Canadian dollars. There were no statistically significant differences in the demographic and clinical characteristics of patients in the RATS cohort and the VATS cohort, including age, sex, pulmonary function and pathological tumour stage. RATS cases had longer operating times (192.8 ± 59.9 minutes) compared with VATS cases (94.25 ± 57.9 minutes) ($p < 0.01$). Hospitalization days (RATS, 5.33 ± 3.5 days; VATS, 4.27 ± 3.31 days; $p = 0.57$) and complication rates (RATS, 6.97%; VATS, 2.86%; $p = 0.363$) were similar between the 2 cohorts. The mean cost for RATS lobectomy was $14 614.56 ± $6806.29 versus $8896.32 ± $4724.97 for VATS lobectomy ($p < 0.01$). The difference in cost was solely attributable to operating room time and disposable equipment (RATS = $6104.86 ± $3309.8; VATS = $2015.81 ± $1050.83; $p < 0.01$). RATS utilizes more health care resource dollars than VATS for early-stage lung cancer. This difference is covered by philanthropic subsidies for robotic operations, but it becomes important when considering public funding for robotic surgery in Canada. Prospective studies are required to compare the cost-effectiveness of RATS to VATS for Canadian lung cancer patients.

20

Left thoracoabdominal approach for surgical treatment of esophagogastric junction tumours: Do the ends justify the means? ***J.C. Molina*, *S. Najmeh*, *U. Ronellenfitsch*, *C. Huynh*, *J. Spicer*, *C. Mueller*, *D. Mulder*, *L. Ferri*. From McGill University Health Centre, Montreal, Que.**

The optimal surgical approach for tumours of the esophagogastric junction (EGJ) is still under debate. The left thoracoabdominal (LTA) approach might facilitate complete resection particularly for bulky tumours, but there are concerns that this approach is associated with significant morbidity. In this study, we assessed perioperative outcomes of LTA, paying particular attention to the ability to perform oncologically appropriate resections with an acceptable rate of complications. A prospectively entered esophageal cancer database from a high-volume centre was queried for patients undergoing resection of EGJ tumours through a LTA between September 2005 and December 2015. Demographic, perioperative and pathologic characteristics were retrieved through chart review. Data are presented as median (range). Of 629 patients in the database with esophagectomies, 87 surgeries were performed through a left thoracoabdominal approach (71 male (82%), age = 65 years [26–84]). Most tumours were adenocarcinoma (80 [91%]) and locally advanced (pT3/4 [70/87]: pN+ [66/87]). Siewert classification was I/II/III (10/28/49) and 60 (69%) received neoadjuvant chemotherapy. Fifty-five underwent esophagogastrectomy with esophagogastrostomy, 31 extended total gastrectomy/distal esophagectomy with pedicled Roux-en-Y esophagojejunostomy and 1 esophagogastrectomy with colonic interposition. Seventeen (20%) required en-bloc resection of adjacent organs (spleen most commonly). Operating room time was 180 (145–480) minutes. Lymph node harvest was 28 (4–79), of which 7 (0–38) lymph nodes were positive. Among the 74 patients who underwent curative intent surgery, 69 (93.2%) had R0 resections. Half (44/87) had postoperative complications, most of which were minor (Clavien-Dindo I/II = 23/44). Major complications arose in 21 (IIIa = 7/ IIIb = 9/IV = 4) including 9 anastomotic leaks (10%) and 16 respiratory complications (18%). Ninety-day mortality arose in 1 patient (1%). Length of stay was 10 days (4–106), with 70 patients (80%) leaving by postoperative day 8. The LTA approach allows for complete resection and extensive lymph node harvest in the majority of patients with bulky tumours of the esophagogastric junction with acceptable short-term outcomes.

Canadian Hepato-Pancreato-Biliary Association

01

Assessing tools for management of non-colorectal non-neuroendocrine liver metastases: external validation of a prognostic model. ***M.E. Tsang, A.L. Mahar, G. Martel, J. Havel, J. Rekman, C. Boulanger-Gobeil, D. Hurlbut, M. Meschino, C. Morin, S.P. Cleary, S. Gallinger, S. Nanji, F.K. Balaa, P.J. Karanicolas, D. Jalink, J.F. Ouellet, R. Hernandez-Alejandro, A.C. Wei, J. Hallet*. From the Sunnybrook Health Sciences Centre – Odette Cancer Centre, Toronto, Ont.; Queen's University, Kingston, Ont.; the Ottawa Hospital, University of Ottawa, Ottawa, Ont.; London Health Sciences Centre, London, Ont.; the University Health Network, Toronto, Ont.; and Centre Hospitalier Universitaire de Québec, Québec, Que.**

The selection criteria and benefits for resection of non-colorectal non-neuroendocrine liver metastases (NCNNELM) remain debated. The Adam score was developed for patient selection but not validated externally. We performed an external validation of the Adam score in an independent contemporary Canadian cohort. Patients with resected NCNNELM were identified from 6 institutions (2000–2014). Risk groups were based on Adam score (extrahepatic metastases, major hepatectomy, R2 resection, disease-free interval, primary tumour characteristics). The TRIPOD guidelines for prediction tool development and validation were followed. Necessary data on score development were not available for formal external validation. Discrimination was thus qualitatively evaluated by visually inspecting the overall survival (OS) curves' separation between risk groups, calculating the slope of the continuous score on OS (Cox regression) and comparing OS hazards between risk groups. A total of 165 patients were included (84 deaths, median follow-up in survivors 68 months): 53 (32.1%) low risk, 85 (51.5%) intermediate risk and 27 (16.4%) high risk. Breast primary was less frequent (12%) and mean disease-free interval longer (48 months) than in the Adam cohort. There was no separation of OS curves among risk groups, with 5-year OS of 60.1% (low), 57.1% (intermediate) and 55.6% (high). OS was superior to the Adam cohort (low 46%, intermediate 33%, high 0%). The slope of the score (parameter estimate) below 1 (0.02) indicated lower discrimination in the Adam cohort. Hazard ratios of 1.05 (0.63–1.70) for low versus intermediate, 0.87 (0.46–1.64) for low versus high and 0.83 (0.46–1.49) for intermediate versus high demonstrated lack of discrimination in OS among risk groups. These results suggest that discrimination of Adam score is not maintained in a Canadian cohort of resected NCNNELM. It does not appear generalizable to this population, probably due to different case mix and initial patient selection for resection. Recalibration to specific practice settings is required before broad adoption of the score.

02

Safety and feasibility of phlebotomy with controlled hypovolemia to minimize blood loss in hepatic resections. ***J. Rekman, S. Bennett, C. Wherrett, M. Gostimir, S. Saeed, K. Lemon, R. Mimeault, F.K. Balaa, G. Martel*. From the University of Ottawa, Ottawa, Ont.**

Blood loss in liver surgery is a key determinant of outcome. Whole-blood phlebotomy, a simple intervention that differs from acute normovolemic hemodilution, aims to decrease blood loss during liver resection by lowering central venous pressure (CVP) and creating a state of controlled hypovolemia. The objective of this work was to review our preliminary experience with this novel technique, looking at safety, feasibility and effectiveness. Patients who underwent liver resection and phlebotomy were followed prospectively (2013–2016). Exclusion criteria were defined a priori. Phlebotomy was targeted to patients' weight (7–10 mL/kg) shortly before parenchymal transection. The withdrawn blood was not replaced by crystalloid or colloid, and low CVP anesthesia was used. Following parenchymal transection, the blood was given back to the patient. Thirty patients underwent liver resection with phlebotomy, of which 48% had metastatic disease. Twenty-six patients had major liver resections and 4 had minor. A median of 7.3 mL/kg (4.8–10.2) of blood was phlebotomized. The median operative blood loss was 400 mL (range 100–2100) or a median of 5.7 mL/kg. Only 3 patients (10%) required an additional allogeneic perioperative blood transfusion, totaling 7 transfused units. The readmission rate was 6.7%. No patients required ICU admission, experienced grade II acute kidney injury or greater, or showed signs of serious liver deficiency postoperatively. Only 2 patients had a grade 3a complication, and there was no mortality. Whole-blood phlebotomy with controlled hypovolemia before liver resection appears safe and feasible. In this preliminary series, phlebotomy also appears effective at reducing blood loss and blood transfusion when compared with published cohorts. This technique warrants further comparative study, particularly where other blood conservation methods are controlled for.

03

The role of simultaneous cystgastrostomy and necrosectomy for walled off pancreatic necrosis. ***M.R. Driedger, F.R. Sutherland, E. Dixon, S. Gregg, O.F. Bathe, C.G. Ball*. From the University of Calgary, Calgary, Alta.**

Severe acute pancreatitis (SAP) occurs in 15% of patients with generalized pancreatitis. Walled off pancreatic necrosis (WOPN) is the most common end result of SAP. When symptomatic, WOPN requires intervention. The aim of this study was to evaluate the role of simultaneous cystgastostomy and necrosectomy (CG/N) for WOPN. A retrospective review of patients with WOPN undergoing surgical management on a high-volume pancreatic service over 10 years (2005–2015) was performed. Outcomes included mortality, morbidity, intervention timing and symptom resolution. Statistics were descriptive. Seventy-three patients were analyzed (mean WOPN diameter = 14.5 cm, 69.8% male, mean age = 48 years). The majority were acutely ill, with an average preoperative length of stay of 28.6 days and 26% requiring preoperative ICU support. Preoperative complications were prevalent (43.8%) and included mesenteric vein thrombosis (37%), gastric outlet obstruction (19.2%), respiratory complications (19.2%), bacteremia (13.7%) and acute kidney injury (9.6%). Nearly all

(94.5%) patients underwent an open trans-gastric CG/N. The median duration of time between the onset of SAP and operative intervention was 45.1 days. Forty per cent of the necrosum was infected. Postoperative morbidity included infection (9.6%), bleeding (5.5%), fistula (5.5%) and reoperation (4.1%). Postoperative hospital length of stay was 11.5 days with 94.5% of patients discharged home. Mortality was 2.7% with 11% requiring postoperative ICU care. The mean length of follow-up was 12 months with 87.7% of patients having complete clinical resolution of symptoms at an average of 7.3 weeks. Recurrent WOPN occurred in only 5.5% of patients at an average of 19 months after the index operation. Despite acutely ill and comorbid patients with large WOPN volumes, simultaneous CG/N offers a definitive single-stage solution in the vast majority of patients with minimal postoperative morbidity and rapid return to an asymptomatic state. Upon consideration of the minimal laparotomy required, this procedure represents the preferred approach for WOPN.

04

Prognostic significance of KRAS mutations in resectable colorectal cancer liver metastases. ***A.J. Pang, A. Connor, S. Farber, S. Nanji, C. O'Brien, S. Gallinger*. From the University Health Network, University of Toronto, Toronto, Ont.**

Gene mutation status in metastatic colorectal cancer has become increasingly important with the aim of identifying specific patterns of spread, survival outcomes and treatment options. In particular, several recent studies have shown that mutations in the KRAS gene in colorectal cancer liver metastases (CRLM) are associated with aggressive tumour biology and worse patient outcomes. To investigate the prognostic value of mutated KRAS (mtKRAS) in CRLM, we evaluated the impact of KRAS mutation status on recurrence and survival in patients undergoing curative resection of CRLM. We hypothesized that mtKRAS in CRLM is associated with worse overall survival (OS) and progression-free survival (PFS) after hepatic resection. A retrospective review of patients who underwent liver resection for CRLM with KRAS analysis was performed and 123 patients were identified. Clinicopathologic characteristics and survival outcomes were stratified by KRAS status and were analyzed using univariate and multivariable Cox analysis. We found that mutant KRAS was identified in 43.1% of patients. There was no significant difference in the pattern of recurrence (liver: mtKRAS 35.6% v. wtKRAS 41.5%; distant metastases: mtKRAS 64.4% v. wtKRAS 58.5%; all $p > 0.05$). OS was comparable between wild-type and mtKRAS (hazard ratio 1.1; 95% CIl 0.67–1.8; $p = 0.721$). PFS was also not affected by KRAS mutation status (hazard ratio 1.3; 95% CI 0.91–2; $p = 0.141$). Multivariable Cox analysis showed that grade of CRLM was independently associated with worse OS ($p = 0.003$) and PFS ($p = 0.044$). In conclusion, about half of our cohort of patients with CRLM had mtKRAS. mtKRAS did not predict worse survival outcomes after curative-intent resection of CRLM, and therefore it may not be a clinically reliable prognostic biomarker. However, CRLM grade may in fact be an independent predictor of worse outcome in this subset of colorectal cancer patients.

08

HPB funding in the QBP era: no margin for error. ***C.G. Compeau, E. Al-Sukhni, S. Jayaraman*. From St. Joseph's Health Centre, University of Toronto, Toronto, Ont.**

Quality-based procedures (QBPs) are an important component of health care reform in Ontario. These are specific groups of patient services that are reimbursed based on evidence-informed rates. In recent years QBP funding has replaced global health centre funding for a variety of patient services. We sought to determine how accurately and adequately the QBP funding formula reimburses hepatobiliary and pancreatic (HBP) surgical procedures. Specifically we retrospectively evaluated health centre costs for HPB procedures at our institution for fiscal year 2014–15. We also determined the cost per case differential as it related to patient length of stay (LOS) and compared this to the set ministry funding rate (QBP) for these procedures. One hundred and forty-nine total HPB cases were performed. The provincial funding rate per case was set at $16 183. One hundred and seven cases had a LOS of 1–9 days with a calculated cost per case of $15 479 and a total cost of $1 656 217 (44% of total costs). Twenty-six cases had a LOS of 10–19 days with a cost per case of $28 903 and a total cost of $751 474 (20% of total costs). Eight cases had a LOS of 20–29 days with a calculated cost per case of $46 116 and a total cost of $368 931 (10% of total costs). Six patients had a LOS of 40–70 days with a cost per case of $131 238 and a total cost of $787 426 (21% of total costs). One patient had a LOS greater than 70 days (102 days) with a case cost of $157 097 (4% of total costs). The 7 of 149 patients with LOS greater than 40 days were responsible for 25% of the total health centre payments for HPB cases. In summary, QBP funding supports "ideal" uncomplicated HPB procedures. Consequently, institutions are forced to support these programs through global budget supplemental funding.

09

Integration of genomics and transcriptomics reveals potential therapeutic targets in pancreatic ductal adenocarcinoma. ***A.A. Connor, R.E. Denroche, G.H. Jang, A. Pollett, S.P. Cleary, L.B. Alexandrov, J. Wilson, J.D. McPherson, F. Notta, L.D. Stein, S. Gallinger*. From the University of Toronto, Toronto, Ont.**

Pancreatic ductal adenocarcinoma (PDAC) has the lowest 5-year overall survival rate of any epithelial carcinoma, yet personalized therapy for PDAC has not been realized. Integration of genomics, transcriptomics and clinicopathologic data will better inform PDAC management. We hypothesized that classifying PDAC according to distinct mutational processes at the genomic level would reveal clinically relevant transcriptional differences in these mutation-based subtypes. Our discovery cohort comprised 160 PDAC from 154 patients (148 primary; 12 metastases) with whole genome sequencing (WGS) on all and RNA sequencing on 52 samples. The replication cohort comprised WGS for 95 PDAC and expression microarrays for 91. Somatic mutations accumulate from sequence-specific processes creating signatures detectable by whole genome sequencing. Using non-negative

matrix factorization, we measured the contribution of each signature to carcinogenesis and, by hierarchical clustering, divided each cohort into subtypes. Five predominant mutational signatures were identified from somatic mutational processes that clustered PDAC into 4 major subtypes, "age related," "double-strand break repair" (DSBR), "mismatch repair" (MMR) and "unknown (Signature 8)." These genomic subtypes were validated in the replication cohort, and they faithfully propagated from primaries to matched metastases. Almost half of the DSBR cases lacked germline or somatic events in homologous recombination genes such as BRCA1, BRCA2 or PALB2, which may have implications for therapies that target DSBR deficiency. Differential expression of genes between subtypes revealed biomarkers predictive of response to cancer therapies. In both cohorts, increased cytolytic activity correlated with increased expression of immune regulatory genes, including CTLA-4, PD-1 and IDO-1, and was enriched in DSBR and MMR cases, corresponding to high frequencies of somatic mutations and tumour-specific neoantigens. In conclusion, signature-based subtyping may predict the response of PDAC to personalized therapy, particularly immune checkpoint blockade and IDO-1 inhibitors, in the context of biomarker-driven prospective trials.

10

The relationship between body mass index, pancreatic fistula and postoperative complications and its associated cost implications following pancreaticoduodenectomy. ***Y. Essaji, M.S. Rashid, H. Kaka, T. Tang, F. Yuan, D. Dath, M.J. Marcaccio, L. Ruo, P. Serrano*. From McMaster University, Hamilton, Ont.**

This study aims to evaluate the effect of increased body mass index (BMI) on pancreatic fistula and postoperative complications and its associated overall cost following pancreaticoduodenectomy. This is a retrospective cohort study of patients undergoing pancreaticoduodenectomy from 2009 to 2014 at a high-volume institution. Risk factors associated with postoperative complications and pancreatic fistula (as defined by the International Study Group on Pancreatic Fistula) were evaluated by univariable and multivariable analyses. Hospitalization and emergency department costs up to 90 days following surgery were analyzed. The median BMI of all patients (n = 276) was 26.2 (range = 16.7–48.4); it was higher for those with pancreatic fistula: 27.9 (range = 16.7–44.4) versus 25.9 (range = 16.7–48.4), p = 0.036. Similarly, the median BMI for those with a postoperative complication was higher: 26.4 (range = 16.7–43.9) versus 25.4 (range = 17.6–48.4), p = 0.073. Obese patients (BMI ≥ 30 kg/m^2) had a higher proportion of pancreatic fistula compared with non-obese patients (25.4% v. 12.4%, p = 0.011) as well as postoperative complications (61.2% v. 45.9%, p = 0.03). By multivariable analyses, higher BMI was associated with a higher risk of pancreatic fistula (OR: 1.09, 95% CI: 1.02–1.16) and postoperative complications (OR: 1.07, 95% CI: 1.07–1.12). The costs for hospitalizations and emergency department visits were higher for obese patients compared with non-obese patients (C$22 042 v. C$25 311, p = 0.004). Similarly, overweight and obese patients (BMI ≥ 25) had a higher proportion of pancreatic fistula (19% v. 10.2%, p = 0.048) compared with non-overweight or obese patients. There was a trend toward higher postoperative complications (54.2% v. 42.6%, p = 0.061) and higher costs (C$21 563 v. C$22 963, p = 0.062) for this group of patients as well. Higher BMI, including overweight and obese classifications, is associated with a higher risk of postoperative pancreatic fistula following pancreaticoduodenectomy. Obesity is associated with overall higher postoperative complications, which translates into significantly increased cost of caring for these patients.

11

Minimally invasive compared with open re-hepatectomy for colorectal liver metastases: a multi-institutional propensity-matched analysis of short- and long-term outcomes. ***J. Hallet, A. Sa Cunha, R. Adam, B. Gayet, D. Goéré, A. Ayav, D. Azoulay, J.Y. Mabrut, F. Navarro, P. Pessaux*. From Institut de Recherche sur les Cancers de l'Appareil Digestif (IRCAD), Strasbourg, France; Sunnybrook Health Sciences Centre – Odette Cancer Centre, Toronto, Ont.; Hôpital Paul Brousse, Université Paris-Sud, Villejuif, France; Institut Mutualiste Montsouris, Université Paris Descartes, Paris, France; Institut Gutave Roussy, Villejuif, France; Hôpital Henri-Mondor, Créteil, France; Hôpital de Brabois, Nancy, France; and Hôpital Saint-Eloi, Montpellier, France**

While uptake of laparoscopic hepatectomy has improved, evidence on laparoscopic re-hepatectomy (LRH) for colorectal liver metastases (CRLM) is limited and this approach has never been compared with the open approach. We sought to define outcomes of LRH compared with open re-hepatectomy (ORH). Patients undergoing re-hepatectomy for CRLM at 39 institutions (2006–2013) were identified. Primary outcomes were 30-day postoperative overall morbidity, mortality and length of stay. Secondary outcomes were recurrence and survival at latest follow-up. LRHs were matched to ORHs (1:3) using a propensity-score created by comparing preoperative clinicopathologic factors (number and size of liver metastases, and major hepatectomy). Of the 376 re-hepatectomies included, 27 were LRH, including 1 (3.7%) conversion. The propensity-matched cohort included 108 patients. Neither median operative time (252 v. 230 minutes; p = 0.82), nor overall 30-day morbidity (48.1% v. 38.3%; p = 0.37) differed. Non-specific morbidity (including cardiac, respiratory, infectious and renal events) decreased with LRH (11.1% v. 30.9%, p = 0.04), while surgical-specific morbidity (including liver insufficiency and biliary leak) was higher (44.4% v. 22.2%, p = 0.03). One ORH and 0 LRH suffered 30-day mortality. Median length of stay (9 v. 12 days; p = 0.60) was comparable. At latest follow-up, 26 (96.3%) LRH and 67 (82.7%) ORH patients were alive. Eight (29.6%) LRH and 36 (44.4%) ORH patients were alive without disease. LRH for recurrent CRLM was associated with overall short-term outcomes comparable to ORH, but different morbidity profiles. While it may offer a safe and feasible approach, further insight is necessary to better define patient selection.

12

The utility of radiologist-performed intraoperative ultrasound in surgical planning for hepatic metastasectomy. ***S. Wong, L. O'Malley, A. Menard, D. Jalink, S. Nanji*. From Queen's University, Kingston, Ont.**

Radiologist-performed intraoperative ultrasound (IOUS) of the liver offers the advantage of identifying occult lesions or local

invasion that may compromise the curative intent of resection for hepatic metastases. A retrospective analysis of liver resections performed at our institution (2011–2013) demonstrated a change in the surgical plan of approximately 40% with radiologist-performed IOUS. Here, we report the results of a prospective study examining changes in operative plan as a result of radiologist-performed IOUS during hepatic metastasectomy. Patients undergoing liver resection of colorectal (CRC) or neuroendocrine (NET) cancer metastases as of January 2014 were recruited. All patients underwent an MRI and CT scan with standard liver protocol within 2 months of surgery. The preoperative plan was documented by the surgeon before the procedure and reassessed based on intraoperative findings and the results of the IOUS. The frequency and details of the changes to the operative procedure based on IOUS findings were reported. From January 2014 to December 2015, 29 liver resections were performed on 26 patients. Mean age was 63 years. There were 24 resections for CRC metastases and 5 for NET metastases. The mean time from most recent imaging (CT/MRI) to surgery was 18.8 (1–59) days. Of the 29 liver resections, 5 (17%) had a change in operative plan based on IOUS results: 1 had a more extensive resection, 2 underwent radiofrequency ablation of the lesion instead of resection and 2 procedures were aborted. In this prospective series, despite preoperative planning using both CT and MRI, 17% of patients had a change in surgical procedure based on IOUS findings. The lower rate in this study compared with our retrospective series may be explained by the higher use of preoperative MRI (100% v. 25%, respectively).

13

Locoregional hepatic therapies for unresectable and chemorefractory colorectal cancer liver metastases: a systematic review and weighted analysis. ***J. Zuckerman, J. Levy, R. Garfinkle, J. Touchette, T. Vanounou, J.S. Pelletier*. From the Jewish General Hospital, McGill University, Montreal, Que.**

Approximately 50% of patients with colorectal cancer develop synchronous or metachronous liver metastases, of which only 10% to 20% are resectable. The purpose of this analysis was to compare the survival benefit and radiological response of 3 locoregional hepatic therapies, namely conventional transarterial chemoembolization (cTACE), drug-eluting bead transarterial chemoembolization (DEB-TACE) and yttrium-90 radioembolization (Y-90), as salvage therapies for unresectable and chemorefractory colorectal cancer liver metastases (CRCLM). A systematic literature search was conducted on the Embase, Medline, PubMed, Cochrane and Trip databases. Original prospective studies published after January 2000 were selected using strict inclusion and exclusion criteria. Study data were extracted only from studies that reported survival and/or radiological response for patients with unresectable and chemorefractory CRCLM. Studies were qualitatively appraised and estimates of effect were calculated according to the weighted mean of reported survival and radiological response by RECIST criteria. Two independent reviewers screened 3498 studies, 3475 of which were excluded. Twenty-three studies were included and analyzed: 5 cTACE (n = 746), 4 DEB-TACE (n = 212) and 13 Y-90 (n = 631) studies. The weighted average overall survival was longer in the cTACE and DEB-TACE (16.7 and 20.4 months) than in the Y-90 studies (11.0 months) ($p < 0.05$). The proportion of patients with a complete or partial response was 20.8%, 46.0% and 20.9%, respectively, for each locoregional therapy (p = NS). The proportion of patients who showed no evidence of disease progression was 75.1%, 87.8% and 65.2%, respectively (p = NS). According to currently available studies examining locoregional hepatic therapies in a palliative setting, cTACE and DEB-TACE provide a superior survival benefit as compared with Y-90 radioembolization when used as salvage therapy for unresectable and chemorefractory CRCLM. Given the common use of radioembolization in this setting, the significant cost differences between the various treatments, and the results of this study, a more robust prospective comparative trial is warranted.

14

Transfusion rates for pancreaticoduodenectomy — overutilization of a scarce resource. ***D.J. Kagedan, Q. Li, P.J. Karanicolas, A.C. Wei, N. Goyert, C.C. Earle, A. Kiss, J. Hallet, L. Paszat, N. Mittmann, N.G. Coburn*. From the University of Toronto, Toronto, Ont.**

Recent reports of low (6%–10%) perioperative blood transfusion (BT) rates following pancreaticoduodenectomy (PD) imply that minimizing BT is possible at single institutions. This study aims to describe patterns of blood and blood product transfusions occurring in the perioperative PD period across a large population. A retrospective observational cohort study was performed using linked administrative health care databases. Patients undergoing PD between 2005 and 2013 in Ontario (population 13.5 million) at hepatopancreatobiliary (HPB) centres (performing >10 PD/year) were identified, and patients receiving allogeneic transfusions of blood, platelets, plasma and albumin during the operative hospitalization (from admission for surgery until discharge) were identified. Transfusion rates were compared between the HPB centres adjusting for other factors (age, comorbidity, malignancy, neoadjuvant treatment, postoperative morbidity) using logistic regression analysis. In total, 2563 patients underwent PD at 1 of 11 HPB centres. The overall transfusion rate was 41% for blood, 3% for platelets, 12% for plasma and 20% for albumin, with substantial inter-institutional variation (blood, 25%–64%; plasma, 4%–26%; and albumin, 1%–51%) ($p < 0.0001$ for all). Increasing hospital PD volume was associated with decreased rates of BT (38% for hospitals performing >40 PD/year, 41% for 20–39 PD/year and 46% for 10–20 PD/year, p = 0.006). Variation between HPB centres persisted on multivariate analysis; other factors independently associated with likelihood of BT included increasing patient age, female gender, postoperative abdominal drain insertion, reoperation and receipt of neoadjuvant therapy. A temporal trend of decreasing rates of transfusion over the study period was observed (from 47% to 31%, p = 0.002). Of the 11 hospitals examined, 9 achieved decreased rates of BT in 2013 compared with 2005, with 1 achieving an annual transfusion rate below 20%. While rates of transfusion following PD have declined, substantial inter-institutional variation persists. Further efforts are needed to examine the reasons behind variation in transfusion practices to create pathways/guidelines so that transfusions can be minimized.

15

The impact of perioperative red blood cell transfusions in patients undergoing liver resection: a systematic review.

S. Bennett, L.K. Baker, R. Shorr, G. Martel, T.M. Pawlik, D. Fergusson. **From the University of Ottawa, Ottawa, Ont.**

Liver resection is typically performed to remove malignant tumours and is associated with a high proportion of patients receiving blood transfusions. There is a proposed association between perioperative transfusions and increased risk of complications and tumour recurrence. The purpose of this study was to review the evidence of the association between transfusions and postoperative outcomes in adults undergoing liver resection. A search of Medline, Embase, and Cochrane databases to Sept. 15, 2015, included MeSH terms "liver neoplasms," "hepatectomy" and "blood transfusion." Included were clinical trials or observational studies of patients undergoing elective liver resection, with the primary objective of comparing patients who did and did not receive a perioperative red blood cell transfusion. Outcomes were mortality, complications and cancer survival. Excluded were emergency resections and liver transplants. Twenty-two studies, published between 1992 and 2015 and involving 6832 patients, were included. No clinical trials were identified, and no studies were scored as low risk of bias. The overall proportion of patients receiving a transfusion was 38.3%. After multivariate analysis, 1 of 5 studies demonstrated an association between transfusion and increased mortality, 5 of 6 studies demonstrated an association between transfusion and increased postoperative complications, and 10 of 18 studies demonstrated an association between transfusion and decreased cancer survival. This review supports the evidence linking perioperative blood transfusions to negative short- and long-term patient outcomes. The most convincing association was between perioperative transfusion and postoperative complications, with some association demonstrated in long-term cancer outcomes and no convincing association with postoperative mortality.

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Liver resection for colorectal hepatic metastases: an evaluation of long-term disease-free survival and adherence to management recommendations. *M-P. Godbout, J-D. Rousseau, A. Bégin*. **From Sherbrooke University, Sherbrooke, Que.**

Hepatic metastases develop in approximately 50% of patients with colorectal cancer (CRC). Unfortunately, only 10%–20% of those cases are operable. Long-term 3- and 5-year disease-free survival (DFS) rates among patients successfully undergoing hepatic resection for colorectal metastasis are 27% and 20%–25%, respectively. Few studies have assessed the adherence of surgeons to the recommended management interventions for resection of CRC-related hepatic metastases. The purpose of this study was an assessment of quality of medical care at Centre Hospitalier Universitaire de Sherbrooke (CHUS). The primary outcome was to evaluate 3- and 5-year DFS. The secondary outcome was to assess the adherence of hepatobiliary surgeons to 5 quality of care criteria suggested by guidelines in the literature. A monocentric retrospective cohort study with 60 consecutive patients who underwent curative resection of CRC-related hepatic metastases between 2008 and 2012 was performed. The 3- and 5-year DFS rates were 33% and 29%, respectively. Median DFS was 15.3 months. Preoperative imaging was performed on every patient. More than 98% of participants received adjuvant chemotherapy. A negative resection margin was achieved for 88% of interventions, 58% of cases were presented during a tumour board and volumetric analysis (CT scan) was completed for only 8% of participants. Our long-term DFS rates tend toward the higher end range of the literature. Since tumour board presentation and volumetric analysis are recommended interventions for liver resection for colorectal hepatic metastases, an educational reminder designed for hepatobiliary surgeons could be a pertinent tool.

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The "Liver First" approach to synchronous colorectal liver metastases: a first Canadian cohort study. *D. Henault, F. Vandenbroucke-Menu, B. Nguyen, G. Soucy, C. Richard, M. Plasse, A. Roy, M. Dagenais, R. Létourneau, R. Lapointe, S. Turcotte*. **From the University of Montreal, Montreal, Que.**

One in 4 patients with a new diagnosis of colorectal cancer present with synchronous liver metastases (CRLMs). Uncertainty remains regarding the best surgical sequence and the "Liver First" approach may be beneficial for patients with an important metastatic burden. The goal of this study was to evaluate survival and prognostic factors of patients with CRLMs undergoing this surgical treatment. A prospective cohort study was conducted on patients with incidental metastatic colorectal cancer and synchronous CRLMs to the liver only, treated by hepatic surgery first and colorectal surgery second (2011–2015). Overall and disease-free survival and potential predictive factors were calculated with Kaplan–Meier, χ^2 and ANOVA tests. Of the 35 patients included in this study, 29 (82.9%) completed the treatment sequence. The cohort consisted of 22 (62.9%) men, mean age 60 years, and 16 (45.7%) had a rectal cancer. Major hepatic resections (≥3 segments) were performed for 21 (60%) patients and 10 (29%) had >3 CRLMs. Mortality after hepatic surgery was 2.9% and morbidity 31%. Four (11.4%) patients died after a median of 17 (1–47) months and 19 (54.3%) recurred after a median of 8 (4–20) months. The main sites of recurrence were liver only (47.4%), lungs only (10.5%) or both liver and lungs (26.3%). Patients with >3 CRLMs ($p = 0.05$) and with positive hepatic resection margins ($p = 0.03$) were more likely to recur. Patients with good pathological response to chemotherapy (low Blazer or Rubbia-Brandt score) had a trend toward lower recurrence rates ($p = 0.06$ and $p = 0.12$, respectively). The "Liver First" approach is a safe surgical option with a low mortality and morbidity rate. Patients with few CRLMs, negative margins and good response to neoadjuvant chemotherapy appear to benefit most from this surgical strategy. A longer follow-up period is required to draw conclusions on the overall survival of this population.

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Systematic review and meta-analysis of restrictive fluid management in pancreaticoduodenectomy. *B.P. Chen, M. Chen, K. Lemon, S. Bennett, K. Eltawil, R. Mimeault, F.K. Balaa, G. Martel*. **From the University of Ottawa, Ottawa, Ont.**

There is significant interest and controversy surrounding the effect of restrictive perioperative fluid management on outcomes in major gastrointestinal surgery. It is most studied in colorectal surgery, although the literature in pancreaticoduodenectomy

(PD) patients is growing. The aim of this systematic review is to evaluate current evidence for restrictive perioperative fluid management strategies and outcomes for PD. Medline, Embase and Cochrane Library databases from 1946 to January 2016 were searched. A review protocol was used and registered with PROSPERO. Primary papers that evaluated fluid management, including those as part of a clinical pathway, in PD were considered. The primary outcome was postoperative pancreatic fistula (PF). Secondary outcomes included delayed gastric emptying (DGE), complication rate, length of stay (LOS), mortality and readmission. Twelve studies involving 1956 patients were included (2009–2013), of which 4 were randomized controlled trials. Only 4 studies assessed postoperative fluid management, whereas all but 1 study assessed intraoperative fluid management. Fluid restriction was significantly favoured for DGE (odds ratio [OR] = 0.63, 95% CI = 0.45–0.89, p = 0.009), complication rate (OR = 0.74, 95% CI = 0.59–0.94, p = 0.01), LOS (mean difference = –1.11, 95% CI = –2.04 to –0.18, p = 0.02) and 30-day mortality (OR = 0.33, 95% CI = 0.12–0.87, p = 0.03) and was favoured, but not significantly, for PF (OR = 0.75, 95% CI = 0.55–1.02, p = 0.07). There was no difference between groups in terms of readmission rate nor hospital and 90-day mortality. Based on a body of literature consisting mostly of low-quality evidence, perioperative fluid restriction in PD may decrease rates of DGE, complications, 30-day mortality and LOS. More convincing high-quality evidence in the form of prospective randomized trials is warranted for both intra- and post-operative fluid restriction.

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Feasibility and tolerability of extended use of prophylactic low molecular weight heparin following pancreas and liver resection. ***M. Lemke, K. Beyfuss, J. Hallet, N.G. Coburn, C.H.L. Law, P.J. Karanicolas*. From the University of Toronto, Toronto, Ont.**

Patients undergoing major abdominal surgeries for malignancy are at an elevated risk of venous thromboembolism (VTE). Current guidelines call for 28 days of postoperative low molecular weight heparin (LMWH); however, compliance is poor. Institutional barriers that reduce compliance have been reported, but the impact of patient opinions on adherence in this setting is limited. We aimed to assess patient-reported compliance and adherence with extended use of LMWH in the ambulatory setting following discharge from hospital for hepatic and pancreatic resection. An institution-wide policy for routine administration of 28 days of postoperative enoxaparin following hepatic or pancreatic resection at a single centre was implemented in April 2013. Patients having surgery from July 2013 to June 2015 were approached to participate in an interview examining adherence and experience with LMWH. Patients had to correctly identify their date of surgery and recall receiving a prescription for LMWH to be included in the study. There were 100 patients included, 26.0% undergoing pancreas resection and 74.0% liver resection. Only 2.0% of patients did not fill their prescription of enoxaparin, and 81.4% reported perfect compliance. The most frequent reasons for noncompliance were that a health care provider stopped the regimen or because of poor experience with injections. Most patients were able to correctly recall the reason for being prescribed enoxaparin (82.6%), and 78.4% of patients performed all injections themselves. Over half the patients (55.7%) did not find the injections bothersome. Patients reported high compliance and a manageable experience with postoperative enoxaparin in an ambulatory setting following liver or pancreas resection. These findings suggest patient adherence is not a major contributor to poor compliance with current VTE prophylaxis guidelines. More attention should be focused on institutional barriers rather than patient resistance.

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Does giving pasireotide to patients undergoing pancreaticoduodenectomy pay for itself? ***P.E. Serrano, F. Yuan, C. Gu, D. Dath, M. Marcaccio, L. Ruo, V. Tandan, A. Gafni*. From McMaster University, Hamilton, Ont.**

We aimed to evaluate if pasireotide is cost saving or cost neutral given the results of a randomized trial showing that pasireotide following pancreaticoduodenectomy could reduce clinically relevant pancreatic fistula (CRPF) by 49% (95% CI: 0.25–0.95). Clinical and cost data were obtained from a cohort of 279 patients at 2 institutions from 2009 to 2014. Health care utilization and cost of pasireotide were obtained from hospital administrative databases. The cost for patients who did not receive pasireotide (our original cohort) was compared with that for 10 000 simulated cohorts of patients receiving pasireotide (standard dose for 7 days). We simulated these hypothetical cohorts receiving pasireotide by randomly generating an event rate for each cohort based on the distribution of the relative risk from the trial. Cost of 10 000 additional simulated cohorts with the event rate of the trial (20%) was calculated. Costs were summarized and compared using descriptive statistics. With a 7% CRPF rate, the mean total cost for the simulated group was $31 526, and for the group not receiving pasireotide (control) it was $31 526 (2.5%–97.5% quantile difference: –3796 to 4264). The probability of cost savings with the current price of the drug ($1300) was 58%, with a mean total cost savings of $388 (2.5%–97.5% quantile difference: –3796 to 4264). The probability of savings when the proportion of patients who experience an event increases to 20% is 90%, with a mean total cost savings of $3960 (2.5%–97.5% quantile difference: –2497 to 9675). Despite the added cost of the drug in the simulated sample of patients who were given pasireotide, their total cost was similar to that for patients who did not receive pasireotide. At its current price, pasireotide is cost neutral. Cost saving could be achieved by lowering the price of the drug. The likelihood of savings would be greater if the event rate is higher.

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Enhancing patient-centred care in pancreatic cancer surgery: a multinational survey of practices and priorities for patient education. ***E. Walser, J. Hallet, T. Harth, L. Gotlib-Conn, P.J. Karanicolas*. From Sunnybrook Health Sciences Centre, University of Toronto, Toronto, Ont.**

Pancreatic cancer portends a poor prognosis. Curative-intent treatment relies on resection that carries high morbidity. Patient education (PE) is critical in patient-centred care to enhance understanding of disease and therapeutic course, but it is not

standardized. We sought to examine surgeons' perceptions regarding pancreatic cancer surgery PE practices, priorities and potential barriers. We conducted a self-administered web-based survey of North and South American pancreatic surgeons. We developed the questionnaire using a systematic approach of item generation and reduction. We tested face and content validity and reliability. We performed descriptive analyses of responses. The survey was sent along with 2 reminders to the membership of the Americas Hepato-Pancreato-Biliary Association. From a mailing list of 1048, 145 responses were received of which 106 (10.1%) were complete (>80% completion) and analyzed. Most respondents practised in academic centres in the US and Canada. For preoperative PE, treatment options (100%), diagnosis details (96.2%) and postoperative complications (96.1%) were considered very high or high priorities. For postoperative PE, oncological prognosis (88.6%) and adjuvant therapy (95.2%) were considered similarly. Patients' understanding was perceived as very good/good for treatment options (90.1%), diagnosis details (81.8%) and adjuvant therapy (85.1%) but as poor/minimal for oncological prognosis (63.4%) and quality of life (55.4%). The most common reported barriers to PE were time pressure (72.9%), limited patient understanding (66.7%) and lack of dedicated personnel for PE (60.4%). Pancreatic surgeons perceived high understanding of patients regarding their diagnosis and treatment course. This survey identified PE priorities and common barriers to PE that can inform targeted intervention to improve patient-centred surgical care for pancreatic cancer.

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Synoptic versus free-form CT reporting for determination of resectability in periampullary malignancy. ***M. Meschino, H. Marshall, J. Hawel, E. Lau, H. Emmerton-Coughlin, C. Yoshy, D. Wiseman, A. Mujoomdar, R. Hernandez-Alejandro, K. Leslie*. From Western University, London, Ont.**

Despite advances in preoperative imaging for periampullary malignancies (PAMs), up to 25% of patients brought to the operating room (OR) for pancreaticoduodenectomy (PD) are found to be unresectable. This study aimed to determine if standardized reporting of staging CT scans better describes resectability status than free-form reporting. We retrospectively identified 135 patients who had unresectable disease found at laparotomy or who had a margin positive (R1) PD at our institution from 2007 to 2015. Staging CT scans were retrospectively re-reported using a synoptic reporting template and resectability was determined using National Comprehensive Cancer Network (NCCN) guidelines. Eighty-nine (66%) patients were excluded from analysis due to inadequate pancreas protocol (68) or delay between imaging and OR more than 90 days (21). The standardized reporting was compared on a case-by-case basis to the original free-form reports. We then retrospectively compared the preoperative resectability status to surgical outcomes. Of the 46 patients who met inclusion criteria, 6 were deemed resectable, 7 borderline and 33 unresectable. Of the 40 scans flagged as borderline or unresectable, 25 (62.5%) were not identified in the original free-form reports. The most commonly "missed" determinants of resectability in the original free-form reports were as follows: superior mesenteric artery = 8/12 (67%), common hepatic artery = 4/5 (80%), portal vein = 21/21 (100%), superior mesenteric vein = 18/21 (85.7%). Furthermore, only 50% of patients excluded from analysis went on to have further imaging (e.g., MRI). Overall, only 11/135 (8%) were reviewed at multidisciplinary tumour boards. Communication between radiologists and surgeons is vital to the appropriate selection of surgical candidates in PAM. Free-form reports are more likely to omit details important in the determination of resectability status. Formal radiology review in high-volume centres, including assurance of proper imaging protocol, should be considered for all operative candidates with PAMs before surgery.

23

Surgical practice patterns and outcomes in T2 gallbladder cancer in Ontario: a population-based study. ***S. Tharmalingam, J.A. Flemming, H. Ouellette-Kuntz, D. Hurlbut, H. Richardson, S. Nanji*. From Queen's University, Kingston, Ont.**

Gallbladder cancer (GBC) is a lethal malignancy and surgical resection remains the only option for cure. The aim of this study was to evaluate practice patterns and determine the association between the extent of surgical resection and overall survival for T2 GBCs using a population-based data set. All cases of GBC in Ontario who underwent surgical resection from 2002 to 2012 were identified using the population-based Ontario Cancer Registry. Pathology reports were reviewed and those identified as having T2 M0 disease were included in the final cohort. Details on patient demographics and surgical and tumour-related factors were abstracted and data on receipt of adjuvant chemotherapy and radiotherapy were obtained using linked electronic records. The type of surgical resection was classified as extended (cholecystectomy + liver and/or bile duct resection) or simple (cholecystectomy only). Overall survival (OS) was determined using the Kaplan–Meier technique. Adjusted hazard ratios (HR) were generated using Cox regression models. A total of 237 patients who underwent surgical resection for T2 disease were identified and 57/237 (24.1%) received an extended resection. Unadjusted 5-year OS for simple versus extended resections was 39.7% and 49.5% ($p = 0.04$), respectively. In a multivariable Cox regression model, extended resection (HR 0.38, 95% CI 0.16–0.92), low grade of differentiation (HR 0.24, 95% CI 0.08–0.75), negative margin status (HR 0.44, 95% CI 0.24–0.82) and absence of lympho-vascular invasion (HR 0.45, 95% CI 0.24–0.85) were independently associated with improved survival. Compared with simple cholecystectomy, extended resection is associated with improved overall survival in T2 GBC. Use of extended resection in T2 GBC remains suboptimal in Ontario.

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Cost analysis of robot-assisted choledochotomy and common bile duct exploration as an option for complex choledocholithiasis. ***A. Almamar, H. Emmerton-Coughlin, N. Alkhamesi, C.M. Schlachta*. From Western University and Canadian Surgical Technologies and Advanced Robotics (CSTAR), London, Ont.**

The aim of this study is to evaluate the clinical outcomes and cost-effectiveness of elective, robot-assisted choledochotomy and common bile duct exploration (RCD/CBDE) compared with open surgery for endoscopic retrograde cholangiopancreatography (ERCP)

refractory choledocholithiasis. A prospective database of all RCD/CBDE has been maintained since our first procedure in 2006. This database was compared with all contemporaneous elective open procedures (OCD/CBDE) performed since 2005. Emergency procedures were excluded from analysis. Cost analysis was calculated using a micro-costing approach. Outcomes were analyzed on the basis of intent to treat. Since 2005, 71 cases of elective CD/CBDE were performed in our institution, comprising 44 consecutive, unselected RCD/CBDE and 27 OCD/CBDE. Comparing RCD/CBDE to OCD/CBDE there were no significant differences between groups with respect to age (65 ± 20 years v. 67 ± 18 years, $p = 0.09$), gender (M14:F30 v. M16:F25, $p = 0.39$), ASA class, comorbidities, reason for failed ERCP or incidence of prior cholecystectomy. The mean duration of surgery for RCD/CBDE was 31 minutes longer than for OCD/CBDE (205 ±70 minutes v. 174 ± 73 minutes, $p = 0.08$). Conversion to laparotomy was performed in 6 (15%). Postoperative complications were significantly reduced with RCD/CBDE (22% v. 56%, $p = 0.002$). Median hospital stay was reduced by 6 days with RCD/CBDE (4 v. 10 days, $p = 0.02$). The average operating room cost for RCD/CBDE was C$4725 compared with C$2359 for OCD/CBDE, while the average cost of postoperative hospital stay was C$3724.88 compared with C$9312.2, respectively. The net overall hospital cost for RCD/CBDE was lower (C$8449.88 v. C$11 671.2). The use of robotic-assisted CD/CBDE resulted in longer operating time and increased operating room cost, but significantly reduced complications, length of hospital stay and overall cost. For patients requiring surgical intervention for choledocholithiasis refractory to ERCP, robotic-assisted choledochotomy and common duct exploration improved patient outcomes with a net cost savings for the hospital.

25

Retrospective analysis of LI-RADS observations: correlation with clinical and pathological outcomes. ***E.S. Tang*, *G. Hall*, *A. Menard*, *S. Nanji*. From Queen's University, Kingston, Ont.**

The Liver Imaging Reporting and Data System (LI-RADS) classification was developed to characterize observations based on their risk of hepatocellular carcinoma (HCC) in high-risk individuals. To date there is only 1 study estimating the risk of HCC in each category. To this end we sought to characterize the risk of HCC for each LI-RADS category and to see if other clinical markers could be used to stratify risk in the intermediate groups. We present here our interim analysis. We performed a retrospective chart review of patients at risk for HCC. The Montage program was used to search the radiology database at Kingston General Hospital for CT or MRI studies including the following keywords: (cirrhosis and lesion)|(cirrhosis and mass)|(cirrhosis and nodule)|(cirrhosis and observation). Evaluation was limited to patients with 2 or more eligible studies for a total of 637 patients. Cases were screened by 2 authors (ET, GH) to ensure patients were eligible for inclusion (i.e., at risk for HCC) and had radiographic observations suitable to follow, for a total of 112 patients. These were then reviewed by a staff radiologist (AM) to assign a final LI-RADS category and radiographic outcome. Chart review has been completed for 26 cases thus far. Of these we identified 5 LR-5 category lesions, 100% of which were confirmed HCC. In contrast, 42.86% of LR-4 lesions were ultimately HCC ($n = 7$, mean time to progression 87.67 days). LR-3 lesions had a progression rate of 66.67% ($n = 12$, mean time to progression 211.2 days). Of the non-HCC lesions, 2 were artifactual and did not appear on subsequent imaging. These values currently do not match those previously published, probably a reflection of the sample size. Continued accrual is required before solid conclusions can be drawn.

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Predictors of morbidity and mortality after hepatectomy at a Saudi tertiary centre: a retrospective study. ***F. Al-alem*, *R.E. Mattar*, *O. Fadl*, *A. Alsharabi*, *F. Alsaif*, *M. Hassanain*. From the Department of Surgery, King Saud University, Riyadh, Saudi Arabia; and the Department of Oncology, McGill University Health Centre, Montreal, Que.**

Hepatic resection is performed for various indications and with increasing frequency. Mortality rates after hepatectomy have declined to <2.5%. Despite favourable survival outcomes, hepatectomy remains a major surgery with significant perioperative risks requiring a specialized setup. Our institution has recently invested in building a specialized hepato-pancreatico-biliary (HPB) unit. Data regarding outcomes of hepatectomy in Saudi Arabia are scarce. We report our rates of morbidity and mortality following hepatectomy and the predicting factors as a case study for new HPB units. Data were collected prospectively from our HPB database on liver resections performed between 2006 and 2014. Primary outcomes were postoperative morbidity (measured via the Clavien–Dindo score) and 90-day mortality. Secondary outcomes were predictors of postoperative morbidity and mortality. A total of 77 resections were retrieved; 55 (71.4%) were for a malignant etiology, mainly colorectal liver metastases (35, 45.45%) and hepatocellular carcinoma (11, 14.29%). Patients' median age was 49 years. Forty-five resections were major (i.e., ≥3 segments), with a mean operative time of 5.28 hours. Complications developed following 30 (38.96%) resections, with the majority being Clavien grades I–III. Factors correlating with morbidity on a univariate analysis were the total bilirubin level preoperatively, operative time, extent of resection (i.e., major v. minor), use of epidural anesthesia, and postoperative liver dysfunction. On a multivariate analysis, the Schindl liver dysfunction score showed the strongest correlation ($p = 0.006$). Ninety-day postoperative mortality was 5.19% (4 patients); 3 fulfilled the 50:50 liver dysfunction criteria. Significant predictors were concurrent intra-abdominal surgery, postoperative liver dysfunction and the development of multiple complications. The database has enabled us to benchmark our outcomes with published data and assure the care providers that we have achieved acceptable rates of both morbidity and mortality after hepatectomy, which we believe to be a major tool for starting HPB units.

28

Impact of intraoperative fluid administration on postoperative complications following pancreaticoduodenectomy. ***K. Lemon*, *K. Eltawil*, *B. Chen*, *M. Paquin-Gobeil*, *F. Balaa*, *R. Mimeault*, *G. Martel*. From the University of Ottawa, the Ottawa Hospital, Ottawa, Ont.**

Perioperative intravenous fluid restriction has been shown to reduce postoperative complications in studies, the majority of which have

been based in the colorectal surgery literature. Given that pancreaticoduodenectomy (PD) is associated with high morbidity, the role of fluid restriction in PD warrants investigation. The aim of this study was to examine the relationship between intraoperative fluid administration and postoperative complications. Between 2009 and 2015, 155 patients underwent PD at our institution and were included in this retrospective study. Patient demographics, data on intraoperative fluid administration, operative details and postoperative complications (wound infection, pancreatic leak, delayed gastric emptying [DGE], urinary tract infection [UTI], pneumonia, ileus, abscess, acute kidney injury [AKI], venous thromboembolism and cardiovascular complications) were collected and predictors of postoperative complications were assessed. The total intraoperative fluid administered (median) in this cohort was 2650 mL and the fluid rate was 8.97 mL/min. Based on this, the cohort was divided into groups, those with a fluid value greater than the median and those with a value less than the median. The higher intraoperative fluid rate cohort was found to have a greater rate of cardiovascular complications (12.9% v. 1.6%, $p = 0.03$). However, the greater total intraoperative fluid cohort did not have an overall increased rate of complications when compared with the lower cohort (40% v. 36%, respectively, $p = 0.62$) on both univariate and multivariate analysis. When the intraoperative fluid balance was analyzed, there was a trend toward significance in relation to overall pancreatic leak (42.9% v. 29.1%, $p = 0.131$). This trend disappeared when specifically grade B/C leaks were analyzed. Based on these results, greater intraoperative fluid administration does not appear to be associated with an increased risk of postoperative complications, with the exception of cardiovascular complications. Prospective trials focusing on fluid resuscitation and goal directed therapy are required to study this issue further.

29

The Ottawa criteria for the appropriate use of perioperative blood transfusions in liver resection: using the RAND/UCLA Appropriateness Method. ***S. Bennett, D. Fergusson, A. Tinmouth, D. McIsaac, T.M. Pawlik, P. Hebert, L. McIntyre, P. Karanicolas, J. Barkun, A. Turgeon-Fournier, G. Martel.*** **From the University of Ottawa, Ottawa, Ont.**

Liver resection is associated with a high prevalence of blood transfusions. A transfusion has the potential to be a life-saving intervention in the appropriate patient, but it is associated with important adverse effects. Given the prevalence of transfusions, their potential for great benefit and harm, and the difficulty in conducting clinical trials, this topic is well suited for a study of appropriateness. Appropriateness studies aim to determine the indications for which expected health benefits of an intervention exceed expected negative consequences. This study was conducted using the RAND/UCLA Appropriateness Method. An international, multidisciplinary panel of experts in hepatobiliary surgery, anesthesia, transfusion medicine and critical care were identified. The panellists were sent a recently conducted systematic review on the topic and asked to rate a series of 468 intraoperative and postoperative scenarios for the appropriateness of a blood transfusion. The scenarios were rated in 2 stages: by each individually, followed by an in-person moderated panel session. The panelists rated 47.6% of the scenarios as appropriate, 28.2% as inappropriate and 24.1% as uncertain. Of the scenarios with an intraoperative hemoglobin <75 g/L, 98.6% were rated as appropriate. No scenarios with an intraoperative hemoglobin >95 g/L or postoperative hemoglobin >85 g/L were rated as appropriate. No scenarios with intraoperative ST changes were rated as inappropriate. Of the 36 postoperative scenarios featuring a hemoglobin of 75 g/L, 58.3% were rated as appropriate. Factors leading to a rating of inappropriate included no history of coronary artery disease, normal hemodynamic status and good postoperative functional status. Patient age and hemoglobin drop did not appear to affect the rating significantly. Based on the best available evidence and expert opinion, criteria for the appropriate use of perioperative blood transfusions in liver resection have been developed. This provides clinical guidance for scenarios where a transfusion is clearly appropriate, for those where it is clearly inappropriate and for those that are equivocal.

30

Basing optimal management of non-functional pancreatic neuroendocrine tumours on lesion size: a retrospective review. ***K. Lemon, A. Jarrar, M. Ogaick, M. Paquin-Gobeil, F. Balaa, R. Mimeault, G. Martel.*** **From the University of Ottawa, Ottawa, Ont.**

Small non-functional pancreatic neuroendocrine tumours (PNETs) may harbour malignant potential, and management by observation alone is controversial. In this study, we aimed to determine a specific lesion size where observation alone is a safe practice based on our institution's experience. Over 14 years (2002–2016) 157 individuals were identified with PNETs using the Canadian Classification of Health Interventions codes (CCI) and chart reviews at our institution. Of these 157 patients, 85 (54%) were found to meet inclusion criteria and were entered into the analysis. Demographics, comorbidities, diagnosis, management and recurrence data were analyzed. Using a composite variable consisting of the presence/development of lymphadenopathy and the presence/development of metastases, we constructed a receiver operating characteristic (ROC) curve using the maximum Youden index to determine a size that maximized our sensitivity and specificity for determining the presence or absence of our composite variable. Of the 85 patients in this cohort, 41 (48%) underwent surgery at diagnosis and 44 (51%) were observed. The ROC cut point was found to be 2.3 cm. However, on further analysis, 3 (3.5%) patients were found to have tumours smaller than this point (0.5, 1.6 and 1.7 cm) and still have the presence of the composite variable. All 3 of these patients were found to have the composite variable at presentation (lymphadenopathy = 2, metastases = 1). There have been several publications over the past few years that have proposed different sizes, from 1–3 cm, below which PNETs are safe to observe. Based on our analysis, in order to maximize accuracy (i.e., maximum specificity and sensitivity) a size cut-off of 2.3 cm could be used. However, as in our cohort, this value does not guarantee 100% specificity and therefore a percentage of malignant PNETs will be missed. Further prospective studies are needed to determine a definitive size cut-off.

34

Evaluation of chemotherapeutic regimens in 3D tissue culture of pancreatic adenocarcinoma. ***A.C. Istl, B. Shrum, V.C. McAlister.*** **From Western University, London, Ont.**

Chemotherapy can improve near-term mortality and morbidity in patients with pancreatic adenocarcinoma (PA). Currently there are multiple chemotherapy regimens being used for PA. Three-dimensional tissue culture (3DTC) is a validated in vitro model for measuring tumour growth and has been shown to be more reflective of in vivo conditions compared with 2DTC. We have used 3DTC to evaluate the effects of chemotherapeutic agents on PA. Panc-1 cells were grown in 3DTC in supplemented Matrigel media with Category 1 and 2a recommended chemotherapeutic regimens. Novel adjuvants were added to overcome resistance. The experiments were also performed in 2DTC. Growth was monitored over 3 days with measurements and digital micrographs. An acid phosphatase (AP) assay was conducted to evaluate cell viability at 72 hours. Tissue samples were processed for markers of cell cycle progression (Ki-67) and apoptosis (active caspase-3). There was a significant effect of culture type on outcome across treatments ($p < 0.001$). Cell viability as measured by AP activity was significantly decreased in all 2D treatment groups compared with control ($p < 0.001$). In 3DTC, cell viability was significantly decreased ($p < 0.01$) in all treatment groups except gemcitabine, gemcitabine/cisplatin and FOLFIRINOX ($p > 0.05$). The most appreciable difference was seen after treatment with tacrolimus/5-FU (63.79% ± 6.7%). This pilot study demonstrates that Panc-1 spheroids can be grown in 3DTC for high through-put screening of chemotherapeutic agents and may be used to investigate new agents or combined therapies. The response of Panc-1 cells to chemotherapeutics in 3DTC is less robust than those seen in 2DTC, which better reflects in vivo conditions.

Canadian Hernia Society

01

Effect of aerobic training on postoperative fatigue syndrome in patients undergoing Shouldice hernia repair and the relationship with postoperative disability. *D. Suarez, F. Palacios, J. Ocadiz, G. Mendez*. From the Mexican Heath Care Institution, Guanajuato University, Leon, Guanajuato, Mexico

Postoperative hernioplasty disability relates to fatigue and to physiologic changes during surgery. More than 30% of patients undergoing surgery present with postoperative fatigue syndrome (PFS) characterized by decreased muscle strength and an increased subjective feeling of fatigue, up to 30 days. Exercise improves PFS, modifying the metabolic response to trauma and increasing the functional capacity of the cardiovascular and muscular systems, which reduces the PFS, producing less disability and better postoperative recovery. Randomized groups of 10 patients undergoing Shouldice inguinal hernia repair were created. Group I was the control group; participants in group II were assigned to undertake aerobic exercise for 12 weeks, walking on a treadmill and pedalling a bike to 75% of their maximum oxygen consumption (VO2 max) and 90% of their maximum heart rate (MHR) in 50-minute sessions, 3 times per week. The variables were as follows: weight, percent body fat, skinfold thickness, maximum cardiovascular capacity (VO2), resting heart rate, peak systolic blood pressure (SBP) and diastolic blood pressure (DBP), hand grip, hematocrit, fatigue scale (Christensen), glucose VO2 and lactate VO2. Participants in group II increased their VO2 max, decreased their resting heart rate (FCR), decreased their SBP and decreased DBP. In group I, VO2 max decreased, FCR increased and SBP and DBP did not change. Hand grip increased in group II and decreased in group I. Fatigue was eliminated in group II until 30 days postoperatively. Group I showed moderately severe fatigue from the beginning to the end. VO2 max increased 11.8% in group II and decreased 5.1 % in group I (Christensen). Only minor changes were observed, but these were seen with only 10 days of training. The model with hernia patients proved feasible. It proved to be a useful tool to reduce the SFP and consequently the participants experienced a better recovery with fewer days of disability.

02

A prospective, randomized, controlled study to compare transfascial sutures and fibrin sealant for mesh fixation during the Rives–Stoppa technique for ventral hernia repair. *D. Suarez, J. Ocadiz, G. Mendez*. From the Mexican Health Care Institute, Leon, Guanajuato, Mexico

Hernia surgical techniques have advanced, but correction of ventral hernias is still associated with high complication rates and recurrences. We compared postoperative outcomes following the use of transfascial sutures (TS) versus fibrin sealant (FS) for mesh fixation during ventral hernia repair. This was a randomized, single-blind, single-centre study. Patients underwent ventral hernia repair (Rives–Stoppa technique) with polypropylene mesh and were randomized to mesh fixation using TS or FS. Intraoperative outcomes included type of anesthesia, drain type, antibiotic use and length of hospital stay. Postoperative complications were assessed after 15 days, 1 and 6 months, and 1 and 2 years. Ninety-two patients were evaluated (TS, n = 50; FS, n = 42). The mean defect size was similar between groups (TS = 107.7 cm^2; FS = 87.4 cm^2; p = 0.490). Regional anesthesia was used most commonly (TS = 68.0%; FS = 69.0%). More patients in the TS group required a drain (88.0% v. 61.9%; p = 0.003) and there was a trend toward more antibiotic use (TS = 74.0%; FS = 54.8%; p = 0.054). Length of hospital stay was similar between groups (~1.3 days), but more patients in the FS group required only ambulatory care (TS, n = 1; FS, n = 12; p < 0.001). Complications were significantly more frequent in the TS than FS group at 1 month (44.0% v. 2.4%; p < 0.001) and numerically more common at all other time points assessed. Recurrences appeared to be more common in the TS group 2 years after surgery (10.0% v. 2.4%; p = 0.214). These results support the use of FS for mesh fixation during open ventral hernia repair, as an alternative to TS.

03

Onlay mesh repair of incisional hernia. *S. Malakar*. From BMRI Hospital, Bhubaneswar, India.

Incisional hernias are iatrogenic and form 80% of all ventral hernias. They occur through an operative scar following laparotomies. It is established that 2%–11% of all patients undergoing laparotomies will develop incisional hernias. The incidence increases in the presence of adverse factors such as diabetes, wound infection, obesity and hypoproteinemia. Conventional repair is not rewarding. Incisional hernial repair has been done through various conventional methods including anatomic repair, onlay mesh repair, inlay mesh repair and sublay mesh repair and laparoscopically by preperitoneal and intraperitoneal methods. A retrospective study of onlay repair cases from October 2000 to January 2010 was done among patients aged 30–70 years with polypropylene mesh being placed over the anterior rectus sheath covering the hernial defect and below the subcutaneous plane. A suction drain was placed anterior to the mesh. The duration of surgery lasted from 60 to 90 minutes. In all, 50 patients were included (40 female and 10 males). The surgeries for women were gynecological operations with vertical infraumbilical midline incisions that included tubectomy, abdominal hysterectomy and Caesarean section; the surgeries for men were for appendicectomy and intestinal obstruction. The mesh was fixed with 2–0 polypropylene suture to the rectus sheath, ensuring that the mesh overlapped the hernial defect on all sides by 5 cm. In 40 cases, dermolipectomy was done. Postoperative hospital stay varied from 7 to 14 days. Our study showed about 5 recurrences (10.0%) out of 50 cases of onlay incisional hernia repair. Within the limitations of our study we conclude that onlay repair yields a lower recurrence rate and is easy, less time consuming, relatively less expensive and preferable among elderly patients with other comorbidities. Therefore, it seems to be an ideal choice for all incisional hernia repairs.

05

A window into the mind: preliminary steps toward understanding expert decision-making in caring for patients with inguinal hernias. ***M. AlRowais, A. Madani, Y. Watanabe, M. AlMabroos, E. Bilgic, L.S. Feldman, M.C. Vassiliou.*** **From the McGill University Health Centre, Montreal, Que.**

Expert surgeons make decisions about patient care by drawing on a complex network of knowledge and skills around a clinical entity. The richness of this mental representation and application of this information is what defines expertise. The purpose of this preliminary study was to develop a methodology for enhancing our understanding of the mental representations of surgeons at various levels of training when they care for patients with inguinal hernias. This was a qualitative study using semi-structured interviews based on a patient with an inguinal hernia including 2 short video clips of a laparoscopic total extraperitoneal (TEP) inguinal hernia repair. The questions centred around management of the patient and comments about the videos, including recommendations the participants might have for the surgeon. Participants included 2 attending surgeons who perform hernia surgery and 9 surgical residents. All interviews were videorecorded and transcribed. Surgeons used very specific, focused and practical language. They were quickly oriented to the operative field and were concrete in their recommendations. They demonstrated evidence of a robust cognitive structure also rich in readily accessible content. Senior residents used language that seemed directly out of a textbook. They were less oriented to the surgical field, and they used vague terms and general principles. As a group they had a structured approach to the patient with clear gaps in content. Junior residents tended to focus more on the history and detailed physical exam. They were not able to orient to the procedure or make any suggestions. They seemed to have an incomplete cognitive structure in addition to content lacunas. This preliminary analysis provided some insight into how we might better understand the mental representations of surgeons caring for patients with inguinal hernias. This method may allow us to identify gaps in knowledge and how it is organized and applied that may inform future curricula or assessment strategies.

06

Reoperation for inguinal hernia recurrence in Ontario: a population-based study. ***J.K. Ramjist, D.R. Urbach, T.A. Stukel, L. Fu, N.N. Baxter.*** **From the University of Toronto, Toronto, Ont.**

Although inguinal hernia repair (IHR) is a common procedure, there is no consensus on which type of repair offers the lowest rate of hernia recurrence in practice. The objective of this study was to compare the rate of repair of recurrent inguinal hernia after 3 common surgical approaches. We conducted a population-based retrospective cohort study, using administrative data including adult patients in Ontario, Canada, undergoing primary IHR from Apr. 1, 2003, to Dec. 31, 2012, followed to Aug. 31, 2014. Surgeries were open repair with prosthetic mesh, open repair without prosthetic mesh or laparoscopic repair. The main outcome and measure was reoperation for recurrent IHR with covariate adjustment using Cox proportional hazards modelling. We identified 109 106 adults undergoing primary IHR (73.2% open with mesh, 14.3% open without mesh, 12.5% laparoscopic) with a 5.6-year median follow-up. The 5-year cumulative risk of recurrent IHR was 1.7% in the open with mesh group, 3.2% in the open without mesh group and 3.0% in the laparoscopic group. After adjusting for patient, surgeon and institution factors, as compared with patients undergoing open repair with mesh, those undergoing laparoscopic repair or open repair without mesh had a higher risk of recurrent IHR (hazard ratio 1.88, 95% CI, 1.61–2.20, and 1.53, 95% CI, 1.33–1.77, respectively, $p < 0.001$ for both comparisons). Restricting our population to patients undergoing primary IHR by a surgeon performing >25 procedure-specific repairs in the previous year, those undergoing laparoscopic repair or open repair without mesh still had a higher risk of recurrent IHR (hazard ratio 2.07, 95% CI, 1.41–3.06, and 2.60, 95% CI, 1.77–3.82, respectively, $p < 0.001$ for both comparisons). In common practice, patients undergoing primary IHR repair performed using an open technique with prosthetic mesh have a lower rate of reoperation for recurrent IHR than those undergoing repair with laparoscopic or open without mesh techniques.

07

Review of postoperative use of routine contrast study in laparoscopic paraesophageal hernia repair. ***S.R. Prasad, C. Robertson-Moore, E. Debru, R. Gill, N. Church, P. Mitchell.*** **From the University of Calgary, Calgary, Alta.**

Laparoscopic paraesophageal hernia repairs can be performed with minimal postoperative complications in the current era by appropriately trained surgeons. There is conflicting evidence with regard to the routine use of contrast studies to detect complications in the early postoperative period. We sought to audit our current practice to evaluate the detection rates of routine contrast studies in laparoscopic paraesophageal hernia repairs. A retrospective review was performed of water-soluble contrast studies performed in the immediate postoperative period of 391 patients undergoing laparoscopic paraesophageal hernia repair from January 2007 to September 2015. Descriptive cohort data, intraoperative findings and repair types, postoperative radiological reports, length of admission, reoperation rates and complication rates were recorded. There were 280 (72%) female to 111 (28%) male patients ranging from ages 25 to 91 years. There were 364 (93%) elective and 27 (7%) acute procedures. The paraesophageal hernia were classified into 360 (92%) large and 31 (8%) small based on intraoperative findings. The anti-reflux fundoplication in the majority of the cases was of anterior 180 degree (87%), full 360 degree (11%), posterior 180 degree (1%) and gastropexy (1%). The contrast studies were performed the day after the paraesophageal hernia repair. Seventy-one per cent of the studies were reported as completely normal, with 28% showing holdup of contrast of various degrees that did not change clinical management. There were 7 (<2%) reoperations. Only 3 studies (0.7%) that detected early recurrences changed management and led to reoperations. Two other reoperations for recurrence were not detected by routine contrast studies. The other 2 reoperations were for gastric leak and esophageal leak where clinical signs changed management. This review demonstrates a very low rate of detection of complications by routine postoperative contrast studies in laparoscopic paraesophageal hernia repairs that changes management. The routine use of contrast may not be warranted.

Canadian Society of Colon and Rectal Surgeons

06

Modified 2-stage ileal pouch-anal anastomosis results in lower rate of anastomotic leak compared with traditional 2-stage surgery for ulcerative colitis. ***E. Zittan, N. Wong-Chong, G. Ma, R. S. McLeod, M.S. Silverberg, Z. Cohen*. From University of Toronto, Toronto, Ont.**

There is a paucity of evidence in ulcerative colitis (UC) comparing the traditional 2-stage (total proctocolectomy with ileal pouch-anal anastomosis [IPAA] and diverting ileostomy, followed by ileostomy closure) versus the modified 2-stage restorative proctocolectomy (subtotal colectomy with end ileostomy, followed by completion proctectomy and IPAA, without diverting ileostomy). This study examines the risk of anastomotic leak following IPAA in traditional versus modified 2-stage IPAA for UC patients. This was a single-institution, retrospective study of all UC patients who underwent a traditional or modified 2-stage IPAA between 2002 and 2013. The primary outcome was anastomotic leak following IPAA. A total of 460 patients had a 2-stage IPAA procedure; 223 (48.5%) patients underwent traditional 2-stage IPAA and 237 (51.5%) patients received the modified 2-stage procedure. There was more preoperative enteral corticosteroid use (44.7% v. 33.2%, $p = 0.04$) before the first surgery in the modified 2-stage group compared with the traditional 2-stage group. The modified 2-stage group had higher UC disease severity at presentation (86.9% patients with moderate/severe UC v. 73.1%, $p < 0.01$). However, the modified 2-stage group had a lower rate of anastomotic leak following IPAA (4.6% v. 15.7%, $p < 0.01$) and was associated with a lower risk of anastomotic leak on univariate (OR 0.26, 95% CI, 0.13–0.52) and multivariate analysis (OR 0.27, 95% CI, 0.12–0.57). Patients with ulcerative colitis who received the modified 2-stage IPAA had a significantly lower rate of anastomotic leak following pouch creation, compared with the traditional 2-stage procedure.

07

A comparison of early postoperative outcomes between fecal immunochemical test (FIT)-screened and symptomatic patients undergoing surgery for colorectal cancer. ***S. Khorasani, J.J. Telford, M. Khorasani, C.J. Brown, A.A. Karimuddin, P.T. Phang, M.J. Raval*. From the University of British Columbia, Vancouver, B.C.**

Fecal immunochemical testing (FIT) outperforms the traditional guaiac-based fecal occult blood test but the impact of FIT-based screening on early postoperative morbidity and mortality in patients undergoing surgery for colorectal cancer (CRC) has not been studied. We compared hospital length of stay (LOS), postoperative morbidity and 30-day mortality between patients undergoing colonoscopy for positive FIT and to investigate symptoms (SYMP). The prospectively maintained Colorectal Cancer Database at our institution was queried to identify patients with surgically resected CRC from November 2013 to April 2015 and divided into FIT or SYMP groups by indication for colonoscopy. Patients with inflammatory bowel disease or at high risk for CRC were excluded. A total of 191 patients were identified (59 FIT, 132 SYMP). FIT patients had significantly earlier stage CRC (stage I/II/III/IV = 48%/22%/28%/2% FIT v. 25%/30%/36%/9% SYMP, $p = 0.013$) despite being older (68 [28–91] v. 64 [30–92] years, $p = 0.02$). Gender, ASA score, BMI and Charlson-Deyo comorbidity index were similar. There was no statistically significant difference in LOS (8.9 days (3–179) FIT v. 12.2 days (3–39) SYMP, $p = 0.198$). There was a trend toward lower overall 30-day postoperative morbidity (myocardial infarction, venous thromboembolism, surgical site infection, anastomotic leak) in the FIT group (46% v. 36%, $p = 0.08$). Mortality was not statistically different (0% FIT, 4% SYMP, $p = 0.13$). There were significantly more right hemicolectomies (34% v. 16%, $p = 0.005$) and shorter length of operation in the FIT group (132 v. 161 minutes, $p = 0.001$). We did not find statistically significant differences in our outcomes of interest, though FIT patients had clinically meaningful improvements in LOS and early postoperative morbidity and mortality. Lack of statistical significance may be explained by the finding in chart review that some FIT patients may actually have had symptoms on directed history. Importantly, statistically significant earlier stage at diagnosis in the FIT group may result in improved oncologic outcomes over the SYMP group.

08

Optimal timing of the first surveillance colonoscopy following curative resection for colorectal carcinoma. ***N. Alhassan, J. Lie, N. Trabulsi, A. Farsi, N. Morin, C.A. Vasilevsky, P.H. Gordon, M. Boutros*. From the Jewish General Hospital, McGill University, Montreal, Que.**

The American Society of Colon and Rectal Surgeons recommends first postoperative colonoscopy following curative colorectal carcinoma resection at 1 year while the Canadian Association of Gastroenterology recommends it at 3 years. The aim of this study was to determine the significant polyp detection rate at the first surveillance colonoscopy and the optimal timing of this colonoscopy. After institutional review board approval, we conducted a retrospective review of all colorectal carcinoma resections with a curative intent performed at our institution from 2007 to 2012. Only patients who had a complete preoperative colonoscopy, underwent elective curative resection and had at least 1 complete postoperative colonoscopy were included. Colonoscopic findings were classified as normal, nonsignificant polyps, significant polyps and recurrences. Among 857 patients identified during study period, 181 met our inclusion criteria. The mean age of patients was 67.2 (±10.72) years and 53% were male. There were 36.4%, 30.1% and 33.5% patients with stage I, II and III disease, respectively. With regards to timing of colonoscopy, 25.9%, 48.1%, 14.4%, 8.8% and 2.8% of patients underwent their first surveillance colonoscopy at postoperative year 1, 2, 3, 4 and 5, respectively. Overall all-polyp detection rate was 30.1%: 21.3% for the first postoperative year, 33.3% for the second and 34.6% for the third postoperative year. The overall

significant-polyp detection rate was 10.5%: 12.8% for the first postoperative year, 8% for the second and 7.7% for the third postoperative year. Two recurrences were reported, 1 in the first and another 1 in the third postoperative year. In this study population, the significant polyp detection rate was highest for the first postoperative surveillance colonoscopies performed at 1 year. Fifteen per cent of patients were found to have significant polyps or recurrence at this time interval. Thus, surveillance colonoscopy at 1 year after colorectal cancer resection is prudent.

09

The impact of mechanical bowel preparation on colon cancer recurrence and mortality following right hemicolectomy. ***A. Gosselin-Tardif, M. Trépanier, M. Demian, U. Bender, M. Boutros, R. Hazan, J. Faria, N. Morin, G. Ghitulescu.*** **From the Jewish General Hospital, McGill University, Montreal, Que.**

A recent follow-up analysis of a Swedish multicentre randomized trial demonstrated significantly improved cancer-specific survival in patients who received mechanical bowel preparation before a right hemicolectomy for colon cancer compared with those who had not. The present study was conducted to assess the impact of mechanical bowel preparation on cancer recurrence, overall mortality and cancer-specific mortality in patients undergoing right hemicolectomy. After institutional review board approval, the provincial cancer registry and patient medical records were retrospectively reviewed to identify all patients who underwent an elective right hemicolectomy for colon cancer at 2 hospitals between 2006 and 2014. Primary outcomes were cancer recurrence, overall mortality and cancer-specific mortality. Secondary outcomes included anastomotic leak and wound infection. Patients with ASA >IV, stage IV colon cancer and mortality ≤30 days postoperatively were excluded. Cox proportional hazard models were used. Of 427 patients who met the inclusion criteria, 208 patients (48.7%) received mechanical bowel preparation. Overall mean age was 73 ± 10.5 years and 44.9% of patients were male. Mean follow-up was 3.3 ± 1.9 years. On univariate analysis, patients who received mechanical bowel preparation had significantly longer follow-up (4.0 v. 2.6 years, $p < 0.0001$) and fewer laparoscopic hemicolectomies (18.8% v. 68.5%, $p < 0.0001$). There was no significant difference in wound infection (6.3% v. 4.6%, $p = 0.44$) and anastomotic leak (0.5% v. 1.8%, $p = 0.37$) rates. On Cox regression, mechanical bowel preparation was not a significant predictor of time to recurrence (HR 0.85, 95% CI 0.49–1.48), all-cause mortality (HR 2.06, 95% CI 0.47–4.48) or cancer-specific mortality (HR 1.80, 95% CI 0.63–5.16). This study suggests that mechanical bowel preparation before elective right hemicolectomy for colon cancer does not impact long-term oncologic outcomes.

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Outcomes of laparoscopic versus open total abdominal colectomy for Crohn's disease: an ACS-NSQIP analysis. ***R. Adessky, J. Abou Khalil, N. Morin, C.A. Vasilevsky, P.H. Gordon, G. Ghitulescu, M. Demian, M. Boutros.*** **From the Jewish General Hospital, McGill University, Montreal, Que.**

Laparoscopy is increasingly used in the management of Crohn's disease, supported by evidence that it decreases length of hospital stay and minor complications. To date, studies have predominantly included ileocolic resections, with little data on laparoscopic total abdominal colectomies (TAC) for Crohn's disease. The aim of this study was to examine the impact of a laparoscopic approach on short-term outcomes following TAC for Crohn's disease. After institutional review board approval, patients with Crohn's disease who underwent elective TACs between 2005 and 2013 were identified from the American College of Surgeons National Surgical Quality Improvement Program database. The main outcomes of interest were length of postoperative hospital stay, operative time, intraoperative blood transfusions, superficial surgical site infections, major morbidity and 30-day mortality. Multivariate linear and quantile regression were used. Of 954 TACs performed in patients with Crohn's disease, a laparoscopic approach was used for 358 (37.5%). Patients undergoing laparoscopy were younger (40.6 v. 46.9 years, $p < 0.0001$) and more likely to be Caucasian ($p = 0.009$). Patients who had a laparoscopic colectomy were more likely to be on steroids (56.7% v. 46.8%, $p = 0.003$) and less likely to be hypertensive (15.1% v. 24.7%, $p < 0.0001$), diabetic (5.0% v. 8.9%, $p = 0.028$) or functionally dependent (1.7% v. 4.4%, $p = 0.026$). On multivariate regression, laparoscopy was associated with a lower rate of superficial surgical site infections (OR = 0.425, 95% CI: 0.248–0.730), shorter length of hospital stay (–0.97 ± 0.51 days, $p < 0.0001$) and longer operative time (55.261 ± 14.31 minutes, $p < 0.0001$) compared with open surgery. A laparoscopic approach did not influence the rate of intraoperative transfusion, major morbidity or 30-day mortality. To our knowledge, this is the largest study to date comparing laparoscopic and open TACs for Crohn's disease. A laparoscopic approach was an independent predictor of decreased length of hospital stay and superficial surgical site infections.

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Impact of bowel preparation on surgical site infection, ileus, anastomotic leak, major morbidity and mortality after elective colorectal surgery: an ACS-NSQIP analysis by coarsened exact matching. ***R. Garfinkle, J. Abou Khalil, N. Morin, G. Ghitulescu, C.A. Vasilevsky, P.H. Gordon, M. Demian, M. Boutros.*** **From the Jewish General Hospital, McGill University, Montreal, Que.**

The aim of this study was to assess the impact of mechanical and oral antibiotic bowel preparation on surgical site infections, ileus, anastomotic leak, major morbidity and 30-day mortality in a large cohort of elective colectomies. After institutional review board approval, patients who underwent elective colectomies between 2012 and 2014 were identified from the American College of Surgeons National Surgical Quality Improvement Program database. Patients who received mechanical bowel preparation alone, oral antibiotic preparation alone, mechanical bowel preparation with oral antibiotics (combined preparation) or no preparation were compared after coarsened exact matching. Multivariate logistic regression with matched patients was performed to determine the impact of preparation on surgical site infections, ileus, anastomotic leak,

major morbidity and mortality. A total of 40 446 patients were identified for analysis. After matching, 3889, 1461 and 3284 patients remained in the mechanical, oral antibiotic and combined preparation groups, respectively. On univariate analysis, groups differed in patient characteristics, and mechanical, oral and combined preparation were all significantly associated with decreased surgical site infections, ileus, anastomotic leaks, major morbidity and mortality when compared with the no-preparation group. On multivariate regression of the matched groups, both combined preparation and oral antibiotics alone remained protective of surgical site infection (OR = 0.36, 95% CI 0.29–0.43 and OR = 0.63, 95% CI 0.49–0.80), ileus (OR = 0.71, 95% CI 0.61–0.82 and OR = 0.76, 95% CI 0.20–0.94, major morbidity (OR = 0.69, 95% CI 0.38–0.70 and OR = 0.71, 95% CI 0.58–0.87) and mortality (OR = 0.47, 95% CI 0.31–0.72 and OR = 0.43, 95% CI 0.22–0.84), respectively. Only combined preparation was protective for anastomotic leak (OR = 0.51, 95% CI 0.38–0.70). Combined bowel preparation significantly reduces mortality and major postoperative complications following elective colorectal surgery. To our knowledge, this is the first study to demonstrate that oral antibiotic preparation alone is also associated with a reduction in surgical site infections, ileus, major morbidity and mortality.

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The use of surgical site infection reduction bundle and enhanced recovery quality improvement interventions in succession improves outcomes for patients undergoing colorectal resection. ***K. D'Souza, J. Wootton, T. Wallace*. From Royal Inland Hospital, Kamloops, B.C.**

Standardized care protocols to improve care for colorectal surgery patients were sequentially introduced at a community hospital. These initiatives included a surgical site infection bundle (SSI) and an enhanced recovery after surgery pathway (ERAS). The purpose of this study is to determine if there was additive benefit with the introduction of these initiatives. Patients at a single institution who underwent elective colorectal surgery between Apr. 1, 2011, and May 31, 2015, were identified using National Surgical Quality Improvement Program data. The cohort of patients was stratified into 3 groups by implementation dates for the initiatives. This included a pre-initiative group (Apr. 1, 2011 to June 16, 2013), a post-SSI/pre-ERAS group (June 17, 2013 to May 20, 2014) and a post-initiative group (May 21, 2014 to Oct. 31, 2015). Characteristics of the groups and their 30-day outcomes were assessed. Primary outcomes assessed were length of stay, morbidity and SSI rate. Inverse proportional weighting (IPW) was used to control for possible differences between the groups. There were 354 patients included: 94 in the pre-initiative group, 95 in the post-SSI/pre-ERAS group and 165 in the post-initiative group. The groups were balanced with respect to procedural and patient characteristics using IPW. Length of stay was reduced by each successive intervention (9 days v. 7 days v. 5 days). SSI rate (17% v. 10% v. 4%) and morbidity (35%, 27%, 20%) were also reduced in each post-intervention group. The combination of SSI and ERAS quality improvement initiatives yielded additive benefit for patients undergoing colorectal surgery with a decrease in morbidity, SSI rate and length of stay.

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Tattooing or not? A review of current practice and associated outcomes in cases of laparoscopic colonic resection following endoscopy at a single tertiary care centre. ***F. Letarte, M. Webb, C.J. Brown, M.J. Raval, A. Karimuddin, P.T. Phang*. From the University of British Columbia, St. Paul's Hospital, Providence Health Care, Vancouver, B.C.**

Since small colonic tumours may not be visualized or palpated during laparoscopy, the location of the lesion must be identified before surgery. The aim of this study is to evaluate the effectiveness of the current tattooing practice of colonic lesions. All consecutive patients who underwent elective laparoscopic resection for a colonic lesion at a single tertiary institution between the years 2013 and 2015 were retrospectively identified. Rectal lesions were not studied. Details concerning tattooing, endoscopic documentations and localization, operative visualization, planned and performed procedures, changes in surgical plan as well as preoperative and postoperative outcomes were recorded. A total of 224 patients underwent laparoscopic resection for a benign or malignant colonic lesion during the study period. All patients had a complete colonoscopy preoperatively. Of these, 148 patients (66%) had their lesion tattooed at endoscopy, with 5% of them being tattooed at a second endoscopy. Most lesions were tattooed distally but 15% were either tattooed proximally (8 lesions) or both proximally and distally (2 lesions) or were tattooed without specifying location as proximal or distal (13 cases). Tattoo localization was accurate in 69% of cases. Tattooed lesions were not visible during surgery 19% of time, with 2 cases converted to open surgery to identify the lesion. Inaccuracy in endoscopic localization led to change in surgical plan in 16% of surgeries. In the non-tattooed group, 1 case was converted to open surgery to localize the lesion, 3 cases required intraoperative colonoscopy and 1 case had positive margins on final pathology. There is variability in the practice of tattooing lesions leading to inaccurate preoperative localization. To improve surgical planning, we recommend adoption of the practice of endoscopic tattooing of all colon lesions just distal to the lesion using multiple injections to cover the circumference of the lumen.

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Salvage total mesorectal excision after transanal endoscopic microsurgery for early rectal cancer: Is it safe and are oncologic principles respected? A case-matched study. ***F. Letarte, S. Harriman, M.J. Raval, P.T. Phang, A. Karimuddin, C.J. Brown*. From the University of British Columbia, St. Paul's Hospital, Providence Health Care, Vancouver, B.C.**

After transanal endoscopic microsurgery (TEM), if final histology demonstrates adverse features or positive margins or if recurrence develops, patients can still undergo salvage excision with total mesorectal excision (TME). However, these cases are technically challenging and it is not clear if oncologic quality of excision is similar to that of primary TME. The aim of this study is to evaluate the feasibility and safety of salvage TME after TEM. At St. Paul's Hospital (SPH) in Vancouver, all consecutive patients treated with salvage TME after primary TEM (TEM-TME) were identified. A comparison cohort was created

of primary TME (P-TME) treated patients, matched for age, gender, ASA score, BMI, tumour height, neoadjuvant chemoradiation and tumour stage. Between 2007 and 2015, 514 patients were treated by TEM at SPH. Of these, 34 patients (6.6%) underwent salvage TME and were included in the TEM-TME group. They were matched to 34 patients in the P-TME cohort. The TEM-TME group was associated with lower rates of sphincter preservation (88.2% v. 52.9%, $p = 0.007$) and increased operation duration (193 minutes v. 168 minutes, $p = 0.038$). Estimated blood loss (346.3 mL v. 283.8 mL, $p = 0.352$) and perioperative complication rates (17.6% v. 2.9%, $p = 0.110$) were increased in the TEM-TME group but not statistically different. The overall complication rate was also similar between the groups (41.2% v. 44.1%, $p = 0.566$). There was no difference regarding oncologic quality of excision, with similar rates of complete mesorectum (94.1% v. 94.1%, $p = 1$), negative circumferential radial margin (91.1% v. 97.1%, $p = 0.887$) and clear margins (100% v. 100%). Salvage TME after TEM might be a more technically challenging surgery but similarities in quality of excised specimen and postoperative outcomes seem to indicate that it is safe and feasible.

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Repeat transanal endoscopic microsurgery for recurrent lesions: a matched-pair case-control study. ***F. Letarte, S. Harriman, M.J. Raval, P.T. Phang, A. Karimuddin, C.J. Brown*. From the University of British Columbia, St. Paul's Hospital, Providence Health Care, Vancouver, B.C.**

In the past decade, TEM has become ubiquitous and surgeons are beginning to see recurrent lesions after TEM resection. The aim of this study is to determine whether repeat TEM is a safe and feasible procedure. At our hospital, TEM has been performed since 2007 and data for all patients have been prospectively collected and maintained in the Saint Paul's Hospital (SPH)-TEM database. Demographic, pathologic, operative and postoperative data were collected. All consecutive patients treated with repeat TEM (TEM-R) for excision of a rectal lesion were identified. A comparison cohort was created of first-time TEM-treated patients (TEM-P), matched for age, gender, ASA score, BMI, tumour location, tumour size and patient positioning. Between 2007 and 2015, 514 patients were treated by TEM at SPH. Of these, 32 (6.2%) patients were in the TEM-R group. These were matched to 32 patients in the TEM-P comparison cohort. Indications for repeated TEM were tumour recurrence (69%), involved margins (25%) and metachronous lesion (6%). Median operative time (46 minutes v. 45.5 minutes, $p = 0.94$), estimated blood loss (5 cc v. 5 cc, $p > 0.99$), length of hospital stay (0 day v. 0 day, $p > 0.99$) and rates of clear margins on pathology (87.5% v. 96.9%, $p = 0.35$) were similar between the 2 groups. No perioperative complications occurred in either group. Repeat TEM was associated with more unsutured rectal defects (66% v. 34%, $p = 0.024$) and a trend toward increased specimen fragmentation (25% v. 7%, $p = 0.09$). No difference was observed between groups in terms of postoperative bleeding rate (3% v. 6%, $p = 0.48$), readmission rate (9% v. 9%, $p = 1$) and overall complication rate (13% v. 16%, $p = 0.77$). While repeat TEM can be technically challenging, it is a safe and feasible procedure when performed by experienced surgeons.

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The Vancouver Outpatient Ileostomy Closure Suitability (VOICeS) score: a predictive model to facilitate outpatient closure ileostomy surgery. ***F. Letarte, M.J. Raval, P.T. Phang, A. Karimuddin, C.J. Brown*. From the University of British Columbia, St. Paul's Hospital, Providence Health Care, Vancouver, B.C.**

The majority of patients who undergo elective ileostomy closure do not experience any form of postoperative complication. Thus, the need for admission to hospital has been questioned. The purpose of this study is to develop a predictive model to identify patients who are candidates for day-case surgery after ileostomy closure that would not lead to substantially higher readmission to hospital or serious complication. All consecutive patients who underwent elective ileostomy closure at a single quaternary colorectal surgery hospital between January 2007 and May 2015 were identified retrospectively. We identified patients who appeared safe for discharge on the day of surgery (DDS) if they met the following criteria: length of stay of less than 5 days, no postoperative complication, no postoperative ileus and no readmission. Using demographic and surgical data, we performed stepwise backward elimination logistic regression to identify the predictors of the outcome and build a simplified predictive model. Receiver operating characteristic (ROC) curves were created with these criteria and a scoring model to maximize specificity. During the study period, ileostomy closure was performed on 495 patients of which 228 met all DDS criteria. Regression analysis identified 6 variables predictive of DDS: age less than 70, ASA 1/2, non-inflammatory bowel disease pathology in original surgery, pelvic pouch surgery, operative time <75 minutes and absence of significant adhesions at surgery. The model created has a Brier score of 0.065 and a C statistic of 0.636. A 10-point scoring system was developed where a score of 8 or higher was associated with an expected readmission rate of approximately 19%. The VOICeS score was developed with the objective to correctly identify patients who would benefit from an outpatient ileostomy closure procedure by excluding patients at risk of a complicated postoperative course. The next step is to validate this score.

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Should surgeons perform more diagnostic and screening colonoscopies? A comparison of endoscopic localization error rate between operating surgeons and referring endoscopists in colorectal cancer. ***A. Azin, F. Saleh, M. Cleghorn, A. Yuen, T. Jackson, A. Okrainec, F. A. Quereshy*. From the University of Toronto, Toronto, Ont.**

Colonoscopy for colorectal cancer (CRC) has a localization error rate as high as 21%. Such errors can have substantial clinical consequences, particularly in laparoscopic surgery. The primary objective of this study was to compare accuracy of tumour localization at initial endoscopy performed by either the operating surgeon or non-operating referring endoscopist. All patients who underwent surgical resection for CRC at a large tertiary academic hospital between January 2006 and August 2014 were identified. The exposure of

interest was the initial endoscopist: (1) surgeon who also performed the definitive operation (operating surgeon group) and (2) referring gastroenterologist or general surgeon (referring endoscopist group). The outcome measure was localization error, defined as a difference in at least 1 anatomic segment between initial endoscopy and final operative location. Multivariate logistic regression was used to explore the association between localization error rate and the initial endoscopist. A total of 557 patients were included in the study: 81 patients in the operating surgeon cohort and 476 patients in the referring endoscopist cohort. Initial diagnostic colonoscopy performed by the operating surgeon compared with referring endoscopist demonstrated statistically significant lower intraoperative localization error rate (1.2% v. 9.0%, p = 0.016), shorter mean time from endoscopy to surgery (52.3 days v. 76.4 days, p = 0.015), higher tattoo localization rate (32.1% v. 21.0%, p = 0.027) and lower preoperative repeat endoscopy rate (8.6% v. 40.8%, p < 0.001). Initial endoscopy performed by the operating surgeon was protective against localization error on both univariate analysis (OR 7.94, 95% CI 1.08–58.52; p = 0.016) and multivariate analysis (OR 7.97, 95% CI 1.07–59.38; p = 0.043). This study demonstrates that diagnostic colonoscopies performed by an operating surgeon are independently associated with a lower localization error rate. Further research exploring the factors influencing localization accuracy and why operating surgeons have lower error rates relative to non-operating endoscopists is necessary to understand differences in care.

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Outcomes of operative management for colonic volvulus: an ACS-NSQIP data analysis. ***D. Hamad, N. Alselaim, J. Abou Khalil, M. Demian, N. Morin, C.A. Vasilevsky, P.H. Gordon, M. Boutros*. From the Jewish General Hospital, McGill University, Montreal, Que.**

The objective of this study was to examine the outcomes of operative management of colonic volvulus and to identify predictors of major morbidity and mortality following operations for left and right colonic volvulus. After institutional review board approval, all patients who underwent an operative intervention with the diagnosis of colonic volvulus between 2005 and 2013 were identified from the American College of Surgeons National Surgical Quality Improvement Program database. Patients were classified into 4 groups according to the type of operation: cecostomy/pexy, total, left or right colectomy. Multivariate logistic regression was used. Of 3864 patients, 72%, 24%, 3% and 1.5% underwent a left colectomy, right colectomy, total colectomy and cecostomy/pexy, respectively. On univariate analysis, patients who underwent a left colectomy were older (66 v. 62 years, p < 0.001) whereas patients who underwent a right colectomy were more likely to be female (75.0% v. 49.5%, p < 0.0001). Patients who underwent a total colectomy had the highest rates of mortality (16.0% v. 6.0% v. 4.0%, p < 0.0001), major morbidity (52.0% v. 26.0% v. 20.3%, p < 0.0001), stoma formation (100% v. 24.5% v. 0%, p < 0.0001), reoperation (18.3% v. 8.9% v. 7.0%, p < 0.0001) and hospital stay (17.6 v. 9.4 v. 8.6 days, p < 0.0001) compared with patients who underwent left and right colectomies, respectively. On multivariate logistic regression, significant predictors of mortality following left colectomy were age, male gender, emergency operation, preoperative dyspnea, dependent functional status and disseminated cancer; significant predictors of mortality following right colectomy were age, preoperative stroke, preoperative weight loss, dirty wound classification, peripheral vascular disease, chronic obstructive pulmonary disease and any preoperative wound infection. Operative management of colonic volvulus is associated with a high morbidity and mortality. Careful preoperative assessment and optimization of patients' pre-existing comorbidities may improve outcomes. Emergency surgery for left-sided volvulus is a strong predictor of poor outcome; as such, bridging to an elective setting is advisable when feasible.

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A comparison of lymph node harvest following emergent laparoscopic versus open colectomy for colon cancer: results from the ACS-NSQIP database. ***E. Salama, J. Abou Khalil, P.H. Gordon, C.A. Vasilevsky, G. Ghitulescu, N. Morin, J. Faria, M. Demian, M. Boutros*. From the Jewish General Hospital, McGill University, Montreal, Que.**

Oncological outcomes of emergent laparoscopic colon cancer resections are not well documented. This study compares the adequacy of lymph node (LN) harvests for emergent laparoscopic and open colon cancer resections. The American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP) colectomy-specific database was reviewed for patients with colon cancer undergoing emergent resection between 2011 and 2014. The primary outcome was adequate LN harvest, defined as 12 or more LNs. Secondary outcomes included surgical site infection (SSI) and major morbidity. To adjust for differences in patient characteristics, one-to-one coarsened-exact matching (CEM) on age, gender, race, preoperative morbidity, preoperative chemotherapy, T stage and M stage was performed. Patients were grouped by type of resection (ileocolic, segmental colon, or left-sided colon including upper rectal), and after matching they were analyzed separately using multivariate logistic regression. Of the 5114 patients who met the inclusion criteria, 3282 underwent open and 1832 laparoscopic resection. Open resections had more preoperative comorbidities than their laparoscopic counterparts. Adequate LN harvests were attained in 92.3% of open and 93.6% of laparoscopic resections (p = 0.10). Mean harvested nodes did not differ significantly between the 2 groups. CEM resulted in 456, 694 and 272 matches for ileocolic, segmental colon and left-sided resections, respectively. On multivariate regression, the odds of adequate LN harvests were similar in both open and laparoscopic for ileocolic (OR 1.64, 95% CI 0.73–3.71), segmental colon (OR 1.00, 95% CI 0.52–1.92) and left-sided (OR 0.79, 95% CI 0.37–1.72) resections. Laparoscopy was associated with significantly lower odds of SSI (OR 0.55, 95% CI 0.46–0.61) and major morbidity (OR 0.58, 95% CI 0.48–0.68) on multivariate analysis. In this large cohort, the use of laparoscopy did not compromise adequate LN harvests in patients who underwent emergent colon cancer resections.

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Impact of immunosuppressants on postoperative complications following colectomies for Crohn's disease: results from the ACS-NSQIP database. ***M. Abou Khalil, J. Abou Khalil, J. Motter, C. Vasilevsky, N. Morin, P. Gordon, G. Ghitulescu, M. Boutros*. From McGill University, Montreal, Que.**

The impact of immunosuppressants on postoperative complications following colon resections for Crohn's disease (CD) remains controversial. We hypothesize that patients with CD who were on immunosuppressants within 30 days of their colectomy were at increased risk of postoperative complications compared with those who were not on these medications. Using the ACS-NSQIP database (2011–2014), CD patients who underwent elective colectomies were identified. Patients who had received chemotherapy/radiotherapy within 90 days of surgery, had disseminated cancer or had evidence of emergency surgery were excluded. Multivariate logistic regression was used to assess the impact of immunosuppression on major morbidity, infectious complications, anastomotic leak, organ space infection (OSI), wound infections and reoperation. Of 2910 patients with CD, 1888 were immunosuppressed and 1022 were non-immunosuppressed. Patients in the immunosuppressed group were younger, had lower rates of chronic medical illnesses and had a laparoscopic approach more often than non-immunosuppressed patients. On multivariate analysis the likelihood of OSI (OR 1.7, 95% CI 1.2–2.4) and all surgical site infections (OR 1.39, 95% CI 1.08–1.78) was higher in immunosuppressed patients. The outcomes composite infections, leak, major morbidity and reoperation were not statistically different in immunosuppressed compared with non-immunosuppressed patients. In this large database, immunosuppressed CD patients were at higher risk of postoperative complications including all wound infections and OSI. There was no difference in reoperation, leak, major morbidity or composite infections between immunosuppressed and non-immunosuppressed patients.

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Effect of a colorectal cancer patient navigator on the completeness of surveillance after colorectal cancer resection. ***D. Gill, S. Harriman, F. Letarte, A. Karimuddin, T. Phang, M. Raval, C. Brown*. From the University of British Columbia, Vancouver, B.C.**

Postoperative surveillance, including CT scan, carcinoembryonic antigen (CEA) testing and colonoscopy, is known to reduce mortality from colorectal cancer (CRC) recurrence. However, adherence to this surveillance is poor. Our aim was to determine the effect of a CRC patient navigator (CPN) on the completeness of CRC surveillance following resection. Data for all patients with CRC is maintained in a colorectal cancer database. We identified all patients diagnosed with stage II or III CRC in the 1-year period before and 1 year after a CPN was introduced. Surveillance adherence, including completion of CEA testing, colonoscopy and CT imaging at appropriate intervals, was assessed for each patient over the 18 months following CRC resection. Patients were excluded if they declined surveillance. Pearson's χ^2 test was used to analyze differences in these outcomes. Between 2012 and 2014, 613 patients had surgical treatment for CRC at our hospital. Of these, 102 eligible stage II-III patients were treated before the establishment of the CPN program and 73 patients in the year after the program start date were included. Overall, complete follow-up was significantly improved in the 1-year period after the CPN program was initiated (79% v. 63%, $p = 0.03$). Surveillance with CT (97% v. 87%, $p = 0.04$) was significantly improved, while there was a trend in improvement in colonoscopy (84% v. 76%, $p = 0.27$) and CEA testing (89% v. 78%, $p = 0.10$). Surveillance of stage II (74% v. 50%, $p = 0.06$) was significantly better, but stage III patients were similarly followed (82% v. 67%, $p = 0.16$). Rectal cancer patients had a particularly dramatic improvement in surveillance (81% v. 59%, $p = 0.01$). In patients with stage II-III CRC, surveillance has been shown to improve outcomes and reduce morbidity and mortality. Using a CPN program to ensure timely surveillance of patients following CRC resection improves the completeness of follow-up.

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Manukah honey — a novel treatment option for patients with pouchitis. ***C. Brown, M. Nasibi, A. Karimuddin, P. Phang, M. Raval*. From the University of British Columbia, Vancouver, B.C.**

Pelvic pouch reconstruction is the treatment of choice in patients who require surgery for ulcerative colitis. Up to 35% of patients will develop pouchitis after pouch construction. Manuka honey has known anti-inflammatory and antibacterial activity. Our objective was to determine if manuka honey enemas (MHE) are a viable treatment option for pouchitis. Between September 2014 and October 2015, all patients presenting with symptoms suggestive of pouchitis were offered MHE therapy as first-line treatment. Clinical and endoscopic evidence of pouchitis was defined by a pouchitis disease activity index (PDAI) score >7 before treatment. All patients were instructed to apply MHE twice daily for 1 month. Post-treatment PDAI scores were assessed within 2 weeks of therapy completion. Statistical analysis was performed using paired *t* test. Overall, 9 patients were enrolled in this study, 7 males and 2 females. Mean patient age was 43 years (24–60) and the mean time from GI continuity restoration and pouchitis symptoms was 5 years (0–30). Pretreatment PDAI was 8.8 (7–10). Post-treatment PDAI was 5.0 (0–10), a statistically significant improvement ($p = 0.001$). All but 1 patient experienced improvement in their symptoms. This is the first study to test MHE as a treatment for pouchitis. Most patients had significant improvement in their symptoms. These promising early results should be tested in a randomized controlled clinical trial.

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Prophylactic mesh to prevent parastomal hernia: a meta-analysis of randomized controlled studies. ***S.V. Patel, L. Zhang, S.A. Chadi, S.D. Wexner*. From Queen's University, Kingston, Ont.; and Cleveland Clinic Florida, Weston, Fla.**

Parastomal hernias are a common problem in patients undergoing stoma creation, with up to 50% of patients developing symptoms. Of those who require surgical repair of the hernia, up

to 20% have a recurrence. For these reasons, there has been increased interest in placing prophylactic mesh at the time of the index operation. The purpose of this study was to determine if the placement of prophylactic mesh decreases the odds of parastomal hernia formation. Secondary outcomes included surgical correction of the hernia, perioperative complications and stoma-specific complications. Medline and Embase were searched between 1946 and 2015. Randomized controlled trials (RCTs) comparing prophylactic mesh to standard stoma formation were included. Odds ratios were calculated for both the primary and secondary outcomes. We used random effects modelling to account for clinical heterogeneity. Seven RCTs (n = 405) were included in the analysis. There was evidence that prophylactic mesh reduced the odds of parastomal hernia incidence (OR 0.23, 95% CI 0.10–0.52, $p < 0.001$, I2 43%). Prophylactic mesh also reduced the odds of surgical repair (OR 0.31, 95% CI 0.11–0.86, $p = 0.02$, $I_2 = 0\%$). There was no evidence that mesh placement increased the odds of surgical complications (OR 1.72, 95% CI 0.71–4.15, $p = 0.23$, $I^2 = 39\%$) or stoma-specific complications (OR 0.72, 95% CI 0.41–1.25, $p = 0.24$, $I^2 = 0\%$). Three of 7 studies had a high risk of bias. The quality of evidence was considered moderate. Our meta-analysis summarizes the best available evidence for prophylactic mesh in preventing parastomal hernias. There was evidence that prophylactic mesh decreases the odds of parastomal hernia formation as well as the need for surgical repair. There is no evidence to suggest that placement of mesh increases the odds of complications.

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Effects of radiation and surgery on function and quality of life in rectal cancer patients. *L. Wang, X. Wang, M.J. Raval, A. Karimuddin, C.J. Brown, P.T. Phang*. From the University of British Columbia, Vancouver, B.C.

Radiotherapy (PRT) neoadjuvant to total mesorectal excision surgery (TME) for rectal cancer yields the lowest risk for local recurrence. However, PRT and TME together negatively impact quality of life (QOL). Here we ask whether PRT affects morbidity and QOL before TME. Patients undergoing curative treatment for rectal cancer were consented for study, 2008–2013. Bowel function, fecal incontinence, micturition, sexual function, global health and emotional function were prospectively assessed using EORTC QLQ-C30, EORTC QLQ-CR38 and the Wexner incontinence scale at 3 different time points: before radiotherapy/chemotherapy and surgery (T1), 6 weeks after radiotherapy and before surgery (T2) and approximately 1 year after stoma closure after surgery (T3). Twenty-five patients completed all 3 questionnaires (16 male, 9 female; mean age was 59 years (range 47–74). Defecation problems (T1 = 21.8 ± 18.5, T2 = 16.0 ± 11.5, T3 = 32.8 ± 20.3) improved after radiotherapy, although not significantly ($p = 0.11$), and worsened after surgery ($p = 0.01$). The Wexner incontinence score (T1 = 5.2 ± 5.9, T2 = 5.8 ± 4.3, T3 = 10.0 ± 6.1) did not change significantly after PRT but did significantly increase after surgery ($p = 0.01$). There were no significant changes to micturition after treatments (T1 = 19.6 ± 16.7, T2 = 26.2 ± 22.4, T3 = 20.4 ± 15.6; $p = 0.39$). Sexual function (T1 = 73.3 ± 23.1, T2 = 82.0 ± 18.0, T3 = 77.3 ± 23.9) was significantly improved after radiotherapy ($p = 0.05$) but was not changed after surgery ($p = 0.31$). Global health status (T1 = 72.33 ± 21.21, T2 = 66.7 ± 23.2, T3 = 75.3 ± 18.1) did not significantly change after treatments ($p = 0.34$). There was an upward trend, although not significant, of improved emotional functioning after surgery (T1 = 74.7 ± 19.0, T2 = 75.6 ± 18.6, T3 = 81.0 ± 19.0; $p = 0.09$). Radiotherapy did not significantly affect bowel problems, fecal incontinence or micturition but did improve on sexual function. TME surgery had negative effects on bowel problems and fecal incontinence but did not affect micturition or sexual function. PRT and TME did not change global health status of rectal cancer patients but trended toward improving emotional status.

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Evaluation of the colon after an incomplete colonoscopy at a tertiary care teaching centre. *E. Hyun, P. Johnson*. From Dalhousie University, Halifax, N.S.

Failure to complete a colonoscopy examination and achieve cecal intubation is a well recognized risk of the procedure. However, little is known about the management and outcomes for these patients. The objectives of this study were to determine the rate of secondary evaluation of the colon after incomplete colonoscopy and to describe the investigations used for the assessment and the diagnostic yield. All patients who underwent an incomplete colonoscopy between January 2012 and December 2013 at a tertiary care teaching centre were identified. A retrospective chart review was conducted and data were collected regarding indications, colonoscopy findings, secondary examinations and results. During the study period 233/5267 (4.4%) patients had an incomplete colonoscopy and a secondary assessment of the colon was performed in 162 patients (69.5%). Computed tomography colonography (CTC) was the most frequently used modality (58.6%), followed by repeat colonoscopy (39.1%) and barium enema (1.9%). The majority of CTC procedures (55.8%) were performed on the same day as the incomplete colonoscopy. The median wait time for remaining CTC procedures was 57 days (range 1–383) compared with 84 days (range 1–826) for colonoscopy and 8 days (range 4–79) for barium enema. Overall, 2.5% of patients had an advanced adenoma and 2% were diagnosed with colorectal cancer on the secondary examination. Among patients who did not have a secondary examination of the colon, no explanation for this could be identified for 35%, in 24% the endoscopist determined that examination could be safely delayed and in 14% the endoscopist decided that it was not necessary. Significant pathology was found in 4.5% of patients who underwent a secondary examination of the colon after an incomplete colonoscopy. However, 30% of patients did not undergo a secondary assessment after an incomplete scope, placing them at risk of missed or delayed diagnosis of polyps and colorectal cancer.

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Oncologic outcomes following laparoscopic versus open resection of pT4 colon cancer: a systematic review and meta-analysis. *A. E. Feinberg, T.R. Chesney, S.A. Acuna, T. Sammour, F.A. Quereshy*. From the University of Toronto, Toronto, Ont.

Locally advanced colon cancer is considered a relative contraindication for laparoscopic resection and clinical trials addressing the

oncologic safety are lacking. The aim of this study was to synthesize the oncologic outcomes associated with laparoscopic versus conventional open surgery for locally advanced colon cancers. We systematically searched Medline, Embase, CENTRAL and ClinicalTrials.gov. Two reviewers independently screened the literature for controlled trials or observational studies comparing curative-intent laparoscopic and open surgery for colon cancer. Studies were included if it was possible to determine outcomes for the T4 colon cancers separately, either reported in the manuscript or calculated with individual patient data. Included studies were systematically reviewed and assessed for risk of bias. Meta-analyses were done using random-effects models. Outcomes of interest were disease-free survival, overall survival, resection margins and lymph node harvest. Of 2878 identified studies; 5 observational studies met the eligibility criteria with a total of 1268 patients (675 laparoscopic, 593 open). There was no significant difference in overall survival (HR 1.28, 95% CI 0.94–1.72), disease-free survival (HR 1.20, 95% CI 0.90–1.61) or positive surgical margins (OR 0.89, 95% CI 0.17–4.77) between the groups. The open group had a larger lymph node retrieval (pooled mean difference 2.26 nodes, 95% CI 0.58–3.93). The pooled rate of conversion from laparoscopy to an open procedure was 18.6% (95% CI 9.3%–27.9%). These results are limited by the inherent selection bias in these nonrandomized studies. Based on the available literature, minimally invasive resection of selected locally advanced colon cancer is oncologically safe. There is a small increase in lymph node harvest with open resections but it is unclear whether this is clinically significant. Surgeons should be prepared for a significant rate of conversion to laparotomy as required to perform en bloc resection.

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Evaluating an Enhanced Recovery After Surgery implementations (iERAS) program using data from the National Surgical Quality Improvement Program (NSQIP). ***L.M. Gresham, M. Sadiq, R. Helewa, M. McGrath, K. Lacelle, M. Szeto, J. Trickett, D. Schramm, R.C. Auer, on behalf of the iERAS Group*****. From the University of Ottawa, Ottawa, Ont.**

Efforts to improve the value of our health care delivery include increasing quality while reducing costs. Enhanced recovery after surgery (ERAS) refers to multimodal perioperative interventions, which, when implemented, decrease postoperative complications and length of stay (LOS). The primary objective of this study was to evaluate the outcomes of patients undergoing elective colorectal surgery during ERAS protocol implementation (iERAS), specifically to determine whether iERAS was associated with reductions of LOS and overall postoperative complications as measured by prospectively collected NSQIP outcome data. Data for outcomes of colorectal surgery patients were collected between March 2010 and September 2015. Pre- and post-ERAS implementation outcome data were compared for 619 patients (320 colon resections, 299 rectal resections) of which 184 underwent a resection before the implementation of ERAS and 435 underwent a resection after ERAS implementation. Implementation of ERAS was associated with a significant increase in the percentage of patients discharged within 5 days of surgery from 28.3% to 45.2% ($p < 0.001$) and with a significant decrease in the percentage of patients discharged between 6 and 10 days from 48% to 34.8% ($p = 0.001$). This was associated with an increase in unplanned return visits to the emergency department (11.4% pre-ERAS and 18.6% post-ERAS, $p = 0.27$). The overall complication rate decreased from 64.4% pre-ERAS implementation to 35.6% post-ERAS ($p = 0.007$), although there were no significant reductions in postoperative urinary tract infections and surgical site infections. There was no difference in 30-day mortality between the 2 cohorts (1.1% pre-ERAS and 0.5% post-ERAS, $p = 0.4$). An iERAS program shows benefits in terms of reducing LOS and overall complication rates. NSQIP is an effective tool to monitor outcomes following implementation. The introduction of an ERAS-NSQIP module for standardized perioperative care and collection of process quality indicators may help inform implementation teams where best to focus their efforts.

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Laparoscopic experience in ileal pouch-anal anastomosis at a high-volume Canadian institution: a case matched series. ***G.W. Ma, A. Yuen, E. Kennedy, R. Mcleod, H. Macrae*****. From the University of Toronto, Toronto, Ont.**

Although many centres currently offer a laparoscopic-assisted approach for ileal pouch-anal anastomosis (IPAA), most studies have relatively small numbers. This study aimed to compare the outcomes of a large series of laparoscopic-assisted IPAA with open IPAA in a single high-volume institution. Patients with UC or FAP who underwent laparoscopic IPAA between 2001 and 2014 at our institution were selected and matched to open IPAA cases according to age, sex and BMI. Clinical data such as length of stay, return of bowel function, the creation of an ileostomy, type of staged surgery and duration of surgery were compared between the 2 groups. We also compared complication rates such as pouch leak, wound infection, pouch stricture and total number of transfusions. χ^2 and linear regression analysis was performed. A total of 159 laparoscopic IPAA cases were matched with 157 open cases. Operative time was longer for the laparoscopic group (5.44 hours v 3.67 hours, $p = 0.03$), while postoperative length of stay was shorter (9.60 days v. 11.05 days, $p = 0.01$). There was no difference in intraoperative blood loss between the 2 groups (267.5 mL v. 239.9 mL, $p = 0.14$). Perioperative transfusions were significantly greater in the open group (0.059 units v. 0.319 units, $p = 0.003$). Complication rates including pouch leak, wound infection and pouch stricture were not found to be significantly different. Laparoscopic IPAA offers the advantage of decreased hospital length stay. There was no increase in pouch leak or other complications. Laparoscopic IPAA may be at least comparable to open IPAA.

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Patient engagement through patient and family advisory council: enterostomal experience in rectal cancer management. ***G.W. Ma, S. Schmocker, M. McKenzie, J. Tjan, M. Frecea, J. Hoeflock, E. Kennedy*****. From the University of Toronto, Toronto, Ont.**

Over the past years, health care has shifted from a position of power concentrated in the hands of providers toward patient-centred care focusing on patients' perception of quality in medical care. Patient perception is inherent and instrumental to health

care quality. In rectal cancer there is a strong focus on survival and quality of life but lack of attention to patients' perception of the quality of their care, particularly in patients with a temporary or permanent enterostomy. The Patient and Family Advisory Council (PFAC) toolkit developed by Green et al. was used to recruit patient and family advisors (PFAs) from each of the 8 cancer centres participating in the Canadian Partnership against Cancer (CPAC) rectal cancer study. The PFAs were invited for a 2-day in-person workshop with enterostomal therapy nurses (ETN) and a third-party mediator to facilitate discussion regarding quality of care received and potential areas for improvement. Twenty patients with accompanying family members or significant others attended the workshop in Toronto. Major themes identified by the PFA group included: (i) lack of access to ETN or ET expertise through all phases of rectal cancer treatment, (ii) feelings of abandonment at discharge with stoma and after closure of stoma, (iii) feelings of isolation and stigma following surgery, (iv) lack of reliable information preoperatively, (v) the key role of a caregiver/partner and (vi) underestimating the effect of surgery on lifestyle. Despite major advances in the clinical and surgical management of rectal cancer, the patient experience continues to be an area that is not routinely considered or addressed in the clinical management of cancer patients. Our PFAC workshop highlights multiple areas of concern for patients and emphasizes the importance of addressing these stresses for patients in a patient-centred approach to cancer care.

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Development of a guideline for the perioperative care of patients with an ostomy within an enhanced recovery after surgery program. ***M.E. McKenzie, E.A. Pearsall, D. Miller, D. Johnston, M. Frecea, R.S. McLeod, on behalf of the ERAS-ETN Provincial Network and the iERAS group, University of Toronto, Toronto, Ont.***

In response to the widespread adoption of Enhanced Recovery After Surgery (ERAS) programs for elective colorectal surgical patients, a provincial ERAS Enterostomal Therapy Nurse Network was created through the Implementation of an Enhanced Recovery after Surgery (iERAS) program. The objective of the network was to develop a guideline to provide recommendations for the preoperative, postoperative and discharge care of patients with an ostomy following elective colorectal surgery receiving care within an ERAS program. A literature review was undertaken to develop evidence-based recommendations for the care of patients with an ostomy undergoing elective colorectal surgery within an ERAS program using Medline and CINAHL. In addition, the grey literature was searched for clinical practice guidelines pertaining to the care of ostomy patients. Members of the provincial ERAS Enterostomal Therapy Nurse Network reviewed the available literature and developed recommendations for preoperative, postoperative and postdischarge phases of care. The recommendations and supporting evidence were then reviewed by all members of the network as well as external stakeholders and patients, and consensus was reached. The guideline provides preoperative recommendations on referral to enterostomal therapy nurses (ETNs), stoma site marking and preoperative education. Postoperatively, recommendations are made for the removal of supporting rods, postoperative education, teaching of a mandatory skill sets, management of the ostomy by the patient and family and access to community care support. Lastly, recommendations on postdischarge care include information on the frequency and timing of visits from community ETNs, available support groups and the management of potential complications. A multimodal knowledge translation strategy is being implemented to ensure widespread dissemination and uptake of this guideline for ETNs in hospitals and the community.

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Robotic ventral rectopexy with biologic mesh for the treatment of obstructed defecation syndrome: approach and initial experience. ***H. Emmerton-Coughlin, C. Schlachta, A. Almamar, N. Alkhamesi*. From Western University, London, Ont.**

Defecatory disorders including constipation and incontinence are common. Studies have shown that mechanical pelvic floor abnormalities are present in greater than 85% of these patients disorders. Laparoscopic ventral rectopexy is safe and effective, with very low rates of perioperative morbidity and long-term results comparable to other treatments. The robotic platform confers additional advantages in terms of visualization and surgical mechanics when performing minimally invasive ventral rectopexy. Here we report our approach and initial experience with 2 cases of robotic ventral rectopexy with biologic mesh for the treatment of obstructed defecation, to our knowledge the first of its kind in Canada. Both cases were female patients aged 59 and 44 years and ASA classes 4 and 3, respectively. Following peritoneal access, robotic dissection is performed in rectovaginal plane to the level of the pelvic floor. A biologic mesh is then sutured from the anterior rectum to the presacral fascia to complete the rectopexy. Colpopexy is performed by suturing the posterior wall of the vagina to the mesh, and the peritoneal defect is closed to cover the mesh. The articulating wrists of the robotic instruments provide increased agility for deep dissection within the fixed volume of the boney pelvis and facilitate suturing around the angulation of the sacral promontory, which can be challenging with traditional fixed linear laparoscopic instruments. The 3D stereoscopic camera affords excellent visualization. Case durations were 220 and 240 minutes, and lengths of hospital stay were 3 and 2 days, respectively. Postoperative courses were uncomplicated. Both patients experienced complete resolution of obstructive symptoms. This preliminary experience confirms the feasibility of robotic ventral rectopexy. Pending further clinical and financial evaluation, the perceived advantages of depth perception and enhanced dexterity show promise in making this a preferred approach.

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Transanal endoscopic microsurgery (TEM): the learning curve. ***R. Ghadiry-Tavi, C.J. Brown, A.A. Karimuddin, P.T. Phang, M.J. Raval*. From St. Paul's Hospital and the University of British Columbia, Vancouver, B.C.**

At St. Paul's Hospital, demographic, surgical, pathologic and follow-up data are captured in a prospectively collected SPHTEM database. Operation time (OT) was selected as a measure of proficiency, adjusting for tumour size (cm^2), tumour

location (anterior, posterior, lateral), tumour height, peritoneal breach and tumour recurrence status, parameters relevant in attaining proficiency. Restricted cubic spline curves were plotted to determine inflection points for OT by number of cases, and comparison of OT before and after inflection points was conducted. Between March 2007 and April 2015, 490 patients were treated by TEM (by surgeons performing >100 cases each). Complete data were available for 466 patients. The mean overall OT was 54 ± 31 minutes. After adjusting for relevant factors, only 1 inflection point was observed, at 50 procedures, and was consistent between surgeons. Comparisons were conducted across 3 groups: 1 before the inflection and 2 after. Comparison between the 2 latter groups was done to determine whether, in the absence of additional observed inflection points, there was further improvement in OT with additional cases. There was a significant difference in OT before and after 50 cases ($p < 0.001$) but not between the 2 groups after the inflection point ($p = 0.07$). We conclude that proficiency in TEM is consistently achieved after performing 50 procedures. These findings reflect the learning curve of colorectal surgeons proficient in laparoscopy. Volume of TEM cases available should be considered when implementing TEM into a hospital, considering costs and time required to attain proficiency. Further study is needed to determine competency limits for trainees and the role of simulation in achieving proficiency.

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Compliance and patient outcomes with a provincial ERAS program for colorectal surgery. ***M.A. Aarts, A. Okrainec, L. Gotlib-Conn, S. McCluskey, M. McKenzie, E.A. Pearsall, O. Rotstein, R.S. McLeod, on behalf of the iERAS group, University of Toronto, Toronto, Ontario.***

Despite strong evidence, enhanced recovery after surgery (ERAS) programs can be difficult to implement. This study explores the impact of a multi-site, multidisciplinary initiative on adherence to ERAS guidelines and patient outcomes. Patients undergoing elective colorectal surgery were included in the iERAS program at 15 academic hospitals. The iERAS guideline includes preoperative, intraoperative and postoperative recommendations and was developed based on evidence and local context. The implementation strategy included identifying nursing, anesthesiologist and surgeon champions at each site; supporting communities of practice; developing a patient education booklet, video and printed materials including standardized orders and care pathways; and audit and feedback. Compliance with the guideline was defined as achieving 3 out of 4 elements in each part of the care pathway. The impact of guideline compliance on 30-day complication and anastomotic leak rates was evaluated. Confounders including demographics, comorbidities, surgical disease, operative technique (laparoscopic/open), site of anastomosis, and hospital were included in a multiple regression analysis. Between October 2012 and April 2015, 2926 patients (1522 males; mean age 62 years; mean BMI 27) were enrolled. The diagnosis was colorectal cancer in 68.3%, a laparoscopic approach was used in 52.5%, 30.3% of patients had a right hemicolectomy, 24.6% had a left colon resection, 17.5% had a low anterior resection and 27.6% had another procedure. Compliance with individual recommendations ranged from 26.7% to 84.4%. Preoperative, intraoperative and postoperative compliance was achieved for 74.2%, 56.0% and 39.9% of patients, respectively. Compliance with all phases of the care pathway was significantly associated with a decreased rate of anastomotic leak (RR [95% CI] 0.65 [0.51–0.82]) and 30-day all-complication rate (RR [95% CI] 0.79 [0.69–0.92]). Multiple implementation strategies were used to implement an ERAS program at multiple hospitals. Increased uptake of guideline recommendations resulted in improved patient outcomes and anastomotic leak rates.

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Transanal total mesorectal excision (TATME), a new approach for difficult cases. ***V. Courval, A. Bouchard, P. Bouchard, S. Drolet*. CHU de Québec, Université Laval, Québec, Que.**

The objective of this study was to review our experience with transanal total mesorectal excision (TaTME). We reviewed data concerning case selection, tumour characteristics, perioperative and postoperative data and final pathology. Retrospective chart review was performed on all cases of TaTME occurring between 2013 and 2016. A total of 15 males were operated for primary (87%; 13/15) or recurrent rectal cancer (13%; 2/15). A total of 3 patients (20%; 3/15) had had previous rectal surgery and 1 had had previous transanal TEM resection. A majority of patients were obese, with 73% (11/15) having a BMI > 29. Two different platforms were used: a soft disposable platform in 10 cases (67%; 10/15) and the transanal endoscopic microsurgery rigid reusable platform in the 5 others (33%; 5/15). The laparoscopic approach was used in the majority of cases (93%; 14/15). Most patients had a low anterior resection (93%; 14/15). Nine patients received a temporary ileostomy (60%; 9/15). Most patients had a delayed coloanal anastomosis (43%; 6/14), 36% (5/14) had a coloanal anastomosis hand sewn and 21% (3/14) had a single stapled anastomosis. Three patients had perioperative complications (colonic ischemia, rectal perforation and arterial bleeding). Final pathology revealed negative margins in 93% (13/14). Mesorectum excision was considered complete in 78.5% (11/14) overall and in 100% (11/11) when considering only primary rectal surgery. Five patients (36%; 5/14) had an anastomotic leak, which was treated with transanal drainage in 14% (2/14). A total of 8 patients required reintervention (transanal drainage, ileostomy revision, coloanal anastomosis revision, colostomy for colonic ischemia and internal hernia repair). According to our cohort, the TaTME appears to help to achieve a complete mesorectal excision with reanastomosis, and so it allows a complete laparoscopic procedure in the majority of patients. In this selected difficult case series, the TaTME appears to be secure, although it is associated with a high rate of surgical complications.

Canadian Society of Surgical Oncology

01

Understanding a rare disease's impact on health systems: a population-based economic analysis of neuroendocrine tumours costs. ***J. Hallet, C.H.L. Law, M. Cheung, H. Fischer, N. Liu, N. Mittmann, S. Singh*. From the Sunnybrook Health Sciences Centre – Odette Cancer Centre, the University of Toronto and the Institute of Clinical Evaluative Sciences, Toronto, Ont.**

The prevalence of neuroendocrine tumours (NET) is increasing. Little is known about resource utilization in NET care. We sought to define patterns of costs in NET management and compare them to a more common malignancy, colon cancer (CC). We identified all patients with NET in a cancer registry (2004–2012). They were matched to CC patients (1:3). We obtained 2012 C$ costs for 4 phases of care around diagnosis: prediagnostic (PrDx: –2 years to –181 days), diagnostic (Dx: –180 days to +180 days), postdiagnostic (PDx: +181 days to +3 years) and prolonged postdiagnostic (PPDx: +181 days to +9 years). Mean costs per patient were compared. Cost predictors were analyzed with quantile regression. We matched 3355 NET cases to 9320 CC cases. Mean NET costs were higher in the PrDx phase ($5877 v. $5368; $p = 0.05$), driven by higher non-drug costs including physician encounters and emergency department visits. Mean NET costs were lower in the Dx and PDx phases (both $p < 0.01$). In PPDx, drug costs were significantly higher in NET cases ($26 788 v $7827; $p < 0.01$), accounting for 41% of costs compared with 16% for CC cases. CC cases had a high initial increase in costs, which then decreased in the PDx phase. NET cases had steady increases between each phase, more pronounced in the PrDx and PPDx phases. Older age, lower income and comorbidities were predictors of higher NET costs in the 4 phases. Gastroenteric primary site was associated with higher costs in the PrDx phase (parameter estimate [PE] $62) and lower costs in the Dx phase (PE $13 644). Pancreatic site was associated with higher costs in the PDx phase (PE $3348) and the PPDx phase (PE $1548). The NET cost pattern is unique and differs from that for CC, with maximal costs during the PrDx and PPDx phases. Primary NET site affected costs differently at different time points. Defining these cost patterns now allows for tailoring the use of health care resources to tumour type and timing in the patient journey.

03

NOD1 promotes colorectal cancer metastasis through p38 MAP kinase activation. ***H.Y. Jiang, S. Najmeh, G. Martel, J. Cools-Lartigue, A. Leone, P. Savage, E. MacFadden-Murphy, L. Roussel, R. Farias, S. Gowing, J. Berube, B. Giannias, F. Bourdeau, C.H.F. Chan, J.D. Spicer, S. Rousseau, M. Park, L.E. Ferri*. From the Northern Ontario School of Medicine, Sudbury, Ont.; McGill University, Montreal, Que.; and the University of Iowa, Iowa City, Iowa**

Strong clinical evidence demonstrates a link between acute bacterial infection and metastasis. While emerging data suggest nucleotide oligomerization domain receptor 1 (NOD1), a cytoplasmic pattern recognition receptor, may play an important and complementary role in the immune response to bacterial infection, its role in cancer metastasis is entirely unknown. Hence, we seek to determine the effects of NOD1 activation and inhibition on metastasis through a series of in vivo and in vitro experiments using colorectal cancer (CRC) as a model. NOD1 expression in human CRC tissues as well as human and murine colon (HT29, MC38) cancer cells was confirmed using immunohistochemistry (IHC), flow cytometry (FC) and immunoblotting (WB). A series of in vitro and in vivo functional assays, including adhesion, migration and murine hepatic metastasis, was conducted to assess the effect of NOD1 activation and inhibition. C12-iE-DAP, a highly selective NOD1 ligand derived from Gram-negative bacterial wall, was used to simulate NOD1 activation under infectious conditions. ML130, a specific NOD1 inhibitor, was used to block C12-iE-DAP activation. Stable knockdown (KD) of NOD1 in HT29 was constructed with shRNA lentiviral transduction and the functional assays were thus repeated. The predominant signalling pathway of NOD1 activation was identified using WB in the presence of specific kinase inhibitors. Our data demonstrate that NOD1 is highly expressed in human CRC, and its activation by the Gram-negative bacterial wall component, C12-iE-DAP, is important in augmenting CRC cell adhesion, migration and metastasis of up to 7-fold. These augmentations are predominantly mediated via the p38 MAP kinase pathway. Furthermore, cancer metastasis mediated via the NOD1-p38 MAP kinase axis can be blocked with NOD1 and p38 inhibition or NOD1 knockdown. This is the first study implicating NOD1 in cancer metastasis, thus identifying this receptor and its downstream effectors as putative therapeutic targets.

05

The relationship between socioeconomic factors and method of tumour identification, stage at diagnosis and type of breast surgery in a cohort of breast cancer patients. ***J. Li, S. Cornacchi, F. Farrokhyar, N. Johnston, S. Forbes, S. Reid, N. Hodgson, S. Lovrics, K. Lucibello, P. Lovrics*. From McMaster University, Hamilton, Ont.**

International studies suggest a correlation between socioeconomic status (SES) and breast cancer (BC) screening, stage at diagnosis and rate of breast reconstruction, although these results are less consistent in Canada. This study examined the relationship between SES and method of tumour identification, stage at diagnosis and rate of breast reconstruction. This is a retrospective cohort study with data drawn from chart review of patients diagnosed with BC between January 2010 and December 2011. Data on patient factors, method of tumour identification (screening v. symptomatic workup), stage at diagnosis and rate of breast reconstruction were collected. The patients' postal codes were then linked to the Canadian census data to obtain SES factors. Multivariate logistic regression was used to assess the association between SES factors and the 3 outcomes listed above. There were 721 patients treated for BC in our study cohort. Predictors of

tumour identification through screening included the following: patients aged 51–70 years, BMI >30, patients with first-degree relative with BC, previous screening within 2 years and patients with previous BC ($p < 0.05$). Predictors of diagnosis at early stage (stage 1–2) were similar to predictors of diagnosis through screening. Age younger than 50 years (OR 30.2, 95% CI 9.2–99.2) and patients with first-degree relative with BC (OR 2.7, 95% CI 1.1–6.5) significantly predicted breast reconstruction. Also, with each increase in income quintile, for women aged 51–70 years, the odds of having breast reconstruction doubled ($p < 0.01$). SES factors were not related to type of breast surgery (lumpectomy v. mastectomy), type of nodal surgery or receipt of adjuvant chemotherapy, radiation or hormonal therapy. Patient variables such as age and family history predicted the likelihood of early detection of BC by asymptomatic screening. In our urban cohort of BC patients, SES factors were not found to be predictors of early diagnosis but did influence rate of breast reconstruction.

07

Establishing a new "normal": a qualitative exploration of women's body image after mastectomy. ***A.M. Covelli, N.N. Baxter, F.C. Wright*. From the University of Toronto, St. Michael's Hospital and Sunnybrook Hospital, Toronto, Ont.**

Increasing rates of breast reconstruction have been described after unilateral (UM) and contralateral prophylactic mastectomy (CPM); however, not all women who undergo mastectomy undergo reconstruction. We wished to explore women's experiences after UM+/–CPM and their decisions to undergo reconstruction. We explored the meaning that reconstruction holds for women who underwent UM+/–CPM for early-stage breast cancer. Purposive sampling identified women who underwent UM+/–CPM across the area. Patients varied in their age, location of treatment and extent of surgery. Data were collected through semi-structured interviews. Constant comparative analysis identified key concepts. Data saturation was achieved after 29 interviews. Fifteen women underwent UM and 14 underwent UM+CPM. Eleven women underwent reconstruction; 8 underwent UM+CPM and 3 underwent UM alone. Four patients were awaiting reconstruction (2 UM+CPM, 2 UM). Median age was 55 years. Establishing a new "normal" was the dominant theme. Regardless of whether they underwent reconstruction, all women described their immediate postoperative period as a time of "disfigurement" and/or "loss." Women felt that breasts define them as "feminine" and "normal." In contrast, post-mastectomy women were seen "abnormal." For some women, appearing "normal" was achieved through reconstruction. For those who did not want reconstruction this was achieved through the use of prostheses. Reasons for choosing reconstruction included becoming "almost normal" and desiring symmetry/balance. Reasons women did not choose reconstruction included not wanting further surgery, wanting to "move on" and satisfaction with prostheses. With or without reconstruction, most women continued to experience some degree of self-consciousness, which they addressed through "camouflaging" with clothing. No woman voiced regret around her decision for mastectomy with or without reconstruction. The only dissatisfaction expressed was while awaiting reconstruction. Women described "establishing a new normal" after mastectomy. Whether they chose reconstruction or not, most women experienced some degree of self-consciousness. Despite ongoing body-image concerns, no woman regretted her choice of surgery.

08

Access to care and outcomes for neuroendocrine tumours: Does socioeconomic status matter? A population-based analysis. ***J. Hallet, K.A. Beyfuss, S. Koudjanian, N. Liu, R. Saskin, C.H.L. Law*. From the University of Toronto, Odette Cancer Centre – Sunnybrook Health Sciences Centre and the Institute of Clinical Evaluative Sciences, Toronto, Ont.**

Despite rising incidence, neuroendocrine tumours (NET) are a poorly understood malignancy lacking standardized care. Differences in socioeconomic status (SES) may further worsen the impact of non-standardized care. We examined the impact of SES on NET peri-diagnostic care patterns and outcomes. We conducted a population-based cohort study, within a universal health care system, of adults with NET. NET cases identified from a provincial cancer registry (1994–2009) were divided into low (1st and 2nd income quintiles) and high SES (3rd, 4th and 5th quintiles). Utilization Band (RUB) captured expected health care need based on baseline comorbidities. We compared peri-diagnostic health care utilization (–60 days to +6 months), metastatic recurrence and overall survival (OS) between groups. Of 4966 NET patients, 38.3% had low SES. Age, gender and RUB did not differ among groups ($p = 0.13$). Neither primary NET sites ($p = 0.15$) nor metastatic presentation differed ($p = 0.31$). Patients with low SES had a higher mean number of physician visits (37.4 ± 33.6 v. 34.5 ± 29.9; $p = 0.001$) and imaging studies (56 ± 50 v. 52 ± 44; $p = 0.009$) leading to NET diagnosis. Primary tumour resection ($p = 0.14$), hepatectomy ($p = 0.45$), systemic therapy ($p = 0.38$) and liver embolization ($p = 0.13$) rates did not differ with SES. Metastatic recurrence was more likely with low SES (41.1% v. 37.6%; $p = 0.01$) over 61.7 months median follow-up. Ten-year OS was inferior with low SES (47.1% v. 52.2%; $p < 0.01$). Low SES was associated with worse OS (HR 1.16; 95% CI: 1.06–1.26) after adjustment for age, gender, comorbidity burden, primary NET site and rural living. Low SES was associated with the need for more physician visits and imaging to reach NET diagnosis but not with more common advanced stage presentation or impact on patterns of therapy. Long-term outcomes were inferior for low-SES patients, with more frequent metastatic recurrence and worse 10-year OS. This data provide further insight for future directives in enhancing health care delivery particularly in NET patients with low SES.

09

Long-term outcomes following level 3 axillary lymph node dissection for breast cancer. ***H.M. Pousbay, J. Hallet, N.L. Hong, F.C. Wright*. From the University of Toronto, Toronto, Ont.**

Axillary lymph node dissection (ALND) for node-positive breast cancer traditionally includes levels I and II. Data remain limited regarding outcomes following level III ALND for patients with

level III nodal metastasis. We sought to assess the oncological outcomes of patients with breast cancer undergoing level III ALND. We performed a retrospective cohort study including all patients undergoing level III ALND from 2004 to 2014 at a tertiary care cancer centre. Primary outcomes were overall and recurrence-free survival (OS and RFS) and time to recurrence (TTR). Preoperative (clinical examination and imaging) and intraoperative (surgeon assessment) clinical diagnosis of malignant LNs were distinguished. Kaplan–Meier methods were used to compute survival curves. Of 21 patients undergoing level III ALND, 18 had a mastectomy and 3 a lumpectomy. Additional therapy included chemotherapy in all patients, radiation in 16 and hormonal therapy in 13. Thirteen (619%) patients were diagnosed preoperatively and received neoadjuvant treatment (NAT). Two of these patients had complete pathologic response, 6 had residual level III lymph node (LN) disease, 3 had disease limited to level I and II, and 2 had no nodal disease but residual primary tumour. Among 8 patients diagnosed intraoperatively, all had metastatic disease in level III LNs. All 8 received adjuvant treatment (AT). At 34-month median follow-up, actuarial 5-year OS was 67.5% (95% CI: 55.0%–80.0%) and 5-year RFS was 47.4% (95% CI: 34.5%–60.3%). At last follow-up, 13 (66.7%) patients were alive, including 2 (9.5%) with disease and 11 (52.4%) without disease. There was 1 (4.8%) local recurrence and 8 patients (38.1%) developed distant recurrences. Median TTR was 5 months (range: 1–36 months). Fewer patients who received NAT recurred (31% v. 62%). Level III ALND dissection provides good local control and may potentially prolong overall survival. Surgeons may consider level III ALND as part of curative-intent therapy in this select group of patients.

10

Utilization and effectiveness of adjuvant chemotherapy for colon cancer in the general population. *S. Nanji, J. Biagi, W. Mackillop, X. Wei, Y. Peng, T. Hanna, M. Krzyzanowska C. Booth*. From Queen's University, Kingston, Ont.

Adjuvant chemotherapy (ACT) is recommended for all patients with stage III colon cancer and may be considered for stage II cases with high-risk features. Here we describe practice patterns and outcomes associated with ACT in routine clinical practice. All patients with colon cancer treated during 2002–2008 were identified using the population-based [PROVINCE] Cancer Registry. Pathology reports and electronic treatment records were used to identify surgical procedures and utilization of ACT. High-risk stage II was defined as follows: T4, <12 lymph nodes, poorly differentiated histology and/or lymphovascular invasion. Logistic regression was used to evaluate factors associated with ACT utilization. Cox proportional hazards model was used to evaluate cancer-specific (CSS) and overall (OS) survival. The study population included 2801 stage III and 2488 stage II patients (47% were high risk). In the stage III subgroup, 66% received ACT, but the rate was 90% among patients aged 20–49 years versus 68% for those aged 70–79 years ($p < 0.001$). ACT was associated with increased CSS (HR 0.63, 95% CI 0.54–0.73) and OS (HR 0.63, 95% CI 0.55–0.71). Among all stage II patients, 18% received ACT but 24% of those in the high-risk disease subset did. ACT utilization was higher in younger patients (51% for those aged 20–49 years v. 16% for those aged 70–79 years, $p < 0.001$). Among all stage II patients ACT was not associated with improved CSS (HR 1.41, 95% CI 1.09–1.82) or OS (HR 1.16, 95% CI 0.94–1.42). Stratified analysis for high-risk stage II disease also did not show benefit with ACT (CSS HR 1.14, 95% CI 0.84–1.55; OS HR 1.02, 95% CI 0.79–1.31). One-third of patients with stage III colon cancer in the general population do not receive ACT, with age the strongest predictor of treatment. For stage II patients, ACT utilization varies substantially across age groups. ACT is associated with improved CSS and OS in stage III patients but not stage II patients, including those with high-risk disease.

11

Re-evaluating the optimal threshold for lymph node harvest in colon cancer: insights from a population-based study. *S. Nanji, J. Del Paggio, Y. Peng, X. Wei, P. MacDonald, C. Nair, C. Booth*. From Queen's University, Kingston, Ont.

Lymph node (LN) harvest is associated with survival in early-stage colon cancer. However, the literature is conflicting with regards to the optimal LN yield. Here, we evaluate LN count threshold associated with both LN positivity and survival using a population-based data set. Treatment records were linked to the provincial cancer registry to identify all patients with stage II and III colon cancer treated during 2002–2008. Surgical pathology reports were reviewed for a random 25% sample. Modified Poisson regression was used to identify factors associated with LN positivity, and Cox's proportional hazards model was used for survival analysis. Sequential regression analysis using multiple thresholds and Pearson/martingale residuals were used to evaluate the optimal threshold for LN positivity and cancer-specific survival. A total of 5508 cases met the eligibility criteria. On adjusted analysis, younger age ($p < 0.001$), left-sided tumours ($p = 0.003$), higher T stage ($p < 0.001$) and greater LN harvest ($p = 0.007$) were associated with greater likelihood of LN positivity. Regression analyses with multiple cut-points suggested that beyond 12–14 LN there was little incremental increase in LN positivity. Results were consistent on Pearson residual plot. Cox model analysis showed that increased LN harvest was associated with improved CSS for stage II and III disease. Sequential Cox analyses with multiple cut-points in stage II disease suggested no gain in survival beyond 20 LNs; for stage III disease, no threshold effect was observed. Martingale residual analysis confirmed these results. While greater LN harvest is associated with improved survival in colon cancer, these data show a disconnect between the number of LNs needed to accurately determine LN positivity and the optimal LNs needed for improved survival. Although the historically stated threshold of 12 LN may ensure accurate LN staging, the threshold for optimal survival is associated with a significantly greater harvest.

12

Lymph node harvest for colon cancer in routine clinical practice: a population-based study. *S. Nanji, J. Del Paggio, X. Wei, P. MacDonald, C. Booth*. From Queen's University, Kingston, Ont.

International guidelines recommend that at least 12 lymph nodes (LN) be resected during surgery for colon cancer. Here we report practice patterns and evaluate whether LN harvest is associated with survival in the general population. Treatment records were linked to the Ontario Cancer Registry to identify all patients with stage II and III colon cancer treated during 2002–2008. Surgical pathology reports were reviewed for a random 25% sample. Modified Poisson regression was used to identify factors associated with LN harvest; Cox models were used to explore association between LN harvest and overall (OS) and cancer-specific (CSS) survival. A total of 25 613 patients underwent resection of colon cancer during the study period. Pathology reports were reviewed for 7519 cases of which 5508 had stage II or III disease. Over the study period median LN harvest increased from 11 to 17 ($p < 0.001$) and the proportion of patients with ≥12 LNs increased from 45% to 86% ($p < 0.001$); the proportion of patients with node-positive disease did not change (from 54% to 53%, $p = 0.357$). The following factors were independently associated with ≥12 LNs: older age (RR 0.88, 95% CI 0.82–0.94), greater comorbidity (RR 0.87, 95% CI 0.79–0.95), higher socioeconomic status (RR 0.94, 95% CI 0.89–0.99), right-sided tumours (RR 1.17, 95% CI 1.13–1.21) and lower hospital volume (RR 0.90, 95% CI 0.86–0.95). In adjusted analyses, LN harvest <12 was associated with inferior OS and CSS for stage II (OS HR 1.36, 95% CI 1.19–1.56; CSS HR 1.52, 95% CI 1.26–1.83) and stage III (OS HR 1.45, 95% CI 1.30–1.61; CSS HR 1.54, 95% CI 1.36–1.75) disease. Despite a temporal increase in LN harvest, the proportion of cases with node-positive disease has not changed. LN harvest is associated with survival in patients with both stage II and III colon cancer. The association between LN harvest and survival is unlikely to be due to stage migration.

13

The role of CEACAM1 in neutrophil extracellular trap mediated cancer metastasis. ***P. Vourtzoumis, R. Seth, R. Rayes, S. Najmeh, J. Cools-Lartigue, B. Giannias, F. Bourdeau, N. Beauchemin, S. Rousseau, R. Blumberg, J.D. Spicer, L.E. Ferri.*** **From McGill University, Montreal, Que.**

Neutrophil extracellular traps (NETs) are an important contributing factor to the metastatic process. The underlying mechanisms by which NETs facilitate metastasis remain unclear. Using mass spectrometry, we identified CEACAM1 (CC1) in isolated human NETs and we sought to determine whether CC1 has a role in NET-mediated cancer metastasis. In vitro static adhesion of human HT29 cancer cells to purified NETs was reduced by 50% using a function blocking antibody against human CC1, an effect equal to NET degradation with DNAse. Adhesion of murine MC38 cancer cells to C57BL/6 mouse neutrophils stimulated to produce NETs with phorbol myristate acetate (PMA) was increased 3-fold compared with untreated neutrophils, an effect that was attenuated with DNAse. PMA stimulation of neutrophils from Ceacam1–/– knockout (KO) mice did not increase adhesion to MC38 cells. Using a parallel flow chamber, we flowed Lewis lung cancer cells over neutrophils from C57BL/6 or Ceacam1–/– KO mice. PMA-induced NET formation in C57BL/6 mouse neutrophils increased cancer cell adhesion 5-fold, an effect again attenuated by DNAse or use of neutrophils from Ceacam1–/– KO mice. To delineate the role of CC1 in NET-related in vivo adhesion of cancer cells to liver sinusoids, we performed a series of neutrophil depletion/re-infusion experiments. C57BL/6 mice, depleted of neutrophils with anti-GR1, were re-infused with neutrophils from C57BL/6 or Ceacam1 / KO mice. This was followed by injection of MC38-CFSE labelled cells and hepatic intravital microscopy to quantify in vivo cancer cell adhesion. PMA-stimulated C57BL/6 neutrophils before re-infusion were associated with a 2-fold increase in adhesion compared with PMA-stimulated Ceacam1–/– KO neutrophils, an effect that was attenuated using DNAse. Our data support the notion that CC1 is, at least in part, responsible for the increased cancer cell migration mediated by NETs. We have thereby identified NET-associated CC1 as a putative therapeutic target.

14

Neoadjuvant therapy for stage III-IV melanoma: a systematic review of the literature and evaluation of future prospects. ***A.M. Yu, A. Tran, C. Nessim, M. Ong.*** **From the Ottawa Hospital Research Institute and Ottawa Hospital Cancer Centre, Ottawa, Ont.**

Currently, there is no defined role for the use of neoadjuvant treatment in locally advanced or oligometastatic melanoma. The primary objective of this systematic review was to determine whether the literature has demonstrated a benefit for neoadjuvant therapy to reduce disease burden or to improve patient survival and surgical outcomes in the context of advanced resectable disease. Databases (Medline, Embase, PubMed, Cochrane CENTRAL) and conference abstracts were searched to January 2014 using a pre-specified search strategy. A repeated search was conducted in March 2016. Included articles were prospective randomized and non-randomized trials, and retrospective analyses, investigating neoadjuvant treatments in adult patients with cutaneous melanoma and advanced yet resectable disease. A qualitative analysis was conducted. A total of 817 participants from 21 studies were included; 4 were randomized trials. Study outcomes were heterogeneous across all therapy types (chemotherapy, biochemotherapy, immunotherapy, targeted therapy, radiotherapy) with considerable risk of bias present among a majority of the included studies. While high objective response rates were reported for neoadjuvant biochemotherapy, interferon, BRAF +/–MEK inhibitors and radiotherapy, they were limited by single-arm designs and limited follow-up to determine effects on long-term relapse and patient survival. Few studies have been completed using newer treatments that have been shown to improve survival in metastatic melanoma. Few studies report on the effects of neoadjuvant therapy on surgical outcomes (resectability, local complications). No studies reported switching systemic therapy based on in vivo tumour response or predictive biomarkers. The role of neoadjuvant treatment of advanced resectable melanoma remains unknown, due to a paucity of completed clinical trials. Proposed benefits of neoadjuvant treatment include decreased surgical morbidity, improved tumour resectability and overall survival. Adaptation of systemic treatment and availability of response biomarkers remain investigational. These findings emphasize the need for prospective randomized neoadjuvant trials in this high-risk patient population.

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Molecular profiling and clinical outcomes in patients with nodular melanoma. ***F.S.W. Zih, N. Kulkarni, D. Escalante, C. Meade, N. Osevala, M. Zibelman, S. Movva, K.S. Gustafson, B. Luo, H. Wu, S. Reddy, M. Lango, A.J. Olszanski, J.M. Farma.*** **From the Fox Chase Cancer Center, Philadelphia, Pa.**

The use of molecular profiling has become increasingly important in providing valuable information on primary cancers, with the potential to uncover actionable mutations and provide prognostic information. Our institution has been using next-generation sequencing (NGS) to examine mutations in 50 cancer-related genes. Here we examine the use of molecular profiling of patients who presented with high-risk nodular type melanoma Patients with the nodular type of malignant melanoma (MM) were included in the study. Using NGS, we analyzed tissue samples for mutations in targeted regions of 50 cancer-related genes. Clinical and pathologic data were collected. We performed NGS on 108 patients with MM; of these, 30 patients presented with nodular melanoma. Median age at diagnosis was 73 years (range 27–88) and 16 patients were male. The location of the primary included head and neck (n = 6), lower extremity (n = 8), upper extremity (n = 7) and trunk (n = 9). At presentation, 3 were stage I, 15 were stage II and 8 were stage III. Of the tissue tested 16 were from the primary tumour. In total 50 mutations were identified, affecting 22 unique genes. No mutations were found in 17% of patients (n = 5), while 43% of patients (n = 13) had only 1 mutation, 13% (n = 4) had 2 mutations, 17% (n = 5) had 3 mutations and 10% (n = 3) had 4 or more mutations. The most frequently identified mutations included NRAS (n = 10), TP53 (n = 6), BRAF V600E (n = 6), CDKN2A (n = 3), APC (n = 2), KRAS (n = 2) and PTEN (n = 2). Using our NGS platform in patients with in-transit melanoma we identified the most common mutations are NRAS in 33% and TP53 in 20% of patients. Further studies will identify and correlate specific patterns of mutation with treatment response and survival outcomes.

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Patient-reported satisfaction following oncoplastic breast conserving therapy. ***A. Bazzarelli, L. Baker, J. Zhang, A. Arnaout.*** **From the University of Ottawa, Ottawa, Ont.**

Oncoplastic breast surgical techniques are becoming increasingly used to limit deformity in breast-conserving therapy (BCT) for breast cancer. We aimed to evaluate patient-reported satisfaction following breast-conserving level II oncoplastic techniques (reduction/mammoplasty techniques) in terms of patient satisfaction with cosmesis and psychosocial and sexual well-being postoperatively. This was a 5-year prospective study whereby patients who underwent BCT with the use of level II oncoplastic techniques were given the BREAST-Q questionnaire postoperatively at 3 months. Clinical and pathological characteristics were identified from patient charts. Since 2010, a total of 802 patients underwent breast cancer surgery, and level II oncoplastic techniques were used in 130 (16%) of them. A total of 88 patients completed BREAST-Q questionnaires (response rate 67.7%). Patient average age at the time of surgery was 59 years (standard deviation [SD] = 12.5 years). Tumour characteristics demonstrated a median T stage of 1 and a median N stage of 0. The average volume of breast tissue resected was 477.7 cm^3 (SD = 966.6 cm^3). Mean satisfaction with BREAST-Q score was 75.1 (SD = 13.4) and satisfaction with nipples was 80.5 (SD = 22.7), while the mean psychosocial well-being score was 85.4 (SD = 16.0) and sexual well-being was 65.7 (SD = 24.0). Results demonstrate a high degree of satisfaction in patients who underwent BCT aided by level II oncoplastic techniques on the BREAST-Q patient-reported outcome measure. These findings demonstrate that oncoplastic breast-conserving therapy has an equivalent or higher satisfaction among patients when compared with those in the literature undergoing mastectomy and reconstruction. Further larger prospective studies comparing patient satisfaction of oncoplastic BCT to standard BCT and mastectomy with reconstruction are required.

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Challenges in using oncoplastic techniques in breast-conserving surgery. ***J. Maxwell, A.M. Covelli, A.S. Scheer, A. Roberts, F. Osman, J. Escallon, T.D. Cil.*** **From the University of Toronto and North York General Hospital, Toronto, Ont.**

Oncoplastic breast surgery (OPS) allows for oncologically safe tumour resection while preserving excellent cosmesis. Despite this, these techniques are not routinely used in Canada. This study examines Canadian general surgeons' beliefs and utilization of oncoplastic techniques in breast-conserving surgery (BCS). A qualitative pilot study exploring general surgeons' knowledge and utilization of OPS was completed. Purposive sampling identified general surgeons who routinely treat breast cancer across Canada. Surgeons varied in length/location of practice, extent of training and gender. Data were collected via semi-structured interviews and focus groups until saturation was reached. Constant comparative analysis identified key themes. Eleven general surgeons participated in the study. While most surgeons were interested in improving cosmesis and employing OPS, knowledge, beliefs and access often limited their utilization of these techniques. Most surgeons lacked knowledge about specific oncoplastic procedures and demonstrated unfamiliarity with the difference between oncoplastic and reconstructive techniques. Some surgeons felt that OPS would not significantly alter patients' cosmetic outcomes, whereas other surgeons believed that patients are not concerned with cosmesis and therefore using OPS would not provide substantial benefit. Many surgeons voiced concerns around the lack of acceptance by their colleagues and feeling unsupported in their attempts to offer OPS. They also described having limited access to "hands-on" training. A minority of participants also discussed limited access to operating room time and lack of appropriate reimbursement given the increased length of time needed for OPS. This study identified the multiple challenges that surgeons face when attempting to utilize OPS. The key barriers included knowledge, beliefs and access to oncoplastic techniques. Most surgeons expressed an interest in oncoplastic procedures; however, they felt unprepared to utilize them in daily practice. Active strategies will be required to overcome these challenges in order to improve overall care for women with breast cancer.

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Morbidity of HIPEC using oxaliplatin versus mitomycin C for peritoneal carcinomatosis arising from colorectal or appendiceal neoplasms: a multi-institutional comparative study. ***E. Benzaquen, Y. Wang, S. Wiseman, L. Sideris, P. Dubé, J.S. Pelletier, T. Vanounou*. From the Division of General Surgery, Jewish General Hospital, Montreal, Que.; and the Division of Surgical Oncology, Hôpital Maisonneuve-Rosemont, Montreal, Que.**

The difference in the morbidity and the toxicity of mitomycin C (MMC) versus oxaliplatin when used for hyperthermic intraperitoneal chemotherapy (HIPEC) combined with cytoreductive surgery (CRS) remains unclear. We therefore sought to compare oxaliplatin versus MMC in adults undergoing CRS-HIPEC for peritoneal carcinomatosis (PC) originating from colorectal or appendiceal neoplasms with regards to their morbidity, toxicity profiles and raw cost. A retrospective multi-institutional study was conducted evaluating patients with PC of colorectal or appendiceal origin treated with CRS-HIPEC using MMC versus oxaliplatin from 2010 to 2015. Demographic, perioperative, morbidity, toxicity and mortality data were compared between the 2 groups. Forty-two patients were identified in the MMC group and 76 in the oxaliplatin group. All baseline demographic and tumour characteristics were comparable between the 2 groups, except for the higher Charlson comorbidity index (CCI) scores in the MMC group (9 [6, 14] v. 9 [1, 11], $p = 0.003$). The MMC group had significantly longer operating times (552.5 [275, 936] v. 320 [130, 767], $p < 0.01$), higher transfusion rates (50.0% v. 28.6%, $p = 0.023$) and lower postoperative baseline hemoglobin levels (100 [70, 140] v. 117 [73, 142], $p = 0.001$). After controlling for postoperative anemia, there was no significant difference in hematologic toxicity scores between the 2 groups. The incidence of Clavien-Dindo grade III/IV complications and 90-day mortality rates were also similar between the 2 groups. However, the raw cost of the chemotherapeutic agents used in these HIPEC surgeries is C$724 for the MMC and an average of C$8928.28 for the mean oxaliplatin dosage. MMC and oxaliplatin are both suitable agents for HIPEC and are associated with comparable toxicity profiles. Differences in cost-effectiveness may ultimately dictate the selection of the treatment agent.

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Evaluation of emergency department visits and associated predictors among seniors after breast cancer surgery. ***Y.S. Rho, T. Westley, A. Syrowatka, D. Henault, F. Khazoom, S.-L. Chang, A.N. Meguerditchian*. From McGill University, Montreal, Que.**

Postoperative complications resulting in visits to the emergency department (ED) represent adverse events negatively affecting the cancer care trajectory. This study identifies patient predictors and types of postoperative complications contributing to the burden of unplanned ED visits in seniors undergoing breast cancer (BC) surgery. A prospective historical cohort study was designed using the health service databases of a provincial universal health care system. Included were all women >65 years undergoing definitive surgery for nonmetastatic incident BC (1998–2012). Reasons for all ED visits occurring within 45 days after surgery were captured. Potential predictors of ED visits including patient demographics, BC stage, surgery type, comorbidities, pharmaceutical profile and hospital surgical volume were entered into Cox regression models. Of the 24 463 women selected (median age 74), 17 021 (69.6%) had localized, 5041 (20.6%) axillary and 2401 (9.8%) in situ disease. In total, 3129 patients (12.8%) visited the ED at least once (median time after surgery was 14 days). The majority visited once (81.9%), 14.4% visited twice and 3.7% had 3 ED visits. Of the 5013 ED visit diagnoses, the most frequent reasons were as follows: superficial site infections ($n = 569$), non-infectious gastrointestinal problems ($n = 439$) and trauma ($n = 422$). Significant predictors of postoperative ED visits included disease stage ($p < 0.0001$), number of surgeries to oncological control ($p = 0.002$), polypharmacy ($p < 0.0001$), anticoagulant use ($p < 0.0001$), benzodiazepine use ($p = 0.045$), cardiologist visit within 1 year of surgery ($p < 0.0001$) and surgery at a lower volume institution ($p = 0.003$). Unplanned postoperative ED visits occur at a non-negligible rate. Early identification of risk factors in patients undergoing BC surgery could prevent unnecessary ED visits.

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Application of the new ATA guidelines leads to a substantial rate of completion total thyroidectomy to enable adjuvant radioactive iodine. ***W.P. Kluijfhout, L.E. Rotstein, Q.-Y. Duh, J.D. Pasternak*. From the University Health Network and University California San Francisco, San Francisco, Calif.**

The revised 2015 American Thyroid Association (ATA) guidelines for treatment of well-differentiated thyroid cancer (WDTC) now recognize unilateral thyroid lobectomy as a viable alternative for 1- to 4-cm cancers due to their favourable prognosis. A subset of these patients have findings at pathological analysis indicating adjuvant treatment with radioactive iodine (RAI), requiring completion total thyroidectomy. Although the new guidelines support thyroid lobectomy, it is unclear how often a low-risk patient will be reclassified postoperatively as higher risk, necessitating reoperation. We performed a retrospective analysis of patients who underwent thyroidectomy for WDTC between January 2000 and 2010. Patients with microcarcinoma (<1 cm) or high-risk disease (>4 cm, gross extrathyroidal extension, clinical N1b, M1) were excluded as were patients with insufficient data regarding RAI treatment. We evaluated the exact indications for adjuvant therapy with RAI based on the ATA guidelines, which include (1) papillary thyroid cancer with vascular invasion, (2) aggressive histology, (3) clinically suspicious N1, (4) >5 positive lymph nodes or lymph node metastases >1 mm or extranodal extension and (4) microscopic extrathyroidal extension. Of the 1000 patients, 149 were eligible for lobectomy preoperatively. Of these, 29 (19.5%) had findings on pathological examination that would favour adjuvant treatment with RAI, according to the same guideline, and would therefore require completion total thyroidectomy. While thyroid lobectomy is a viable option for the treatment of low-risk WDTC, about 20% of patients may need completion total thyroidectomy due to pathological findings found postoperatively for which RAI use is favoured. Though this should not prevent surgeons from doing a lobectomy, clinicians caring for thyroid cancer patients should be aware that a small but significant number of patients will be reclassified as higher risk after surgical intervention indicating reoperation and RAI.

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Surgeon bias in sentinel lymph node biopsy for breast cancer. ***D. Percy, J. Pao, E. McKevitt, C. Dingee, U. Kuusk, R. Warburton*. From the University of British Columbia, Mount St. Joseph's Hospital, Vancouver, B.C.**

Sentinel lymph node biopsy (SLNB) is the standard of care for axillary staging in clinically node-negative breast cancer. The number of sentinel lymph nodes (SLN) should not differ based on tumour biology. Removing more than 4 lymph nodes does not reduce false-negative rates. Recent publications suggest that surgeons may be biased, removing more nodes in high-risk breast cancer. The purpose of this study was to assess for surgeon bias in SLNB at our centre. A prospectively maintained breast cancer database was reviewed. All patients who had a SLNB for primary treatment of breast cancer between January 2012 and December 2014 were included. Patient demographics, clinical and imaging findings, tumour biology, neoadjuvant therapies and pathology were reviewed. Groups were compared using t test with Welch's correction, and 1-way ANOVA for multiple comparisons. A total of 1120 patients met the inclusion criteria. The average number of SLNs, non-SLNs and total LNs was 2.50, 0.62 and 3.11, respectively. The average number of SLNs removed for patients aged <50 years v. those aged >50 years was 2.72, 2.43 ($p = 0.011$); ductal carcinoma in situ v. invasive 2.26, 2.53 ($p = 0.052$); ER+ v. ER– 2.47, 2.78 ($p = 0.037$), HER2+ v. HER2– 2.63, 2.61 ($p = 0.367$); neoadjuvant v. no neoadjuvant 2.49, 2.56 ($p = 0.571$). There was a significant difference in the number of SLNs removed for size T2 v. T3 3.06 v. 3.40 ($p < 0.05$) and for total LNs removed for grade II v. III 3.02, 3.35 ($p < 0.05$). There was a significant difference in the total number of LNs removed for DCIS v. invasive carcinoma 2.70, 3.18 ($p = 0.0097$). Overall, the averages fell within the generally accepted range of 2–4. The number of SLNs and total LNs removed was statistically higher in some high-risk groups, including younger age, ER negative, higher grade and larger tumours.

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Initial presentation of patients with peritoneal malignancy from appendiceal neoplasms: an opportunity for prevention and early diagnosis. ***M.J. Furman, E. Taylor, D. Bischof, J.A. McCart, A. Govindarajan*. From Mount Sinai Hospital, Toronto, Ont.**

Peritoneal surface malignancy from appendiceal neoplasms represents a deadly disease, for which early and complete cytoreductive surgery offers the only real chance for cure. However, patients often present with advanced disease because of delayed recognition of these rare malignancies. The objective of this study was to determine the initial presentation of patients with appendiceal-based peritoneal malignancies. We conducted a retrospective cohort study using a prospectively collected institutional database at a single tertiary care centre that is the only referral centre for peritoneal malignancy in the province. All patients diagnosed with peritoneal surface malignancy from an appendiceal primary between July 2007 and January 2015 were included. Age, gender and etiology of initial presentation were evaluated. A total of 235 patients were identified. The majority of the patients were female (67.3%). The average age of all patients in this cohort was 57 years. The initial presentation in 27.6% (65/235) of the total patient group was perforated appendicitis without suspicion of an appendiceal neoplasm. Of these, 45% (28/65) were managed nonoperatively. The majority of these patients were over 50 years old (66.2%), but a significant minority were under 50 years old (33.8%). Among female patients, 32.9% (52/158) presented initially with ovarian masses and had been treated with surgery for suspected ovarian cancer before the diagnosis of an appendiceal primary was made. Over one-third of all patients who develop peritoneal malignancy from an appendiceal primary, such as pseudomyxoma peritonei, initially present with an ovarian mass or as perforated appendicitis managed nonoperatively. Recognition of these presentations may lead to earlier diagnosis and treatment. Additionally, in patients with perforated appendicitis, discussion of interval appendectomy may be warranted as a means to prevent the development of peritoneal disease.

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"The inertia of practice" challenges in addressing infertility in young women with cancer. ***A.M. Covelli, M. Facey, C. Daly, E. Kennedy, N. Baxter*. From the University of Toronto, St. Michael's Hospital and Mount Sinai Hospital, Toronto, Ont.**

Infertility can be a devastating side effect of cancer treatment for young women. Fertility preservation is important and may influence treatment decisions. The American Society of Clinical Oncology (ASCO) guidelines recommend that health care providers (HCPs) discuss potential infertility with their cancer patients. Despite this, nearly 50% of young women remain uninformed. We conducted a qualitative study exploring HCPs' discussions around infertility in young women with cancer. Purposive sampling identified HCPs who routinely treat young women across Canada. HCPs were varied in length/location of practice, clinical focus and gender. Data were collected via semi-structured telephone interviews. This continued until saturation was reached. Constant comparative analysis identified key ideas. Twenty-two HCPs consisting of medical and surgical oncologists, gynecologists, fertility specialists and nurse practitioners completed interviews. "The inertia of practice: challenges in addressing infertility" was the key concept. Knowledge, beliefs and access all influenced HCPs' discussions around infertility. Several HCPs expressed a general unfamiliarity with the guidelines among oncologists. Many HCPs also described lacking detailed knowledge about preservation options and their efficacies. Due to this lack of knowledge many HCPs were reluctant to initiate discussions around infertility. Providers also voiced concerns around potential delays in cancer treatment and worsening oncologic outcomes. Some HCPs felt that infertility is "non-fatal" and therefore a lesser priority. Many HCPs also described having limited access to fertility centres and resources, feeling ill equipped in their discussions around infertility. A minority of HCPs believed that patients are not concerned about potential infertility and/or they would be unable to afford fertility treatments. We present an understanding of those factors that contribute to inertia of practice in discussing fertility preservation with young women with cancer. Active strategies will be required to overcome the current inertia of practice in order to improve care of young women with cancer.

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A population-based study of 135 676 patients with benign thyroid nodules in Ontario: Are we performing too many biopsies? ***J.D. Pasternak, W.P Kluijfhout, K.M. Devon, Y. Liu, L.E. Rotstein, D.R. Urbach*. From the University Health Network, Toronto, Ont.**

Thyroid nodules are present in 50% of the general population. Widespread use of neck ultrasonography has increased the detection of asymptomatic lesions that have a low risk of being clinically significant. Once characterized by ultrasound, fine-needle aspiration is often performed for determination of malignancy risk. Lesions found to be benign are followed long term and often subject to multiple subsequent biopsies. We sought to determine the future risk of malignancy in benign thyroid nodules by looking at all biopsies performed in the province of Ontario over a 20-year period. Thyroid biopsies in the province of Ontario performed between 1991 and 2010 were identified using administrative health data. A diagnosis of thyroid cancer in the Ontario Cancer Registry within 1 year of the first biopsy during the study period ("index" biopsy) was considered malignant. We analyzed the occurrence of any subsequent biopsy, surgery or diagnosis of thyroid cancer among persons with non-malignant nodules for up to 25 years after the index biopsy using Kaplan–Meier methods. Overall, 146 014 people had 1 or more thyroid biopsies. Among the index biopsies, 135 676 (92.9%) were benign. Biopsies were performed by a surgeon in 35 516 (24.3%) of patients. Overall, 6354 patients (4.7%) with a benign index biopsy developed thyroid cancer, with a mean number of 318 (0.2%) patients per year. The cumulative risk of developing a thyroid cancer was 4.6% after 10 years and 7.5% after 24 years. Forty-eight per cent of patients (51 907) had at least 1 additional biopsy during the study period, and 8% (10,242) had 2 or more subsequent biopsies. Most thyroid nodules biopsied in Ontario are benign. These nodules have a relatively high rate of rebiopsy despite a very low risk of developing thyroid cancer. Thyroidologists should understand the likelihood of malignant transformation of benign thyroid nodules and avoid rebiopsy when applicable.

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The importance of surgeon-directed ultrasound combined with the surgeon's interpretation of 99-Tc sestamibi scan in the preoperative planning of patients with primary hyperparathyroidism. ***S. Tharmalingam, J.L. Pasieka*. From Queen's University, Kingston, Ont.; and the University of Calgary, Calgary, Alta.**

With a shift away from a 4-gland exploration to a focused parathyroidectomy in primary hyperparathyroidism (HPT), improving preoperative localization has become increasingly important. We hypothesized that the surgeon's interpretation of the Tc-99m sestamibi scan (MIBI) combined with a bedside ultrasound is more accurate than the radiologist's reading of the MIBI scan. Between 2010 and 2015, 228 HPT patients underwent a parathyroidectomy by a single surgeon. In a retrospective manner, the radiologist's reading of the MIBI and the surgeon's preoperative interpretation of the MIBI and bedside ultrasound were reviewed. These readings were compared with intraoperative and pathology findings, which served as the "gold standard." Of the 228 patients with HPT, 186 (86%) were single-adenoma cases and 32 (14%) were multi-gland disease cases. Sensitivity and positive predictive values were 64% and 87.5% for the radiologist compared with 92.3% and 83.5% for the surgeon. The overall accuracy of correct localization was 58.8% versus 77.6%, which increased in the single-adenoma patients for both radiologist and surgeon (64% v. 86%). Factors affecting the surgeon's inability to localize included obesity, the presence of multi-glandular disease, and lower adenoma weight (333 mg v. 1026 mg, respectively, $p = 0.002$). Thirty-three per cent of MIBI reports were non-localizing by the radiologist while only 13.5% of the MIBI were non-localized according to the surgeon. The ability to perform a bedside ultrasound and independently interpret a Tc-99m sestamibi scan (MIBI) offers the surgeon a valuable real-time assessment in parathyroid adenoma localization. In turn, this combination significantly improves preoperative localization in HPT, compared with radiologist interpretation of the MIBI scan.

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Breast-conserving surgery using NaviKnife technology: pilot study on nonpalpable tumours. ***G. Gauvin, T. Ungi, A. Lasso, C.T. Yeo, G. Fichtinger, D. Jabs, R. Walker, S. Merchant, J. Rudan, C.J. Engel*. From Queen's University, Kingston, Ont.**

Positive margins in breast-conserving surgery are associated with a higher risk for local recurrence despite adjuvant therapy. Current surgical strategies have a reexcision rate for positive margins as high as 25%. We have developed NaviKnife, a real-time electromagnetic navigation system, which defines (contours) the desired tumour resection margins using ultrasound and allows tumour movement to be followed in real time during surgery. Our initial study done on breast phantoms showed NaviKnife decreased the positive margin rate from 42.9% (wire localization alone) to 19.0% (NaviKnife). Our study on palpable tumours revealed that tumour contouring time takes an average of 8.44 minutes and that NaviKnife was safe and easy to use intraoperatively. Twenty-five patients with a single nonpalpable breast tumour will be recruited in this pilot study to assess the use of NaviKnife technology in breast-conserving surgery for nonpalpable tumours. Feasibility will be assessed by demonstration of safety and sterility, acceptable duration of the operation and tumour contouring time, as well as positive margin rate. To date, 9 patients (mean age 65.1 years) have been recruited and have undergone a partial mastectomy using the NaviKnife technique. The mean operative time was 81.75 minutes for partial mastectomy with sentinel node biopsy (from skin incision to closure). The mean tumour contouring time was 4.99 minutes. All margins were clear of invasive carcinoma. One specimen had a positive margin for ductal carcinoma in situ (positive margin rate of 11.1%). There were no complications or breaches in sterility during surgery. Feedback questionnaires stated that NaviKnife navigation was easy to use and a useful guide to surgical excision of nonpalpable tumours. NaviKnife provides useful real-time feedback to surgeons. This pilot study suggests that NaviKnife technology could reduce the incidence of positive margins and improve treatment outcomes in breast-conserving surgery.

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A care pathway for hyperthermic intraperitoneal chemotherapy with cytoreductive surgery (CS/HIPEC) patients: unifying input from an international survey and evidence-based practices. ***A. Maciver, E. Al-Sukhni, J. Esquivel, J. Skitzki, J. Kane III, V. Francescutti*. From the Roswell Park Cancer Institute, Buffalo, N.Y.; and Cancer Treatment Centers of America, Philadelphia, Pa.**

Cytoreductive surgery and heated intraperitoneal chemotherapy (CS/HIPEC), considered a major surgical oncology procedure, is performed for selected indications at a limited number of specialized centres worldwide. Currently there is no standardized approach to the perioperative care process. We sought to capture current practices of key stakeholder surgeons in the perioperative management of patients who undergo CS/HIPEC at high-volume centres and, with this information, to develop and implement a care pathway at our institution as a phase I trial. Surgeon members of the American Society of Peritoneal Surface Malignancies (ASPSM) working at high-volume CS/HIPEC centres (>10 cases/year) were invited to complete an online survey. The survey included questions relating to preoperative preparation of patients, intraoperative practices and postoperative care. Using these data with guidelines and recommendations from published literature, a comprehensive pathway was developed and prospectively implemented at our centre. Ninety-seven surgeons from 5 continents completed the survey (response rate 55%). The majority (80%) practised in academic environments. Most respondents (68%) indicated that a formal preoperative preparatory pathway for CS/HIPEC surgery existed at their centres, but few (26%) had used enhanced recovery protocols in this group of patients. Whereas the intraoperative technical practices of the CS/HIPEC procedure were relatively consistent across respondents, there was little agreement on pre- and post-operative care practices, including use of mechanical bowel preparation, nutritional supplementation, methods of perioperative analgesia, timing of nasogastric tube and Foley removal, intravenous fluids, transfusion parameters, use of extended thromboembolic prophylaxis and postoperative antibiotics. Perioperative care of CS/HIPEC patients varies nationally and internationally. Gaps are identified that present opportunities for standardization and evidence-based improvement in quality of care, in the challenging context of a complex procedure for a heterogeneous patient population. Implementation has begun with our experience demonstrating feasibility of a formal care pathway in a high-volume program.

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Do surgical gloves and instruments harbour cancer cells? ***D. Berger-Richardson, A. Pollett, D.A. Bischof, P. Ferguson, A. Govindarajan, J.A. McCart, J. Wunder, A.M. Griffin, E.L. Taylor, P. Sharosh Shahi, C.J. Swallow*. From the University of Toronto, Toronto, Ont.**

It has been hypothesized that surgical gloves and instruments harbour malignant cells following the extirpative phase of a cancer resection and that these cells can be exfoliated into the tumour bed and surgical wound, ultimately leading to recurrence. A recent survey of Ontario surgeons confirmed that there is no consensus on how surgical gloves, instruments and wound protectors should be handled in cancer operations. We have shown that malignant cells can survive on surgical instruments (>80% viability at 10 minutes) and gloves (>80% viability at 30 minutes) while maintaining proliferative potential. The goal of our study was to determine whether gloves and instruments retain malignant cells in human cancer operations. We investigated 3 procedures: (1) cytoreductive surgery for peritoneal malignancy, (2) incisional biopsy for extremity soft tissue mass and (3) resection of extremity soft tissue sarcoma. At a consistent time point during surgery, surgeons' gloves and instruments were irrigated separately with normal saline (0.9%). The effluent was collected, a cell preservative was added and the samples were centrifuged. The pellet was examined by microscopy. In the cytoreductive surgery group (n = 39 operations), 33% of glove and 36% of instrument washings contained malignant cells. In the incisional biopsies (n = 11 operations), washings were positive for malignancy in 73% and 36% of instrument and glove washings, respectively. Washings obtained during resection of extremity sarcoma (n = 42 operations) did not contain any malignant cells. In procedures in which there is a high likelihood of direct contact with malignant tissue, surgical gloves and instruments are capable of retaining malignant cells. However, in curative resections, we have not identified malignant cells on gloves and instruments. Acknowledging that routine glove and instrument changing, use of wound protectors, changing drapes before reconstruction and other protective strategies have an important financial and environmental burden, evidence-based guidelines for these practices are warranted.

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Management of positive margins in elderly women with breast cancer: Is re-excision necessary? ***F.A. Angarita, S.A. Acuna, J. Escallon*. From University of Toronto, Toronto, Ont.**

It is unclear whether re-excision of positive margins in elderly women following breast-conserving surgery (BCS) confers survival advantage. We evaluated the management of positive margins and its impact on survival in elderly women with breast cancer who were treated at our high-volume cancer centre. Women ≥50 years old diagnosed with stage I-III tumours who underwent BCS between 2004 and 2011 were identified from an institutional database. A multivariable logistic regression was used to evaluate factors associated with reoperation. Incidence of recurrence was evaluated by plotting the cumulative incidence function of recurrence and death without recurrence. A total of 1670 women were identified: 50–69 years (n = 1177) and ≥70 years (n = 493). Compared with younger patients, elderly women had tumours that were larger (2 cm v. 1.4 cm, $p < 0.001$), more differentiated (34% v. 25%, $p = 0.003$), more hormone receptor positive (91.9% v. 66.4%, $p < 0.001$) and more HER2 negative (75% v. 71%, $p = 0.04$). Elderly women were more frequently diagnosed with stage II tumours (49%) while younger women had stage I (57%) ($p < 0.001$). Positive margins were less common in elderly than younger women (11% v. 16%, $p = 0.004$). Age was inversely associated with reoperation (≥70 years: 5% v. 50–69 years: 15%, $p < 0.001$). After adjusting by size,

grade and positive lymph nodes, elderly women with positive margins had lower odds of undergoing reoperation (OR: 0.1; 95% CI: 0.06–0.3). The recurrence rate was 5% and did not differ by age (≥70 years: 5% v. 50–69 years: 4%, $p = 0.6$). Although the cumulative incidence of death without recurrence in patients with positive margins was higher in elderly women ($p < 0.001$), the cumulative incidence of recurrence did not differ ($p = 0.2$).Five-year disease-free survival (DFS) was similar between the groups (≥70 years: 86% v. 50–69 years: 86%, $p = 0.8$). Elderly women with positive margins are less likely to undergo reoperation than younger women independent of poor prognostic factors. However, no differences were observed in recurrence and DFS.