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ABSTRACTS

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Abstracts

Canadian Obesity Network (CON)

01

Iron deficiency in bariatric surgery patients — a single-centre experience over 5 years. *B. Lowry, K. Hardy, A. Vergis.* From the University of Manitoba, Winnipeg, Man.

As the prevalence and severity of obesity have increased in Canada, so too has the demand for bariatric surgery. The objective of this study was to determine the incidence of postoperative iron deficiency and anemia as well as the impact of increasing body mass index (BMI) on these outcomes. Patients undergoing bariatric surgery from 2010 to 2014 were included in the analysis. Data captured included age, gender, date of surgery, BMI pre- and postoperatively (3, 6 and 12 months), iron and ferritin preoperatively and 12 months postoperatively, and hemoglobin preoperatively and 12 months postoperatively. Data were analyzed using *t* tests, standard analysis of variance (ANOVA) and latent trajectory analysis. A total of 399 patients were included. Corresponding to an evolving, more aggressive perioperative nutrient regimen, both iron and ferritin levels at 12 months increased from 12.9 to 18.3 mmol/L (p = 0.001) and from 64 to 124 mg/L (p = 0.001), respectively, with no statistically significant difference in the 12-month postoperative hemoglobin levels. The mean preoperative BMI increased from 42.1 in 2010 to 46.1 in 2014, reflecting the increase in maximum BMI accepted by the program. Using latent trajectory analysis, it was demonstrated that the rate and amount of weight loss over time were equal regardless of preoperative BMI, with a mean 12-month postoperative loss of 14 BMI units. This correlated well with the ANOVA model demonstrating an increase in BMI at 12 months after surgery from 30.0 in 2010 to 32.3 in 2014 (p = 0.01). Bariatric surgery performed for patients with increasing maximum operable BMIs can be expected to produce equal, but proportional, weight loss. Additionally, when bariatric surgery is performed with more aggressive perioperative iron supplementation, it can result in increasing iron and ferritin levels at 1 year after surgery. This is not associated with a change in hemoglobin at 1 year.

02

Roux-en-Y gastric bypass reduces or eliminates pharmacologic dependence in individuals living with obesity and type 2 diabetes mellitus. *A. Vergis, M. Mullan, K. Hardy.* From the University of Manitoba, Winnipeg, Man.

Roux-en-Y gastric bypass (RYGB) is an effective means of addressing type 2 diabetes mellitus (DM2) in individuals living with obesity. However, little investigation looks directly at the effect of RYGB on pharmacologic utilization in this population. We sought to determine the effect of RYGB on the use of both insulin and oral hypoglycemic medications in a population of diabetic patients living with obesity. Consecutive patients undergoing RYGB with a history of DM2 were identified in a prospectively collected database. Resolution of DM2 was defined as HbA_{1C} less than 6.5% and discontinuation of all diabetic medications. Other reported outcomes include percentage excess weight loss, change in HbA_{1C} at 1 year and change in diabetic medications. Diabetes care was reviewed by the bariatric team during pre- and postoperative visits. Fifty-two patients were identified. Reduction in overall pharmacologic use (number of oral agents and insulin per patient) was 98.1% (51/52). The remaining patient was changed from insulin to an oral hypoglycemic. Resolution was observed in 37/52 patients (71.2%), and 11/52 (21.2%) patients had improved HbA_{1C} (range 6.2%–8.2%) while remaining on at least 1 diabetic medication. All 3 of the patients still requiring insulin were able to stop 1 or more oral medications. There is a dramatic reduction in diabetes-related pharmacologic utilization for the obese population with DM2 at 1 year postoperatively. This is associated with high rates of DM2 resolution as well as a reduction in disease severity for those who remain diabetic.

03

Fellow and attending surgeon operative notes are deficient in reporting established quality indicators for Roux-en-Y gastric bypass. *S. Stogryn, K. Hardy, A. Vergis.* From the University of Manitoba, Winnipeg, Man.

It is essential for surgeons to dictate the findings and important components of any invasive procedure in a comprehensive yet concise operative report. This documentation is the key format for communicating intraoperative events with health professionals and has far-reaching implications for providing additional health care and planning future operative procedures. Evidence suggests that the quality of reports dictated by trainees and surgeons is poor despite their importance. This investigation analyzed and compared the quality of fellow and staff surgeon Roux-en-Y gastric bypass (RYGB) narrative dictations against nationally derived, validated and reliable quality indicators (QIs) for this procedure. Twenty-one bariatric fellow reports and 21 attending RYGB narrative reports were selected at random and analyzed against checklist QIs that were established by a Canadian national Delphi process by overall score and broken down by QI subsection (e.g., "Gastrojejunostomy Details"). These checklist QIs have been previously validated and have high inter-rater agreement at our institution. Fellows had a mean completion of 66.4% ± 3.1% compared with 61.5% ± 7.6% for attendings (p < 0.0001). Fellows statistically outperformed attendings on all subsections except patient, closure and postoperative details. Attendings statistically outperformed fellows on closure details only (63.8 ± 7.5 v. 50.5 ± 12.0, p = 0.002). Bariatric surgery trainees statistically outperformed their attending surgeons in completion rates for RYGB operative dictations. The clinical significance of this between the 2 groups is unknown. However, both groups are deficient in reporting at least one-third of items deemed essential to an RYGB operative report by Canadian experts in bariatric surgery. This indicates a need for further education in RYGB operative dictation for both practising surgeons and trainees. It also lends interest in exploring alternative forms of operative communication, such as synoptic operative reporting in bariatric surgery.

04

Documentation of quality of care data for Roux-en-Y gastric bypass: comparison of synoptic and narrative operative reports. *S. Stogryn, K. Hardy, M. Mullan, C. Andrew, A. Vergis.* From the University of Manitoba, Winnipeg, Man.

Operative reporting is the foundation of surgical communication. The quality indicators (QIs) contained in these reports can be used

to document the performance of processes that affect patient care and may afford quality assurance with improvement in health care. We assessed the degree to which the electronic synoptic report (SR) documents the operative QIs compared with narrative reports (NR) for Roux-en-Y gastric bypass (RYGB). Forty prospectively collected RYGB SRs and 40 case-matched historical NRs were compared against checklist QIs that were established by a national Delphi process by both overall completion and completion by QI subsection (e.g., "Entero-enterostomy Details"). These checklist QIs are validated and have high inter-rater agreement at our institution. SRs had a mean completion rate of 99.7% (SD 1.3%) compared with 64.0% (SD 6.3%) for NRs ($t = 36.0$, $p < 0.0001$). All subsections of SRs were more than 99% complete and significantly higher than NRs (range 36.6%–99.3%, $p < 0.001$). The RYGB synoptic report is superior to the narrative report for inclusion of accepted QIs. Important elements, including process of care, demographics and anatomic-related data, were frequently missing from the NR. Thus, the SR is an encouraging method for improving documentation and may serve as a measure of quality care in RYGB.

05

Synoptic operative reporting: assessing the completeness, accuracy, reliability and efficiency of synoptic reporting for Roux-en-Y gastric bypass. S. *Stogryn*, *K. Hardy*, *M. Mullan*, *J. Park*, *C. Andrew*, *A. Vergis*. From the University of Manitoba, Winnipeg, Man.

This was a prospective cohort study to assess the completeness, accuracy, reliability and efficiency of synoptic (SR) versus narrative operative reports (NR) in Roux-en-Y gastric bypass (RYGB). SR is one solution to improve the quality of operative reports. However, SR has not been investigated in bariatric surgery despite an identified need by bariatric surgeons. SR for RYGB was developed using quality indicators (QIs) established by a national Delphi process. An NR and SR were completed on 104 consecutive RYGBs. Two evaluators independently compared the reports to QIs. Completeness and accuracy measures were determined. Reliability was calculated using Bland–Altman plots and 95% limits of agreement (LOA). Time to complete SR and NR was also compared. The mean completion rate of SR was 99.8% (SD 0.98%) compared with 64.0% (SD 6.15%) for NR ($t = 57.9$, $p < 0.001$). All subsections of SR were more than 99% complete. This was significantly higher than for NR ($p < 0.001$) except for small bowel division details ($p = 0.530$). Accuracy was significantly higher for SR than NR (94.2% [SD 4.31%] v. 53.6% [SD 9.82%], respectively, $p < 0.001$). Rater agreement was excellent for both SR (0.11, 95% LOA –0.53 to 0.75) and NR (–0.26, 95% LOA –4.85 to 4.33) ($p = 0.242$), where 0 denotes perfect agreement. SR completion times were significantly shorter than NR (3:55 minutes [SD 1:26 minute] and 4:50 minutes [SD 0:50 minute], respectively, $p = 0.007$). The RYGB SR is superior to NR for completeness and accuracy. This platform is also both reliable and efficient. This SR should be incorporated into clinical practice.

06

The impact of a preoperative exercise program on patients awaiting bariatric surgery. *K. Kwok* (University of Manitoba, Winnipeg, Man.), *N. Bharti* (University of Manitoba, Winnipeg, Man.), *D. Gamey* (University of Manitoba, Winnipeg, Man.), *A. Vergis* (University of Manitoba, Winnipeg, Man.), *K. Hardy* (University of Manitoba, Winnipeg, Man.), *D. Bouchard* (University of New Brunswick, Fredericton, NB).

Obesity is epidemic worldwide, and bariatric surgery is an efficacious treatment. Evidence supports the association between physical activity and weight loss following bariatric surgery; however, evidence for preoperative exercise is lacking. The objective of the study was to evaluate short-term benefits of a preoperative exercise program in patients awaiting bariatric surgery. The primary outcome was improvement in the 6-minute walk test (6MWT). Secondary outcomes included anthropometric measurements, strength testing and quality of life (QoL). We hypothesized preoperative exercise would improve short-term exercise capacity and fitness in patients awaiting bariatric surgery. Fifty-four patients enrolled in this randomized control study. Twenty-nine patients were randomized to control and received standard preoperative care, including multidisciplinary evaluation, exercise counselling with a kinesiologist and participation in Craving Change, a behaviour modification program. Twenty-five patients were randomized to intervention, consisting of standard care and a 12-week supervised exercise program. The intervention group was required to exercise 3 times per week and document their activities. Ten patients dropped out from the intervention (40%) and 11 patients dropped out from control (37%). Average attendance for the intervention group was 75.6%. There was a statistically significant improvement in 6MWT between intervention and control (change in control –4.88 m, $p = 0.63$; change in intervention 27.46 m, $p = 0.01$; absolute difference 32.34 m, $p = 0.03$). There were no differences in anthropometric measurements or strength testing between groups. The intervention group had statistically significant improvements in all domains of the QoL survey, whereas the control group had no changes. When absolute differences were compared, the intervention group had statistically significant changes in symptoms, hygiene and emotions. A preoperative exercise intervention was associated with statistically significant improvements in 6MWT and QoL in patients awaiting bariatric surgery. Future research on this cohort will examine if preoperative exercise impacts fitness outcomes after bariatric surgery.

07

Bariatric surgery: the impact of socioeconomic factors and Indigenous status. *J. Dang* (University of Alberta, Edmonton, Alta.), *N. Switzer* (University of Alberta, Edmonton, Alta.), *S. Skulsky* (University of Alberta, Edmonton, Alta.), *B. Miskew Nichols* (University of Alberta, Edmonton, Alta.), *X. Shi* (Centre for the Advancement of Minimally Invasive Surgery, Edmonton, Alta.), *S. Eagle Bear* (University of Alberta, Edmonton, Alta.), *C. de Gara* (University of Alberta, Edmonton, Alta.), *D. Birch* (University of Alberta, Edmonton, Alta.), *S. Karmali* (University of Alberta, Edmonton, Alta.).

The prevalence of obesity is much higher in Indigenous populations than in non-Indigenous ones. Additionally, the rate of diabetes is 2 times higher in Indigenous Canadians, as it manifests at a lower body mass index (BMI). To effectively treat obesity, bariatric surgery has increasingly been used. However, despite the high rate of obesity, 1 study found that only 0.46% of bariatric surgery was performed on Indigenous patients. There is a paucity of literature focused on Indigenous populations and bariatric surgery. The

objective of this study is to determine socioeconomic factors that influence access to bariatric surgery for Indigenous Canadians. A retrospective review was performed on severely obese patients (BMI ≥ 35) seen at a specialty bariatric clinic in 2015. Clinical data, socioeconomic data and Indigenous status were collected. Socioeconomic factors that predict successful completion of a bariatric surgery program were determined. A total of 780 patients were included. Of 7 Indigenous patients (0.9%), the majority were single (71.4%), had completed secondary education (57.1%) or college (28.6%) and were unemployed (100%). None of these patients completed bariatric surgery. Due to low power, multivariate analysis was not completed for this cohort. For the whole cohort, 28.8% successfully completed bariatric surgery. The main reasons for not completing the bariatric program were poor attendance (32.7%) and patient decision not to pursue surgery (22.0%). Multivariate analysis determined that patients who were married (OR 2.04, 95% CI 1.2–3.5), nonsmokers (OR 0.30, 95% CI 0.14–0.65), and female (OR 0.33, 95% CI 0.19–0.56) were more likely to complete bariatric surgery. Education, income and occupation were not predictive of completion. Despite an alarming rate of obesity in Indigenous populations, very few Indigenous people are treated in specialized bariatric treatment centres. Further, major socioeconomic factors did not influence successful completion of bariatric surgery. Especially in Canada's public health care system, more treatment should be directed at underserved Indigenous populations.

08

Sleeveplasty. ***M. Mullan*, *C. Botkin*, *K. Hardy*, *A. Vergis*. From the Victoria General Hospital, Winnipeg, Man.**

Narrowing at the angularis is a recognized technical error of laparoscopic sleeve gastrectomy. We present a multimedia video of the correction of this error in a patient with type 1 diabetes mellitus. Eight months earlier the patient had undergone sleeve gastrectomy. From the time of operation, the patient described dysphagia. Postoperatively, calorie intake was severely restricted, as the patient's diet had never advanced beyond soft foods. Further, the patient experienced extreme, rapid weight loss of 115 lbs over 8 months. Investigations (gastroscopy, GI contrast study) suggested a twisting or narrowing of the sleeve at the angularis. At the time of re-gastroscopy with combined laparoscopy, it was apparent there was a stricture at the angularis. This was corrected by making a gastrotomy across the narrowed waist of the sleeve and suturing the gastrotomy in the opposite direction to widen the narrowed area. Six weeks after the procedure the patient reports marked improvement in dysphagia and oral intake. In addition, the patient's weight has stabilized.

09

The utility of routine esophagogastroduodenoscopy prior to laparoscopic Roux-en-Y gastric bypass. ***W. Sun*** **(University of Alberta, Edmonton, Alta.),** ***J. Dang*** **(University of Alberta, Edmonton, Alta.),** ***N. Switzer*** **(University of Alberta, Edmonton, Alta.),** ***R. Gill*** **(University of Calgary, Calgary, Alta.),** ***C. de Gara*** **(University of Alberta, Edmonton, Alta.),** ***D. Birch*** **(University of Alberta, Edmonton, Alta.),** ***S. Karmali*** **(University of Alberta, Edmonton, Alta.).**

Currently, esophagogastroduodenoscopy (EGD) is recommended for symptomatic patients before laparoscopic Roux-en-Y gastric bypass (LRYGB), but the use of EGD for routine screening in asymptomatic patients is debatable. We aimed to study the utility of routine EGD in patients undergoing LRYGB. A retrospective review of consecutive patients undergoing LRYGB with 1 surgeon at our hospital from May 2014 to March 2016 was completed. Data for these participants were collected from patient clinical records. All patients had preoperative EGD with biopsies. EGD findings were compared with findings from surgical gastrojejunal (GJ) anastomoses pathology and postoperative complications. A total of 116 patients were identified with an average age of 46.3 ± 10.2 years and 70.7% were female. Of the 113 patients with reported EGDs, 52 patients (46.0%) had normal EGD, 46 (40.7%) had at least 1 EGD pathology but did not require a change of management and 15 (13.3%) had EGD pathologies resulting in change of management. Sixteen patients (13.8%) were found to have chronic gastritis of the GJ anastomosis. The relative risk of gastritis in the GJ specimen was 5.1 ($p < 0.001$) for patients with gastritis on EGD and 5.1 ($p < 0.001$) for patients with *Helicobacter pylori* infection on EGD. Seventeen patients (14.7%) had complications following surgery, 11 of whom had marginal ulcers. The relative risk of patients with marginal ulcers was 1.1 ($p = 0.84$) for patients with gastritis on EGD and 1.9 ($p = 0.38$) for patients with *H. pylori* on EGD. No anastomotic leaks were identified. Routine EGD only identified abnormalities leading to change in management in 13.3% of patients, and abnormalities on EGD were not significantly associated with postoperative complications. Based on the findings from this study, we recommend using less invasive screening in the routine workup of patients awaiting LRYGB and reserving EGD for symptomatic patients.

10

The incidence of iron deficiency after Roux-en-Y gastric bypass and sleeve gastrectomy: a systematic review. ***G. Enani*** **(University of Manitoba, Winnipeg, Man.),** ***E. Bilgic*** **(McGill University, Montreal, Que.),** ***E. Lebedeva*** **(McGill University, Montreal, Que.),** ***M. Delisle*** **(University of Manitoba, Winnipeg, Man.),** ***A. Vergis*** **(University of Manitoba, Winnipeg, Man.),** ***K. Hardy*** **(University of Manitoba, Winnipeg, Man.).**

Physiologic changes after bariatric surgery result in nutritional deficiencies, especially iron. This study aims to quantify the impact of bariatric surgery on the incidence of iron deficiency. Databases searched included Ovid Medline, Ovid Embase, HealthStar, Scopus, Cochrane (CDSR), LILACS and ClinicalKey with additional snowballing search. Search terms were iron deficiency, iron deficiency anemia, Roux-en-Y gastric bypass and sleeve gastrectomy. Original articles reporting the incidence of iron deficiency and anemia before and after Roux-en-Y gastric bypass (RYGB) and laparoscopic sleeve gastrectomy (LSG) from January 2000 to January 2015 with a follow-up of at least 1 year were selected. Data extraction from selected studies was based on protocol-defined criteria. Out of the 1133 articles screened, 13 studies were analyzed (1 randomized controlled trial, 2 controlled studies, 5 prospective studies and 5 retrospective studies). Data pooling was precluded owing to observed heterogeneity in patients, interventions or outcome. The total incidence of postoperative iron deficiency was 16.6% compared with 15.2% preoperatively. The incidence was 17.4% before RYGB versus 12.3% after RYGB and 13.7% after LSG versus 27.3% before LSG. It was higher after RYGB (15% postop v. 2% preop; $p < 0.01$) than LSG (0% postop v. 0% preop) in 1 study, while it was unchanged in 2 studies. The incidence of iron deficiency anemia was increased

after RYGB (5.57% preop v. 16.18% postop). Seven studies reported prophylactic iron supplementation postoperatively and 2 studies reported therapeutic iron supplementation for iron-deficient patients. Iron dosage varied from 7 mg to 80 mg daily across studies. Risk factors for iron deficiency were found to include premenopausal women, duration of follow-up and preoperative iron deficiency. Iron deficiency is frequent in people with obesity and should be treated preoperatively. The level to which patients should be supplemented is not yet established and careful nutritional surveillance is important, especially for premenopausal women and those with pre-existing iron deficiency.

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A minimalist approach to gastric outlet obstruction secondary to vertical banded gastroplasty. ***E. Yorke*****,** ***C. de Gara*****,** ***F. Kamel*****. From the University of Alberta, Edmonton, Alta.**

Bariatric surgery is an evidence-based approach to the treatment of severe obesity. Vertical banded gastroplasty is a technique that gained popularity in the 1990s but was eventually abandoned owing to long-term complications, including intermittent gastric outlet obstruction. Revision requires conversion to Roux-en-Y gastric bypass (RYGB) or reversal with a gastrogastrostomy. Both procedures are technically challenging and come with their own complications. This study presents an alternative surgical approach to the management of gastric outlet obstruction. A retrospective chart review from November 2014 to July 2016 identified 6 patients with a previous vertical banded gastroplasty procedure and gastric outlet syndrome. The preoperative assessment, operative approach and postoperative follow-up were reviewed. Preoperative investigations included gastroscopy and fluoroscopy, which confirmed the diagnosis of gastric outlet obstruction in all 6 patients. A laparoscopic approach was successful in 83% of patients. The mesh was identified and divided in 83% of patients and entirely removed in 33%. There was complete resolution of symptoms in all patients on postoperative day 1 and at the 30-day follow-up. This study presents a less involved procedure to treat gastric outlet obstruction secondary to vertical banded gastroplasty. This procedures has low morbidity and excellent short-term success, and it allows for the option to convert to RYGB in the future should the procedure be indicated.

12

Long-term hypovitaminosis D and secondary hyperparathyroidism outcomes of the Roux-en-Y gastric bypass: a systematic review. ***G. Marcil*** **(University of Calgary, Calgary, Alta.),** ***N. Switzer*** **(University of Alberta, Edmonton, Alta.),** ***S. Prasad*** **(University of Calgary, Calgary, Alta.),** ***E. Debru*** **(University of Calgary, Calgary, Alta.),** ***N. Church*** **(University of Calgary, Calgary, Alta.),** ***R. Gill*** **(University of Calgary, Calgary, Alta.),** ***E. Billington*** **(University of Calgary, Calgary, Alta.),** ***P. Mitchell*** **(University of Calgary, Calgary, Alta.).**

Preoperative vitamin D deficiency is markedly prevalent in prospective bariatric surgery patients. While bariatric surgery leads to significant weight loss, it can exacerbate or prolong vitamin D deficiency. We systematically reviewed the literature to assess whether secondary hyperparathyroidism is maintained in the medium to long term in patients following Roux-en-Y gastric bypass. A comprehensive literature search was conducted through Medline, Embase, Scopus, Web of Science, Dare, Cochrane Library and the HTA database. The search terms used were bariatric surgery, gastric bypass and hyperparathyroidism. Fourteen studies were included (n = 2688 patients). Parathyroid hormone levels rose gradually from a mean preoperative level of 5.69 ± 1.2 pmol/L to 6.36 ± 0.77 pmol/L, 7.59 ± 0.73 pmol/L and 8.29 ± 1.41 pmol/L at 2 years, between 2–5 years and beyond 5 years, respectively. Vitamin D levels slowly fell to a mean of 20.50 ± 4.37 ng/mL and 20.76 ± 3.80 ng/mL between follow-up intervals 2–5 years and beyond 5 years, respectively. It appears that hyperparathyroidism persists at 5 years follow-up after gastric bypass, despite most patients being supplemented with calcium and vitamin D.

13

Using a shorter circular stapler height when constructing the gastrojejunostomy during a laparoscopic Roux-en-Y gastric bypass results in a reduced rate of strictures and staple line bleeding. ***M. Horkoff*** **(University of Calgary, Calgary, Alta.),** ***K. Purich*** **(University of Alberta, Edmonton, Alta.),** ***N. Switzer*** **(University of Alberta, Edmonton, Alta.),** ***S. Prasad*** **(University of Calgary, Calgary, Alta.),** ***N. Church*** **(University of Calgary, Calgary, Alta.),** ***X. Shi*** **(University of Alberta, Edmonton, Alta.),** ***P. Mitchell*** **(University of Calgary, Calgary, Alta.),** ***E. Debru*** **(University of Calgary, Calgary, Alta.),** ***S. Karmali*** **(University of Alberta, Edmonton, Alta.),** ***R. Gill*** **(University of Calgary, Calgary, Alta.).**

The laparoscopic Roux-en-Y gastric bypass (LRYGB) is considered the gold standard bariatric operation worldwide. While a safe operation, the gastric bypass is prone to a number of morbid complications, including bleeding, stricturing and staple line leaks, most notably at the gastrojejunostomy (GJ). The circular stapler technique is a common method to construct the GJ anastomosis. A few studies have suggested that a shorter circular stapler height is associated with lower stricture rates and trends toward a lower incidence of postoperative anastomotic bleeding. This is felt to be due to enhanced tissue compression with a shorter stapler height. However, these reports are heterogeneous, with variability in surgical technique, timelines and stapler technology that may confound their results. We therefore completed a retrospective cohort study within the Alberta Provincial Bariatric Program (APBP) with 2 sites (Calgary and Edmonton) performing standardized gastric bypass surgeries that vary only in circular stapler height (3.5 mm v. 4.8 mm). In total, 214 patients had an LRYGB done between 2015 and 2017 within the APBP. Of those, 143 patients had the GJ constructed with a 3.5 mm circular stapler height, with the remaining 71 patients having the GJ fashioned with a 4.8 mm circular stapler height. The rate of anastomotic stricturing requiring balloon dilation was lower in the 3.5 mm stapler group than in the other cohort, 3.5% versus 14.1%, respectively (p = 0.008). Likewise, the overall rate of bleeding requiring a postoperative blood transfusion was lower in the 3.5 mm stapler group than in the 4.8 mm group, 6.3% versus 15.5%, respectively (p = 0.043). There was no difference in the leak rates or mortality between groups. In conclusion, it appears that the complication rate with respect to GJ strictures and staple line bleeding is reduced when using a 3.5 mm stapler height to fashion the GJ compared with the 4.8 mm stapler height.

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Initial experience and short-term outcomes in a remote Northern Bariatric Centre of Excellence. ***A. Smith*****,**

***S. Cassie, J. Poling*. From the Northern Ontario School of Medicine, Thunder Bay, Ont.**

Our centre is a remote Northern tertiary hospital housing 2 dedicated fellowship-trained bariatric surgeons and is a unique practice model in Canada. Our aim was to complete a review of the first 2 years of practice and analyze short-term outcomes to determine whether it is safe and feasible to offer minimally invasive bariatric surgery in this setting. An observational retrospective chart review was completed for all patients taken to the operating room for bariatric surgery between June 2014 and December 2016. Primary outcomes included 30-day mortality, aborted procedures, return to OR and 30-day readmission. Secondary outcomes included length of stay and operative time. Patient characteristics assessed were preoperative body mass index (BMI), age at time of surgery, sex and presence of obesity-associated comorbidities. During the study period a total of 251 patients were taken to the OR for bariatric procedures; 163 patients (64.9%) received gastric bypass with Roux-en-Y reconstruction, and 84 (33.5%) received sleeve gastrectomy. Patients were predominantly female (87.3%), with a mean age of 45.3 ± 11.1 years and mean preoperative BMI of 47.3 ± 6.4 kg/m^2 (range 36.3–67.5). There were no deaths. Four procedures were aborted. There were 4 patients taken back to the OR; 3 had intra-abdominal bleeds and 1 had a negative diagnostic laparoscopy. All were ultimately discharged home without major complication. There were no anastomotic leaks. There was a single readmission. Overall mean length of stay was 2.1 ± 0.6 days. Mean OR times were 104 ± 25 and 76 ± 27 minutes for bypass and sleeve gastrectomy, respectively. Obesity-associated medical comorbidities included diabetes mellitus (25.5%), hypertension (43.8%), obstructive sleep apnea (35.1%), gastroesophageal reflux disease (GERD, 50.2%), coronary artery disease (2%), dyslipidemia (29.5%) and osteoarthritis (38.6%). Based on our results we believe that high-quality minimally invasive bariatric surgery can be offered in a remote Northern setting to the standards of a Bariatric Centre of Excellence.

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Predictive factors of 30-day readmission after bariatric surgery in a publicly funded bariatric centre: a multivariate analysis. *J. Dang* (University of Alberta, Edmonton, Alta.), *X. Shi* (Centre for the Advancement of Minimally Invasive Surgery, Edmonton, Alta.), *I. Tavakoli* (University of Alberta, Edmonton, Alta.), *N. Switzer* (University of Alberta, Edmonton, Alta.), *D. Birch* (Centre for the Advancement of Minimally Invasive Surgery, Edmonton, Alta.), *S. Karmali* (Centre for the Advancement of Minimally Invasive Surgery, Edmonton, Alta.), *C. de Gara* (Centre for the Advancement of Minimally Invasive Surgery, Edmonton, Alta.).

The objective of this study was to determine readmission rates after primary bariatric surgery in a publicly funded, comprehensive bariatric centre and determine predictive factors associated with readmission. Previous studies found rates ranging anywhere from 0.6% to 11.3%. They also found that length of stay greater than 2 days or any complication during the initial admission was associated with readmission. A population-based cohort study was performed on patients undergoing primary bariatric surgery from January 2010 to December 2015. Procedures included laparoscopic Roux-en-Y gastric bypass (LRYGB), laparoscopic sleeve gastrectomy (LSG) and laparoscopic adjustable gastric band (LAGB). Multivariate regression analysis was performed to determine factors that predict 30-day readmission. In total, 1469 patients had primary bariatric surgery (51.0% LRYGB, 40.4% LSG, 8.6% LAGB) with an overall 30-day readmission rate of 7.49%. The mean length of stay (LOS) for readmissions was 5.3 days, and readmission stays of 4 days or less accounted for 70% of the cohort. The majority of patients (67.9%) were admitted early, within the first 10 days from discharge. LRYGB had a higher readmission rate (11.3%) than LSG (3.9%) or LAGB (1.6%). The most common admitting diagnoses for readmission were infectious complications (24.8%), pain (17.4%), nausea/vomiting (10.1%), bleeding (9.2%), obstruction (6.4%) and anastomotic ulcers (5.5%). Readmission for venous thromboembolisms was 5.2%. Three factors were independently predictive of readmission: initial LOS greater than 4 days (OR 2.56, 95% CI 1.31–5.00, p = 0.006), LRYGB (OR 5.92, 95% CI 1.28–27.45, p = 0.023) and acute renal failure (OR 19.67, 95% CI 1.16–332.80, p = 0.039). The rate of readmission after bariatric surgery in our centre is 7.49%. Patients with LOS greater than 4 days are at higher risk of readmission. Prevention of acute renal failure and closer follow-up in high-risk patients may reduce readmissions.

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Sleeve gastrectomy and hypertension: a systematic review of long-term outcomes. *C. Graham* (University of Calgary, Calgary, Alta.), *N. Switzer* (University of Alberta, Edmonton, Alta.), *R. Gill* (University of Calgary, Calgary, Alta.), *A. Reso* (University of Calgary, Calgary, Alta.), *E. Debru* (University of Calgary, Calgary, Alta.), *N. Church* (University of Calgary, Calgary, Alta.), *P. Mitchell* (University of Calgary, Calgary, Alta.).

Bariatric surgery has been shown to be a safe and dramatic management strategy for patients struggling with severe obesity and the metabolic syndrome, including hypertension. Buchwald and colleagues reported hypertension resolution rates in 67.1% and improvement in 78.5% following aggregate bariatric surgery. Laparoscopic sleeve gastrectomy (LSG) is becoming more recognized as a primary bariatric surgery, but it lacks long-term outcome data to solidify its reputation. Our aim is to establish the long-term efficacy of LSG on hypertension outcomes. A comprehensive literature search was conducted through Medline, Embase, Scopus, Web of Science, Dare, Cochrane Library and the HTA database. The search terms used were broad: sleeve gastrectomy AND hypertension OR blood pressure. Adult patients (older than 18 years) undergoing LSG with follow-up hypertension outcome results of at least 5 years were included. Revisional surgeries were excluded from this review. Fourteen studies were included in this systematic review, which included 3550 patients in total. The mean age was 41.1 ± 10.7 years. Mean preoperative body mass index and weight were 47.7 ± 8.83 kg/m^2 and 272.8 ± 48.4 lbs, respectively. The preoperative prevalence of hypertension was 36.5%, which dropped to 14.79% at approximately 5 years follow-up. Hypertension resolved in 62.17% of patients and improved in 35.71% at a mean of 5.35 years follow-up. From our systematic review, it appears that LSG is an effective long-term metabolic strategy for patients with hypertension. It would be interesting to further investigate the overall effect on cost reduction on our health care system with improvement in patient comorbidities, such as hypertension.

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The role of cefazolin, metronidazole and oral chlorhexidine rinse as preoperative antimicrobial prophylaxis in reducing surgical site infection following bariatric surgery: a quality control initiative. ***D. Skubleny, N. Switzer, J. Dang, C. de Gara, D. Birch, S. Karmali*. From the University of Alberta, Edmonton, Alta.**

Surgical site infection (SSI) following bariatric surgery contributes to patient morbidity and additional use of health care resources. We investigated whether an SSI quality control initiative in the form of a refined preoperative antimicrobial protocol affected the rate of SSI following laparoscopic Roux-en-Y gastric bypass (LRYGB). We reviewed all LRYGB procedures performed between June 2015 and December 2016 at a single bariatric surgery centre of excellence. Two preoperative antimicrobial protocols were compared. Patients undergoing surgery before February 2016 received 2 g of cefazolin whereas patients undergoing surgery after Feb. 1, 2016, received a new antimicrobial protocol consisting of 2 g cefazolin, 500 mg metronidazole and 30 mL oral chlorhexidine rinse. The primary outcome was 30-day SSI, including superficial SSI, deep incisional SSI and organ/space infection as defined by the US Centers for Disease Control and Prevention. Clinic charts and provincial electronic medical records were reviewed for emergency department visits, microbiology investigations and physician dictations diagnosing SSI. Outcomes were assessed using a Student's *t* test. In total, 276 patients underwent LRYGB, of which 167 received the refined antimicrobial protocol and 109 received cefazolin. The refined antimicrobial protocol significantly decreased the rate of deep incisional SSI compared with cefazolin ($n = 1$, 0.6% v. $n = 5$, 4.6%; $p < 0.05$). The refined antimicrobial protocol resulted in an insignificant overall reduction in the rate of superficial SSI ($n = 12$, 7.2% v. $n = 13$, 11.9%; $p > 0.05$) and organ/space infection ($n = 0$, 0.0% v. $n = 2$, 1.8%; $p > 0.05$), respectively. A preoperative antimicrobial protocol using cefazolin, metronidazole and oral chlorhexidine rinse appears to reduce the rate of SSI following LRYGB. This protocol may be most effective to prevent deep incisional SSI. Additional patient cases or alternative study designs, including a randomized controlled trial are required to better understand the efficacy of this protocol.

18

Prospective 3-year evaluation on the use of the urine cotinine test in patients undergoing stapled bariatric procedures. ***H. Cheah, K. Wong*. From the Gosford Private Hospital, New South Wales, Australia.**

Smoking is a strong predictor of anastomotic leak in gastrointestinal surgery and a risk factor for poor wound healing. Patients can present an alternative version of reality with regards to their smoking habits before their bariatric procedures. Anastomotic leak from stapled bariatric operations can have devastating outcomes, which include admission to intensive care units, multiple returns to theatre and radiologically guided drainages. The aim of our study is to evaluate the use of the urine cotinine test as a screening tool for patients undergoing stapled bariatric operations. A prospectively collected database of 539 patients undergoing stapled bariatric operations was analyzed. Patient demographics, type of operation (primary and revision sleeve gastrectomy, and gastric bypass), smoking habits and postoperative complications were further analyzed. All patients were advised to cease smoking on initial consultation, and a screening urine cotinine test was performed before the subsequent patient follow-up. All of the 539 patients were screened with the urine cotinine test. Six of the patients returned with a positive cotinine test and had their operations deferred to a later date. One patient returned with 2 positive results and another with 4 positive results. All the subsequent cotinine tests for all patients were negative. No anastomotic leaks were detected in any of the 539 patients. The urine cotinine test is an effective way of screening patients undergoing stapled bariatric operations and potentially other gastrointestinal, plastic and reconstructive operations where smoking is a risk factor for anastomotic leaks and wound healing.

19

Innovative method of resolving gastric outlet obstruction from intragastric balloon. ***H. Cheah, K. Wong, R. Poon*. From the Gosford Private Hospital, New South Wales, Australia.**

Intragastric balloon for obesity was first introduced in 1985. Common complications with the intragastric balloon include abdominal pain, nausea and balloon migration. Delayed treatment could lead to more severe complications, such as bowel obstruction, bowel necrosis and perforation. Removal of the intragastric balloon is the key to managing these complications. A 43-year-old woman presented to the emergency department with vomiting and epigastric and right upper quadrant pain. She had had an endoscopic insertion of a gastric balloon as a weight loss procedure 10 days before her presentation. Since her discharge, she had only been able to tolerate small volumes of oral intake. Examination revealed tenderness in the epigastric and right upper quadrant regions with a mass palpable in the right upper quadrant region. A CT scan of the abdomen and pelvis showed a gastric balloon measuring $9 \times 11 \times 10.5$ cm at the distal stomach causing subtotal obstruction. The patient was taken to theatre the day after her admission for endoscopic removal of the gastric balloon. Upper endoscopy was performed under general anesthesia. An ORBERA intragastric balloon was seen in the distal stomach region, obstructing the pylorus. An 8 mm 21FG endoscopic needle was used to puncture the ORBERA intragastric balloon. A syringe was used to further deflate the gastric balloon. The intragastric balloon was successfully removed with a 3 cm endoscopic polypectomy snare on the first attempt. The patient's symptoms improved after removal of the intragastric balloon, and she was discharged 2 days after the procedure. In our experience, the 8 mm 21FG endoscopic needle attached to a syringe was easily available and provided adequate deflation of the intragastric balloon for removal of the balloon. This can be done by general surgeons and gastroenterologists who are familiar with upper gastrointestinal endoscopy and could potentially avoid a transfer to a tertiary centre and delaying urgent management.

20

Selective use of liver retractors in sleeve gastrectomy based on morphological hepatic assessments. ***H. Cheah, K. Wong*.**

From the Gosford Private Hospital, New South Wales, Australia.

Laparoscopic sleeve gastrectomy (LSG) is the most commonly performed bariatric procedure. The Nathanson liver retractor is commonly used to provide visualization and access to the gastroesophageal junction. However, there are potential complications related to the use of the Nathanson liver retractor. The aim of this study is to examine the feasibility of performing LSG without the use of liver retractors. A total of 407 patients who underwent LSG from February 2015 to March 2017 in our unit were included in this study. Data collected include patient demographics, patient body mass index (BMI), complications and readmission to the hospital. Criteria for patient selection for LSG without liver retractor include thin left liver edge and laparoscopic visualization of gastric fundus without any manipulation of the liver. Of the 407 patients who underwent LSG, all had a BMI above 32. Eleven cases were performed without the use of any liver retractors. In the 11 cases, there were no differences in length of stay in hospital, complication rate, or rate of readmission to hospital. LSG can be performed without the use of liver retractors in selected patients. This will minimize the risk of trauma to the liver, reduce the number of incisions required, improve surgical operating time and reduce the cost of the operation.

21

Laparoscopic sleeve gastrectomy achieves normalization of C-reactive protein at 18 months after surgery. ***V. Falk*, *D. Pace*, *D. Boone*, *C. Smith*, *L. Twells*. From Memorial University of Newfoundland, St. John's, Nfld.**

Obesity leads to a chronic state of inflammation and elevated C-reactive protein (CRP). Bariatric surgery achieves both long-term weight loss and reduction in inflammatory markers. We aim to examine the effect of laparoscopic sleeve gastrectomy (LSG) on CRP levels. This is a retrospective review of patients who underwent LSG at our centre between May 2011 and February 2014. Data were collected on patient demographics and obesity-associated comorbidities. CRP levels were measured preoperatively and at 3, 6, 12 and 24 months postoperatively. Secondary outcomes were postoperative weight loss, 30-day complications and death. In total, 209 patients underwent LSG, with average preoperative body mass index (BMI) of 49.2 kg/m^2 (min 35.0 kg/m^2, max 67.4 kg/m^2), average age of 43.4 years (min 22 years, max 70 years), and with 82% female. The most common comorbidities were hypertension (55.0%), obstructive sleep apnea (46.4%), dyslipidemia (42.1%) and diabetes (37.8%). The mean preoperative CRP level was 11.53 mg/L (min 0.6, max 49.3). The mean preoperative weight was 134.3 kg versus 97.7 kg after 24 months ($p < 0.01$). The total average percent BMI loss was 59.8% kg/m^2 after 12 months and 58.5% kg/m^2 after 24 months. No deaths occurred. Preoperatively, 89 patients (Group N) had normal (≤ 8 mg/L) and 114 patients (Group E) had elevated (> 8 mg/L) CRP levels. While preoperatively the mean CRP levels were significantly different between these groups (4.66 mg/L v. 16.90 mg/L, $p < 0.001$), this difference became nonsignificant after 18 months (2.85 ± 5.72 v. 5.33 ± 6.79, $p = 0.076$). Group E had significantly more females and higher mean BMI. The overall 30-day complication rate was 15.3% (13.4% minor and 1.9% major). While overall complications were higher in Group N (19.1%) compared with Group E (12.3%), this was not statistically significant ($p = 0.238$). LSG leads to a significant decrease in mean CRP levels, which normalize at 18 months after surgery. Female gender and BMI greater than 50 kg/m^2 were associated with elevated CRP levels. Elevated CRP levels did not correlate with postoperative complication rate.

22

The effect of *Helicobacter pylori* on outcomes following bariatric surgery: a systematic review. **V. *Mocanu*, *N. Switzer*, *J. Dang*, *C. de Gara*, *D. Birch*, *S. Karmali*. From the University of Alberta, Edmonton, Alta.**

Patients undergoing bariatric surgery have a greater prevalence of *Helicobacter pylori* than the general population. This infection is thought to be associated with an increase in adverse outcomes, yet no consensus exists regarding its clinical impact on surgical outcomes to date. To help determine the impact of *H. pylori* on patients undergoing bariatric surgery, a systematic review of current literature was performed. A comprehensive electronic literature search was conducted using the Medline, Embase, Cochrane, Dare, HTA and Scopus databases. Our search strategy included the following keywords: bariatric, gastric bypass, gastric band, sleeve gastrectomy, *Helicobacter pylori* and *H. pylori*. Pre- and postoperative characteristics, complications and weight-loss outcomes were evaluated. A total of 532 studies were identified, with 6 meeting inclusion criteria. *H. pylori* rates ranged from 0.1% to 41.4%, with a median prevalence of 25%. Overall, 569 patients were *H. pylori*–positive, while 254 323 patients were not infected. Follow-up ranged from 1 to 60 months. *H. pylori* patients had a median age of 38 ± 7 and an average body mass index (BMI) of 46 ± 4. In contrast, non–*H. pylori* patients had a median age of 41 ± 6 and an average BMI of 47 ± 2. Rates of stricture, leak, length of stay, and postoperative weight loss were similar between both groups. Readmission rates ranged from 9.6% to 23.8% for *H. pylori* versus 6.2% for the non–*H. pylori* individuals. The marginal ulceration rate was 31.2% for *H. pylori* patients and 3.9% for those without *H. pylori*. Owing to the heterogeneity of studies assessing adverse outcomes, a meta-analysis was not performed. In this review, it appears that *H. pylori* is associated with an increased rate of readmission and substantially increased marginal ulceration rates in patients following bariatric surgery.

Canadian Association of General Surgeons (CAGS)

01

Impact of a hepatopancreatobiliary program on management of pancreatic cancer at Health Sciences North. ***L. Hartford*** **(Western University, London, Ont.),** ***V. Doucet*** **(Northern Ontario School of Medicine, Sudbury, Ont.),** ***J. Ramkumar*** **(Northern Ontario School of Medicine, Sudbury, Ont.),** ***K. Asai*** **(Northern Ontario School of Medicine, Sudbury, Ont.),** ***J. Shum*** **(Northern Ontario School of Medicine, Sudbury, Ont.).**

Centralization of specialist services to urban centres presents a challenge to patients living in rural communities. The Hepatopancreatobiliary Surgery (HPB) program at Health Sciences North (HSN) is the 10th and newest HPB centre by Cancer Care Ontario and presents a unique opportunity to evaluate the impact and barriers to delivering HPB cancer care to patients in Northern Ontario. A retrospective review was completed on all patients referred to the Northeastern Ontario Cancer Centre and those seen at Health Sciences North with a diagnosis of pancreatic cancer between 2009 and 2015. Data collected included distance to travel, consultations to HPB surgeons and medical oncologists, as well as operations performed and their timing. We compare referrals and management of pancreatic malignancies before and after July 2013, which marks the inception of the HPB program. There were 207 patients with a diagnosis of pancreatic cancer reviewed from 2009 to 2015. A total of 114 had a consultation with an HPB specialist. The HPB program resulted in an increase in the number of consults, with shorter times to consult. Time to see medical oncology was increased. Average distance of travel was decreased. Time to operation was reduced for adenocarcinomas. The overall length of hospital stay of patients with all pancreatic malignancies decreased yearly, including after inception of the HPB program. The development of an HPB program in the North East Local Health Integration Network appears to have increased the number of patients undergoing treatment for pancreatic malignancies and decreased the time to operative management and distance of travel for care. It is anticipated that these changes may impact overall outcomes and patient satisfaction, and this will be the focus of future investigations.

02

Laparoscopic splenectomy for splenomegaly. ***S. Jayaraman*** **From the University of Toronto, Toronto, Ont.**

Total laparoscopic splenectomy is the gold standard in most indications for elective splenectomy. Patients with enlarged spleens may not be candidates for this approach owing to the size and vascularity of the spleen. This case demonstrates a safe approach to total laparoscopic splenectomy in a symptomatic patient with splenomegaly due to hereditary spherocytosis.

03

Utility of the ACS NSQIP surgical risk calculator to accurately predict postoperative outcomes after colon resection. ***R. Al Lawati, D. Mayson, P. Brasher, T. Hong, G. Warnock.*** **From the University of British Columbia, Vancouver, B.C.**

Predicting complications from surgery aids the decision to operate. The American College of Surgeons (ACS) initiated the National Surgical Quality Improvement Program (NSQIP), which developed a surgical risk calculator (RC) to predict risks of postoperative complications. The aim of this study was to assess RC accuracy for predicting complications in patients undergoing colon resection. A validation study with the use of local NSQIP data was conducted in a tertiary care centre on patients who received colorectal procedures in our Enhanced Recovery After Surgery program from November 2013 to December 2015. RC predictions were compared with observed 30-day follow-up NSQIP outcomes, including predicted versus observed length of stay. RC accuracy was assessed by graphical examination of the calibration curve for outcomes exceeding 50 events. Out of 368 patients, RC-predicted risks versus observed were as follows: serious complication 40 versus 51; any complication 61 versus 70; surgical site infection (SSI) 32 versus 51; pneumonia 6 versus 15; and urinary tract infection 10 versus 11. Predicted risks were higher for cardiac complication (17 v. 9); venous thromboembolism (5 v. 4); acute renal failure (17 v. 5); return to operating room (15 v. 6); death (4 v. 2); and discharge to facility (20 v. 12). Good calibration was observed for any complication and serious complications. SSI was underestimated, but incorporating a risk adjustment option improved it. Length of stay was inaccurately predicted: 4 ± 1 versus 9 ± 12 days, $p < 0.01$. Application of RC in this population closely predicted serious complications and any complication, but less accurately predicted SSI unless adjusted; average length of stay was underestimated.

04

Clinical encounters recorded by patients: What do surgeons think? ***S. Ullah, T. Cil, K. Devon.*** **From the University of Toronto, Toronto, Ont.**

Cases where patients record clinical encounters without their physician's knowledge have recently been reported, raising ethical and legal questions. No study to date has examined surgeons' opinions toward this practice. An anonymous online survey was developed and administered to residents, fellows and attending physicians in a large academic department of surgery. We also compared responses between surgeons and trainees. There were a total of 114 responses (response rate 12.6%). Opinions on the utility of recording clinical encounters and on whether this practice was reasonable differed between attendings and trainees. Attending physicians were more likely to disagree that discussing difficult information without any memory aid was sufficient, compared with trainees (22% v. 5.3%, $p < 0.05$). They were also more likely to think it was reasonable for patients to record their clinical encounters than trainees (38.8% v. 13.5%, $p < 0.05$). They were less likely to agree that recording a clinical encounter without their knowledge would hinder their therapeutic relationship (38.8% v. 62.2%, $p < 0.05$). Finally, attending physicians were less likely to believe that these recordings could be taken out of clinical context (29.2% v. 52.8%, $p < 0.05$) or used against them in a medico-legal dispute (38.8% v. 62.2%). Surgeons' opinions on different aspects of patients recording clinical encounters vary; however, there was a significant difference in opinions between trainees and attending physicians. Trainees were less likely to value recording clinical encounters and more likely to believe that these recordings could be harmful.

05

A systematic review of transabdominal ultrasound in the diagnosis of gallbladder polyps. ***E. Martin, R. Gill, E. Debru.*** **From the University of Calgary, Calgary, Alta.**

Gallbladder polyps are a risk factor for gallbladder cancer and therefore can be an indication for cholecystectomy. Previous research has shown variable but generally poor accuracy of the ultrasound diagnosis of gallbladder polyps. A comprehensive review of ultrasound reports and final pathology will help surgeons interpret and apply these reports in the preoperative assessment and counselling of their patients. A search of the

PubMed, Medline and Cochrane databases using the keywords "gallbladder," "polyp," "ultrasound," "pathology" and "diagnosis" returned 1816 results, which were narrowed down to 14 articles, representing 16 638 patients. Of the 1251 out of 16 638 patients who were diagnosed with gallbladder polyp on ultrasound, 191 were later confirmed as true polyps by pathology (positive predictive value 15.3%) and 85 were malignant polyps (positive predictive value 7.4%). Of the 14 848 with a negative ultrasound, 30 had a true polyp on pathology (sensitivity 70.9%, specificity 79.9%, negative predictive value 99.9%). Transabdominal ultrasound has an 85% false-positive rate and, in the absence of other clinical indications for surgery, may be an unreliable indication for elective cholecystectomy.

06

Technical performance as a predictor of complications in laparoscopic gastric cancer surgery: another piece of the puzzle. ***A. Fecso, J. Bhatti, P. Stotland, F. Quereshy, T. Grantcharov, A. Fecso.*** **From the University of Toronto, Toronto, Ont.**

The purpose of this study was to evaluate the relationship between technical performance and patient outcomes in laparoscopic gastric cancer surgery. A retrospective video and chart review was performed for all patients who had undergone laparoscopic gastrectomy for cancer at 3 teaching institutions between Jan. 1, 2009, and Dec. 31, 2015. Patients with unedited video files were included in the study. Video files were rated using OSATS (Objective Structured Assessments of Technical Skills) and GERT (Generic Error Rating Tool) instruments. The main outcome variable was short-term complications. The effect of technical performance on patient outcomes was assessed using logistic regression analysis with backward selection strategy. Sixty-one patients were included in the study. The serious complication rate was 29.5% (Clavien–Dindo grade III–V). The mean Charlson Comorbidity Index, type of procedure and the global OSATS score were kept in the final model. Lower performance score (OSATS ≤ 29) remained an independent predictor for short-term outcomes (odds ratio 6.49), while adjusting for comorbidities and type of procedure. Intraoperative technical performance predicts short-term complications in laparoscopic gastrectomy for cancer. Ongoing assessment and enhancement of surgical skills, using modern strategies, such as structured feedback, deliberate practice and coaching, might improve patient outcomes. Future work should focus on developing and studying the effectiveness of such interventions in laparoscopic gastric cancer surgery.

07

Studying the interactions between teams and individuals in the operating room: a pilot study. ***A. Fecso*** **(University of Toronto, Toronto, Ont.),** ***S. Kuzulugil*** **(Ryerson University, Toronto, Ont.),** ***C. Babaoglu*** **(Ryerson University, Toronto, Ont.),** ***A. Bener*** **(Ryerson University, Toronto, Ont.),** ***T. Grantcharov*** **(University of Toronto, Toronto, Ont.).**

The purpose of this study was to explore the intraoperative relationships between technical and nontechnical performances of the surgical and nursing teams. A prospective, single-centre observational study was conducted at a tertiary academic medical centre. All patients who underwent a laparoscopic Roux-en-Y gastric bypass (LRYGB) operation and had their procedure captured using the OR Black Box platform were included in the study. Technical assessment was performed using Objective Structured Assessments of Technical Skills (OSATS) and Generic Error Rating Tool (GERT). For nontechnical assessment Non-Technical Skills for Surgeons (NOTSS) and Scrub Practitioners' List of Intraoperative Non-Technical Skills (SPLINTS) were used. Spearman's rank-order correlation and Ngram statistics were conducted. Fifty-six patients were included in the study, and 90 procedural steps (gastrojejunostomy and jejunojejunostomy) were analyzed. There was a moderate to strong correlation between intraoperative events (rs = 0.417–0.687), rectifications (rs = 0.380–0.768) and NOTSS and SPLINTS. Ngram (Bi-gram) statistics showed that post error, post event and before rectification the 2 main contributors to team dynamics are the surgeon and the scrub nurse, regardless of the training level of the operator. Technical and nontechnical performances are strongly related. The 2 main contributors to team dynamics are the surgeon and the scrub nurse. Studying this environment is promising, and future work should include more participants and diverse operations.

08

Low-dose indocyanine green is effective for near-infrared fluorescence cholangiography during laparoscopic cholecystectomy. ***V. Nguyen, A. Meneghetti, N. Panton.*** **From the University of British Columbia, Vancouver, B.C.**

The use of near-infrared (NIR) imaging as a method of fluorescence cholangiography during laparoscopic cholecystectomy as a noninvasive alternative to the gold standard intraoperative cholangiography (IOC) is increasing in both practice and in the literature. Indocyanine green (ICG) is the most commonly used dye and has been shown to be a safe and cost-effective alternative to IOC. This study aims to extend both the safety and cost-effectiveness of ICG by demonstrating effective biliary tract visualization at varying doses of ICG. Patients undergoing laparoscopic cholecystectomy using NIR fluorescence cholangiography at a community teaching hospital between August 2015 and November 2016 were retrospectively analyzed in a prospectively maintained database. ICG dosing was left to the discretion of the surgeon. The primary outcome was biliary tract visualization. ICG dose was dichotomized to low-dose and non–low dose, with non–low dose ICG defined as anything greater than 0.25 mg. Doses ranged from 0.25 mg to 3.75 mg. Fifty-four patients were included. Twenty-seven patients received low-dose ICG and 30 patients received non–low dose ICG. Cystic duct (96% v. 86.2%, $p > 0.05$), common bile duct (100% v. 83.3%, $p > 0.05$) and common hepatic duct (44.4% v. 60%, $p > 0.05$) visualization rates showed no statistical difference comparing low-dose ICG to non–low dose ICG. There were no adverse reactions to ICG administration. This study shows that low-dose ICG use in fluorescence cholangiography is safe and effective. The advantages are less background signal from the liver, decreased cost and potentially fewer adverse reactions while not compromising the ability to visualize ductal structures. Further research is necessary for dose optimization in conditions beyond elective laparoscopic cholecystectomy.

09

Development and implementation of a prevention bundle to reduce surgical site infection following pancreatectomy using quality improvement methodology. ***J. Hallet, M. Sadeghi, N. Coburn, S. Porter, S. Michaelson, C. Law, A. Nathens*. From the Sunnybrook Health Sciences Centre, Toronto, Ont.**

Our institutional post-pancreatectomy surgical site infection (SSI) rate in 2015 (31.4%) was a statistical outlier in the American College of Surgeons' National Surgical Quality Improvement Program (ACS NSQIP) (8th decile for pancreaticoduodenectomy, 10th decile for distal pancreatectomy). We aimed to reduce the SSI rate to the 19% expected rate by implementing a prevention bundle. Stakeholders were engaged in a working group. We used a series of plan-do-study-act (PDSA) cycles. We identified possible factors contributing to SSIs through an Ishikawa diagram. We reviewed our practices in 54 pancreatectomies and constructed a Pareto diagram to define items to change. Changes were implemented over 6 months. Overall SSI rates (superficial, deep and organ/space) were tracked using ACS NSQIP. A running G-chart was constructed to examine reduction in SSIs. The following changes were implemented: avoidance of preoperative biliary stenting, preoperative chlorhexidine shower, extended antibiotic prophylaxis if biliary stent in situ, selective use of pancreaticogastrostomy anastomosis for high-risk pancreas, wound protector, glove change and separate tray for closing, and perioperative glycemic control below 11 mmol/L. From January to October 2016, 74 patients underwent pancreatectomies. The rate of SSIs dropped by March 2016 and reached 15% in the third quarter of 2016. The reduction was significant and sustained on G-chart. The reduction was larger in superficial and deep (16.8% to 9.4%) than organ/space SSIs (14.3% to 9.4%). Risk-adjusted performance in ACS NSQIP improved to the 4th decile for both pancreaticoduodenectomy and distal pancreatectomy. Development and implementation of an institutional SSI prevention bundle using structured quality improvement methods successfully reduced overall SSIs following pancreatectomy and improved institutional risk-adjusted performance.

10

Why do general surgeons decide to retire? ***H. Poushay, D. Kagedan, J. Hallet, L. Gotlib Conn, K. Beyfuss, A. Nadler, N. Ahmed, F. Wright*. From the University of Toronto, Toronto, Ont.**

Limited recent data exist regarding intended retirement plans for general surgeons (GS). We sought to understand when and why surgeons decide to stop operating as the primary surgeon and stop all clinical work. A paper-based survey of practising GS was conducted. A questionnaire was developed using a systematic approach of item generation and reduction. Face and content validity were tested. The survey was administered via mail, with a planned reminder. Overall response rate was 33.5% (242/723). The median age at which respondents planned to/did stop operating was 65 (IQR 60–67.5). The median age at which respondents planned to/did retire from all clinical work was 70 (IQR 65–72.5). Career satisfaction (97%), sense of identity (90%) and financial need (69%) were factors that influenced the decision to continue operating. Enjoyment of work (79%), camaraderie with surgical colleagues (66%) and financial need (45%) were reasons to continue working after ceasing to operate as the primary surgeon. On multivariate analysis, younger respondents (36–50 years old) were less likely to continue operating past age 65 (OR 0.13), and academic surgeons were more likely to stop operating after age 65 (OR 2.39). Call coverage by non–staff surgeons was not associated with retirement age. Overall, GS plan to stop operating at age 65 and to cease all clinical activities at age 70. Younger, nonacademic surgeons plan to stop operating earlier. Career satisfaction, sense of identity and financial need are the principal reported motivations to continue operating.

11

Impact of the SEE Colonoscopy Skills Improvement course in Newfoundland: survey of course participants. ***A. Modasi, D. Pace, C. Smith, M. Borgaonkar*. From Memorial University of Newfoundland, St. John's, Nfld.**

Training and skill in endoscopy is an area of great variability. Recently the Canadian Association of Gastroenterology has developed the Colonoscopy Skills Improvement (CSI) course to improve the technique of endoscopists throughout Canada. To assess the impact of this course we have developed a survey of course participants in Newfoundland. A 14-question survey was created following discussion among a panel of expert endoscopists in St. John's. Of the 30 CSI course participants in Newfoundland, 20 responded anonymously (10 general surgeons, 8 gastroenterologists, 2 general surgery residents). Of those 20, 90% had over 3 years of endoscopy experience, 80% had an annual scope volume over 150 and 20% performed more than 600 colonoscopies per year. All 20 participants stated that their intended purpose for completing the course was to improve their endoscopic skill. Seventeen (85%) stated that they felt more confident in their endoscopic ability following course completion. Nineteen participants (95%) stated that they adopted the CSI approach to holding the scope and torque steering, 80% turned their patients more during scope insertion and 70% used less sedation on their patients after taking the course. All 20 participants stated that they would recommend this course to a colleague. Among the most common strengths identified by participants was the hands-on training and individualized feedback (65%). When asked to identify an area for improvement, 50% stated that they would prefer more advanced polypectomy teaching. The demographic of participants in the CSI course appears to be experienced endoscopists looking to add to their existing practice. The course has been well received and has had a significant impact on the practice of Newfoundland endoscopists. Advanced polypectomy teaching appears to be an area lacking within the current CSI curriculum and raises the interesting possibility of an advanced-level course being added to the SEE program.

12

Impact of acute care surgery service on acute cholecystitis management and outcomes at a single Canadian academic network. ***S. Godzisz, A. Giles, S. Forbes, R. Nenshi, C. Eskicioglu*. From McMaster University, Hamilton, Ont.**

Acute care surgery (ACS) services have seen increasing traction. In our academic network, 2 of 3 adult surgical hospitals use this arrangement. We sought to describe differences in cholecystitis management and outcomes between these care delivery models. Fifty patients diagnosed with acute cholecystitis undergoing index

admission cholecystectomy were selected from each hospital in reverse chronological order. Data from ACS services were pooled for analysis. Demographic, preoperative, operative and postoperative data were collected. The primary end point was overall complication rate; secondary end points were length of stay (LOS) and time to operating room (OR). Groups were compared using parametric and nonparametric analysis. Linear regression was used to identify adjusted predictors of log-transformed LOS. Baseline characteristics were similar between patients at ACS and non-ACS hospitals. Time from arrival at the emergency department to admission was comparable (ACS median 7 hours, non-ACS 7 hours; $p = 0.61$). Time from admission to OR was decreased at ACS hospitals (median 19.5 v. 55.5 hours; $p < 0.01$). Operative length (ACS 83 minutes, non-ACS 94 minutes; $p = 0.47$) and rate of conversion (4.0% v. 10%; $p = 0.16$) were equivalent. Overall postoperative complication rates were similar between groups (ACS 19%, non-ACS 30%; $p = 0.19$). On univariate analysis, median LOS was shorter among ACS than non-ACS hospitals (3 v. 3.5 days, $p < 0.01$). However, multivariable analysis demonstrated that LOS is unaffected by the presence of an ACS service ($\beta = 0.001$, $p = 0.98$) but is lengthened by other variables. Readmission rates did not differ between groups (2.0% v. 8.0%; $p = 0.10$). Acute care surgery services are effective in reducing time to operation in our academic network. LOS appears to primarily depend on other factors; however, a trend favouring ACS is seen regarding OR length, intra- and postoperative complications and readmission rates.

13

Surgical time and the risk of complications in patients following appendectomy: a population-level case-crossover study. ***S. Patel*** **(Kingston General Hospital and Queen's University, Kingston, Ont.),** ***S. Merchant*** **(Kingston General Hospital and Queen's University, Kingston, Ont.),** ***S. Nanji*** **(Kingston General Hospital and Queen's University, Kingston, Ont.),** ***S. Brogly*** **(Queen's University, Kingston, Ont.).**

Previous studies have shown that night-time operating and delays in surgical treatment can increase the risk of complications in patients undergoing appendectomy. The objective of this study was to determine the effect of time of day of surgery on the risk of complications in patients undergoing appendectomy for acute appendicitis in a Canadian population. This study is a case-cohort study, using population data available through the Institute for Clinical Evaluative Sciences. Adult appendectomy patients were included. Patients with complications were matched (1:1) with those without, based on operating surgeon. Primary outcome was a composite of complications (mortality, readmission, emergency department visits, prolonged stay, reintervention). Primary exposure was time of day of surgery, categorized as daytime (0800–1700), evening (1700–2400) and night (0000–0800). Univariate and multivariate analyses were performed. Analyses were undertaken for perforated and nonperforated appendicitis separately. A total of 50 369 patients were operated on over the study period, of which 29.5% had at least 1 complication. A total of 28 874 patients were included in the matched analysis. For those with nonperforated appendicitis, we found that those operated on in the evening (OR 0.814, 95% CI 0.742–0.892) and those operated on at night (OR 0.759, 95% CI 0.620–0.929) had lower odds of a complication than those with daytime operations, after adjusting for important confounders. There was no evidence of a difference between evening and night operating in this group. In the perforated appendicitis patients, time of day of surgery was not associated with complications. Daytime operating was associated with increased complications in patients with nonperforated appendicitis. The mechanism for this is unclear and could not be explained based on delay between presentation at triage and operation.

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Geographic variation of screening colonoscopy providers in Canada. ***S. Anvari, A. Doumouras, D. Hong*****. From McMaster University, Hamilton, Ont.**

Screening colonoscopies for detection of colorectal carcinoma (CRC) may be provided by gastroenterologists, surgeons or other specialists. However, conflicting findings have emerged regarding which type of provider primarily performs colonoscopies and achieves better patient outcomes. Few studies have assessed geographic variations in the delivery of this care and how surgeons and gastroenterologists differ in where they practise. Our objective was to investigate variations in the delivery of colonoscopies by specialty across Canada. This was a retrospective, population-based cohort of all screening colonoscopies performed at Canadian hospitals between April 2008 and March 2015. The main outcome of interest was the proportion of colonoscopies done by surgeons and gastroenterologists at the neighbourhood level. Predictors of interest included neighbourhood socioeconomic status, rural status and distance to the hospital that performed the colonoscopy. Spatial analysis was used to analyze for significant clustering of practitioner services. Predictors of clustering were assessed using multinomial logistic regression. From 2008 to 2015, we identified 658 113 screening colonoscopies of which 53.7% were performed by surgeons. Of all neighbourhoods, 56.3% had a mix of colonoscopies provided by gastroenterologists and surgeons, while 24.2% were primarily served by gastroenterologists and 19.5% were served by surgeons. Rural neighbourhoods had significantly increased odds of being predominantly served by surgeons (OR 5.38; 3.38–8.01) compared with mixed neighbourhoods. Compared with mixed clusters, neighbourhoods served predominantly by gastroenterologists had higher odds of being in the highest socioeconomic status compared with the lowest socioeconomic status (OR 1.74; 1.14–2.56, $p = 0.005$) and a substantially decreased odds of being rural (OR 0.12; 0.01–0.35). Surgeons provide a large proportion of colonoscopies across the country and are essential for access to care, particularly in rural regions. Both specialties are necessary for adequate provision of screening colonoscopies in Canada.

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Trends in the Fundamentals of Laparoscopic Surgery (FLS) certification exam over the past 9 years. ***E. Bilgic*** **(McGill University, Montreal, Que.),** ***P. Kaneva*** **(McGill University, Montreal, Que),** ***A. Okrainec*** **(University of Toronto, Toronto, Ont.),** ***E. Ritter*** **(Uniformed Services University of the Health Sciences, Bethesda, Md.),** ***S. Schwaitzberg*** **(University at Buffalo, Buffalo, N.Y.),** ***M. Vassiliou*** **(McGill University, Montreal, Que.).**

The Fundamentals of Laparoscopic Surgery (FLS) certification exam assesses both cognitive and manual skills and has been administered for over a decade. The purpose of this study is to report results

over the past 9 years of testing to identify trends over time and evaluate the need to update scoring practices. This is a quality initiative of the Society of American Gastrointestinal and Endoscopic Surgeons FLS committee. A representative sample of FLS exam data from 2008 to 2016 was analyzed. The de-identified data included demographics and scores for the cognitive and manual tests. Standard descriptive statistics were used to compare trends over the years, training levels, and to assess the pass/fail rate. A total of 7232 FLS tests were analyzed (64% male, 6.4% junior [PGY 1–2], 84% senior [PGY 3–5], 2.8% fellows [PGY6] and 6.7% attending surgeons). Specialties included 93% general surgery, 6.2% gynecology and 0.9% urology. The Pearson correlation between cognitive and manual scores was 0.09. For the cognitive exam, there was an increase in scores over the years, and the most junior residents scored lowest. For the manual skills, there were marginal differences in scores over the years, and junior residents scored highest. The odds ratio of PGY3+ passing was 1.8 (CI 1.2–2.8) times higher than a PGY1–2. The internal consistency between tasks on the manual skills exam was 0.73. If any 1 of the tasks was removed, the Cronbach's α dropped to between 0.65 and 0.71, depending on the task being removed. The cognitive and manual components of the FLS test different aspects of laparoscopy and demonstrate evidence for reliability and validity. More experienced trainees have a higher likelihood of passing the exam and tend to perform better on the cognitive skills. Each component of the manual skills contributes to the exam and should continue to be part of the test.

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Laparoscopic surgery for adhesive small bowel obstruction is associated with a higher risk of bowel injury: a population-based analysis of 8584 patients. ***R. Behman, A. Nathens, J. Byrne, S. Mason, N. Look Hong, P. Karanicolas.* From the University of Toronto, Toronto, Ont.**

Laparoscopic lysis of adhesions for small bowel obstruction (SBO) is becoming more common, but it might increase the risk of bowel injury given the distended and/or potentially compromised small bowel. To explore this possibility, we set out to compare the incidence of bowel repair and/or resection in a large cohort of patients with adhesive SBO (aSBO) managed operatively. We used administrative discharge data derived from a large geographic region, identifying patients who underwent surgery for their first episode of aSBO between 2005 and 2014. Procedure codes were used to determine the exposure: either an open approach or a laparoscopic approach (including procedures converted to open). The primary outcome was incidence of bowel intervention, defined as intraoperative enterotomy, suture repair of intestine or bowel resection. We estimated the odds of bowel intervention after adjusting for patient and clinical factors. A total of 8584 patients underwent operation for aSBO. Patients undergoing laparoscopic procedures were younger with fewer comorbid conditions. The rate of laparoscopic approaches increased more than 3-fold over the study period (4.3% to 14.3%, $p < 0.0001$). The incidence of bowel intervention was 53.5% versus 43.4% in laparoscopic versus open procedures ($p < 0.0001$). After adjustment for potential confounders, the odds of bowel intervention among patients treated laparoscopically versus open was 1.6 (95% CI 1.4–1.9). Laparoscopic procedures for aSBO are associated with a greater likelihood of intervention for bowel injury and/or repair. This increase might be due to challenges inherent with laparoscopic approaches in patients with distended small bowel. Surgeons should approach laparoscopic lysis of adhesions with a higher level of awareness and use strategies to mitigate this risk.

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Wound protectors in reducing surgical site infections in lower gastrointestinal surgery: an updated meta-analysis of randomized controlled trials. ***L. Zhang, B. Elsolh, S. Patel.* From Queen's University, Kingston, Ont.**

Surgical site infection (SSI) is a common complication in gastrointestinal surgery, affecting up to 25% of patients. SSIs increase length of stay, incur increased costs to the health care system and contribute to postoperative morbidity and mortality. Wound protection devices (or "wound retractors") have been increasingly used in the past few decades in the effort to reduce SSI rates. We performed a meta-analysis to determine if the use of wound protectors reduces the incidence of SSIs in lower gastrointestinal surgery. The Medline and Embase databases were searched between 1946 and 2016. Randomized controlled trials (RCTs) comparing SSI rates in wound protector versus no wound protector in lower gastrointestinal surgery were included. The odds ratio (OR) was calculated for the primary outcome. We used random effects modelling to account for clinical heterogeneity. Subgroup analysis was conducted comparing single-ring versus dual-ring wound protectors. Twelve RCTs with 3029 participants were included in the meta-analysis. The wound protector group demonstrated significantly decreased odds of developing SSI (OR 0.64, 95% CI 0.45–0.90, $p < 0.01$, $I^2 = 55\%$). There was evidence of a subgroup effect ($p = 0.01$) with dual-ring wound protectors associated with significantly lower incidence of SSIs (5 studies, OR 0.31, 95% CI 0.18–0.52, $p < 0.0001$, $I^2 = 12\%$), which was not appreciated in the single-ring wound protectors (7 studies, OR 0.84, 95% CI 0.67–1.04, $p = 0.11$, $I^2 = 0\%$). Three studies had high risk of bias. The Grading of Recommendations Assessment, Development and Evaluation (GRADE) quality of evidence was moderate. Wound protector use is associated with decreased odds of developing SSIs in patients undergoing lower gastrointestinal surgery. We found that there was a subgroup effect when comparing dual-ring to single-ring wound protectors.

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Diagnosis and management of acute cholecystitis: an audit of guideline adherence and patient outcomes. ***A. Giles, S. Godzisz, R. Nenshi, S. Forbes, C. Eskicioglu.* From McMaster University, Hamilton, Ont.**

The Tokyo Guidelines (TG) introduced diagnostic criteria, severity ratings and management pathways for acute cholecystitis. We sought to assess penetrance of guideline adherence at our academic centre and the impact on patient outcomes. We retrospectively reviewed 150 patients with a diagnosis of acute cholecystitis who underwent cholecystectomy during admission. Preoperative data were examined for a severity designation, otherwise one was assigned retrospectively. Moderate and severe cases were pooled for analysis. Operative and postoperative data were recorded. TG definitions were used for antibiotic and time to operating room (TTOR) compliance. The primary outcome was guideline compliance; secondary outcomes were complications and length of stay (LOS). Parametric and nonparametric analysis was used to

compare groups, with logistic regression to determine predictors of complications. Severity was not recorded for any patient. A total of 104 cases were graded as mild, 45 as moderate and 1 as severe. Compliance with antibiotic recommendations was poor overall (41.3%) and worse for moderate/severe than for mild cholecystitis (13.0% v. 53.8%, $p < 0.01$). TTOR compliance was 86.0% and equivalent between groups ($p = 0.63$). Operative length was increased for moderate/severe cases (98 minutes v. 78 minutes, $p = 0.01$); rate of conversion to laparotomy was comparable ($p = 0.46$). The overall postoperative complication rate was similar (mild 20.2%, moderate/severe 28.3%; $p = 0.38$). After adjustment, comorbidities (odds ratio [OR] 1.5, $p < 0.01$) and conversion to laparotomy (OR 13.1, $p = 0.01$) were found to be predictive of postoperative complications, while severity (OR 1.0, $p = 0.99$), antibiotic compliance (OR 0.9, $p = 0.90$) and time to OR (1.0, $p = 0.72$) had no effect. LOS was 3 days for mild and 4 days for moderate/severe cases ($p = 0.04$). Readmission rates were similar (mild 7.3%, moderate/severe 4.3%; $p = 0.39$). Compliance with severity grading and antibiotic administration was poor, while TTOR was acceptable. Severity and guideline compliance had no impact on complication rate. Quality improvement measures could improve antibiotic stewardship in this context.

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Decreased sedation usage following Colonoscopy Skills Improvement (CSI) training maintained at 8 months. ***B. Evans*, *M. Goldring*, *M. Borgaonkar*, *D. Pace*, *D. Boone*, *J. McGrath*. From Memorial University of Newfoundland, St. John's, Nfld.**

The Canadian Association of Gastroenterology (CAG) has implemented the Colonoscopy Skills Improvement (CSI) program across Canada with a goal of improving colonoscopy quality. Efficacy of the program has not yet been formally assessed. This retrospective cohort study was performed on 15 endoscopists practising in a tertiary referral centre who underwent CSI training between October 2014 and December 2015. Fifty consecutive procedures immediately before, immediately after and 8 months after undergoing training were included for each endoscopist. Data were extracted from the electronic medical record and entered into SPSS version 20.0 for analysis. The Student's t test was used to compare groups for continuous data; χ^2 tests were used for categorical data. Thus far, partial data for analysis have been collected for 2250 procedures. The most common indication for colonoscopy was family history of colorectal cancer in 413 (36.5%) patients. Patient groups before, immediately after and later after CSI training were comparable in terms of mean age (59.5 years v. 59.9 years v. 59.9 years), sex (44% male v. 46% v. male v. 45% male), indication, and completion rate (98.6% v. 98.7% v. 99.3%). Fentanyl and midazolam were the only sedation agents used. Intravenous sedation was used in 1982 (88.1%) cases. There was no difference in the rate of sedation usage between groups. There was a statistically significant decrease in average dose of fentanyl (77.8 μg v. 68.5 μg, $p < 0.001$) and average dose of midazolam (2.6 mg v. 2.3 mg, $p < 0.001$) used during each procedure immediately before and after CSI training. This decrease in mean sedation dose was maintained 8 months after undergoing training for both fentanyl (77.8 μg v. 66.4 μg, $p < 0.001$) and midazolam (2.6 mg v. 2.2 mg, $p < 0.001$). Participation in the CSI program is associated with decreased sedation usage during colonoscopy. This was maintained in the 8-month follow-up period.

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Quality improvement in thyroid surgery: reduction in unplanned postoperative hospital readmission, emergency department visits and reoperations. ***J. Margolick*, *W. Chen*, *S. Wiseman*. From the University of British Columbia, Vancouver, B.C.**

Unplanned hospital readmission, reoperation and emergency department (ED) visits following thyroid operations are a source of frustration for both patients and surgeons. Some hospitals are now mandated to report readmission statistics, and these can be used for quality control. The objective of this study was to systematically review the current literature to evaluate the rates of readmission, reoperation and ED visits following thyroid operations. This systematic review was conducted in accordance with the Preferred Reporting of Items for Systematic Reviews and Meta-Analyses for Protocols (PRISMA-P). Literature was searched using the Medline, Embase and PubMed databases. Titles of articles were scanned, followed by abstract review and full text review. Studies were then graded on their level of evidence based on the Oxford Centre for Evidence-based Medicine Levels of Evidence. Twenty-two studies were included in this systematic review. The rates of unplanned readmissions ranged from 0.2% to 11%, while the rates of ED visits ranged from 1.8% to 11.1%. Unplanned emergency reoperation rates ranged from 0.07% to 1.95%. Postoperative hypocalcemia was the most common reason for hospital readmission, while neck hematoma was the most common reason for reoperation. Prophylactic postoperative calcium and vitamin D supplementation may reduce rates of postoperative hypocalcemia, while avoiding postoperative hypertension may decrease risk of neck hematoma. Older age, thyroid cancer diagnosis, dependent functional status, higher American Society of Anesthesiologists (ASA) score, diabetes, steroid use for chronic obstructive pulmonary disease, hemodialysis and recent weight loss increase the risk of hospital readmission after thyroid operations. By identifying risk factors for readmission, reoperation and ED visits, this review may assist optimizing perioperative care algorithms for individuals undergoing thyroid operations.

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The development of a standardized protocol for the closure and care of perineal wounds. ***A. Fowler*, *C. Cahill*, *Y. Zhang*, *C. Schulz*, *V. Meyouhas*, *T. Miller*, *J. Powell*, *H. Moloo*, *I. Raîche*, *R. Musselman*, *L. Williams*. From the University of Ottawa, Ottawa, Ont.**

Perineal wounds represent a major source of morbidity for patients undergoing abdominoperineal resection (APR). Despite rich literature describing approaches to wound closure and postoperative care, there exists no gold standard with which to compare interventions. Our aim was to develop a standardized approach to the intra- and postoperative management of these wounds, based upon expert input from a group of multidisciplinary stakeholders at our institution. Using the framework of the Comprehensive Unit-based Safety Program (CUSP), a multiprofessional team of institutional stakeholders was identified to develop and pilot a standardized wound protocol. We engaged all professions involved in the care of patients with perineal wounds and explored the literature to extrapolate best practices for these wounds. Consensus was reached using the nominal group technique. A protocol was first piloted at the simulation centre and then instituted at our institution, with

multiple iterative revisions. As a result, a protocol was developed that includes standards for preoperative care, intraoperative interventions, dressing, activity, elimination and postdischarge care for patients with perineal wounds after APR. To date, 6 patients have received this protocol, with a surgical site infection (SSI) rate of 0%. A standardized approach to the care of perineal wounds after APR has been developed and piloted, using multidisciplinary expertise. Early review of this case series of patients receiving the protocol has been very encouraging. Future retrospective trials will be needed to compare the previous rate of perineal SSI at our institution to that with continued use of this protocol. We plan to follow up this work with a multicentre randomized controlled trial of incisional negative pressure wound therapy, and this protocol is the first that would allow for standardization within the nontreatment arm.

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Retrospective analysis of the adequacy of surgical margins after breast conservation surgery in Manitoba. ***L. Findlay-Shirras*, *O. Outbih*, *C. Muzyka*, *K. Galloway*, *P. Hebbard*, *M. Nashed*. From the University of Manitoba, Winnipeg, Man.**

Breast conserving therapy (BCT) is the standard of care for the treatment of early stage breast cancer. Even with the new "no ink on tumour" margin recommendations, an ongoing debate over what constitutes an adequate resection margin continues. This controversy contributes to the persistence of high re-excision rates, and revision surgery is potentially of limited clinical value in the era of multimodality therapy. The objectives of this study are to identify the local rate of re-excision for compromised margins after lumpectomy for breast cancer and to identify factors that could potentially predict no residual disease found at revision surgery. This retrospective cohort study included women with breast cancer who underwent a lumpectomy between 2009 and 2012, with a close (≤ 2 mm) or positive margin that led to re-excision. Patients were identified through the provincial cancer registry, and patient demographics and tumour characteristics were identified through chart review, including review of operative and pathology reports. Each of the 6 anatomic margins was reported for margin status, including margin width and pathology type at the margin. Of the 2458 patients identified, 539 women underwent a re-excision for close or positive margins, resulting in a re-excision rate of 21.9%, which is slightly lower than previous literature reports. In our cohort, 37.3% of patients with invasive cancer (116/311) had no residual disease identified on their revision surgery pathology. On univariable analysis, the size and grade of the invasive component, the nodal stage and the number of positive margins were associated with residual disease on revision surgery (all $p < 0.05$). With the exception of nodal stage, the same variables remained statistically significant on multivariable analysis. These results suggest an identifiable subgroup of patients who could potentially avoid unnecessary surgery, and could help to dramatically reduce the rates of revision procedures in the future.

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The impact of surgical modality on self-report body image, quality of life and survivorship in patients with rectosigmoid cancer — a mixed methods study. ***D. Hirpara* (University of Toronto, Toronto, Ont.), *A. Azin* (University of Toronto, Toronto, Ont.), *V. Mulcahy* (University Health Network – Toronto Western Hospital, Toronto, Ont.), *A. Chadi* (University Health Network – Toronto Western Hospital, Toronto, Ont.), *F. Quereshy* (University Health Network – Toronto Western Hospital, Toronto, Ont.).**

The objective of this study is to add to the limited body of literature assessing the impact of surgical modality on body image and quality of life (QoL) in patients with rectosigmoid cancer (RSC). We used a mixed methods approach, with semi-structured interviews with 30 RSC patients, from January 2015 to July 2016. Cosmetic outcomes and QoL were assessed using validated body image and European Organization for Research and Treatment of Cancer (EORTC) QLQ-30 and QLQ-CR29 questionnaires. Thirty patients, with comparable sociodemographic characteristics ($p > 0.05$), were interviewed and stratified into groups treated with open ($n = 8$), laparoscopic ($n = 12$) and robotic ($n = 10$) approaches. Patients receiving open surgery experienced greater 30-day morbidity than those in the laparoscopic and robotic groups ($p = 0.03$). This included a higher incidence of postoperative wound infections and ileus. One patient experienced complete erectile dysfunction and retrograde ejaculation. The 3 groups were comparable with respect to readmission rates ($p = 0.60$) and 30-day mortality. Median body image scores were significantly lower in patients receiving open surgery ($p < 0.001$). A majority of patients expressed dissatisfaction with midline laparotomy scars as well as the presence of incisional hernias. Open surgery was also detrimental to physical function, such as engaging in strenuous activities, prolonged ambulation and self-care ($p = 0.021$). Patients receiving laparoscopic surgery were significantly less likely to have stoma bags after their operation, in comparison to those treated with open and robotic approaches ($p = 0.008$). They also reported superior role ($p = 0.01$) and social function ($p = 0.04$), including the ability to enjoy hobbies, family life and social activities. Surgical modality did not impact emotional and cognitive function, global QoL, or sexual enjoyment or function, as well as symptoms scales assessing micturition, pain and defecation. Open surgery for RSC has a detrimental impact on self-reported body image and physical function. While laparoscopic surgery is protective in preserving role and social function, prospective randomized studies are required to validate these findings.

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A retrospective cohort analysis on the management of percutaneous drains for intra-abdominal sepsis at a Canadian tertiary care centre. **J. *Springer*, *S. Forbes*, *C. Eskicioglu*, *S. Nair*. From McMaster University, Hamilton, Ont.**

Intra-abdominal sepsis (IAS) accounts for a large proportion of surgical complications, and if not promptly controlled, it carries mortality rates that range between 25% and 100%. Minimally invasive techniques, such as image-guided percutaneous drain (PD) have become the standard of care as surgery for IAS carries high morbidity and mortality. Numerous studies have evaluated the outcomes of PDs; however, management guidelines are unclear and inconsistent in the literature. The purpose of this retrospective cohort analysis was to describe the management and outcomes of PDs for IAS. All patients who underwent PD insertion for IAS at a tertiary care centre between Jan. 1 and Dec. 31, 2015, were retrospectively analyzed. Data were collected on patient characteristics, drain details, post-insertion management and abscess recurrence. During the study period, 191 patients (mean age 61, 63% male) received a PD for IAS. Fifty-nine (31%) PDs were inserted for sepsis secondary to a

disease process and 132 (69%) were placed postoperatively. Seventy-three percent of the postoperatively placed PDs were following emergency surgery. Reasons for PDs included malignancy (44%), benign perforation (32%), trauma (3%), inflammatory bowel disease (5%) and other (16%). Percutaneous drains remained in situ for a median of 19 days, and 17 patients died with their drain. Fifty patients (26%) had a sinogram before PD removal, and in 71% of cases, the sinogram results influenced the decision to remove the drain. Overall abscess recurrence was 22%. There was a significantly higher abscess recurrence rate following PD removal when a sinogram was not performed compared with when a sinogram was performed (26% v. 8%, $p = 0.006$). A second PD was required in 41% of patients who did not receive a sinogram and 2% of patients who received a sinogram. Our data suggest that routine sinograms before PD removal for IAS would reduce rates of abscess recurrence and the requirement for additional drainage procedures.

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Preoperative response to steroids predicts success of laparoscopic splenectomy in treating immune thrombocytopenia. ***A. Istl*** **(Western University, London, Ont.),** ***G. McCreery*** **(Western University, London, Ont.),** ***L. Allen*** **(London Health Sciences Centre, London, Ont.),** ***L. Dubois*** **(London Health Sciences Centre),** ***K. Vogt*** **(London Health Sciences Centre, London, Ont.),** ***D. Gray*** **(London Health Sciences Centre, London, Ont.).**

Laparoscopic splenectomy (LS) is a standard second-line therapy for immune thrombocytopenic purpura (ITP). The sustained success rate of LS for ITP is roughly 66% and the likelihood of success can be predicted based on response to first-line therapy. There is concern that LS may be unsafe or ineffective in older patients. The purpose of this study is to identify factors predictive of LS failure that will enable prognostication preoperatively. A retrospective cohort study was conducted of patients undergoing LS for ITP at a single centre. Data evaluating response to medical and surgical therapy were collected. Response to therapy and disease remission were defined as a platelet level of 50×10^9/L with no bleeding events. Univariate and multivariate analyses evaluating factors predictive of LS failure for ITP were conducted. A total of 141 patients were reviewed. The operation was completed successfully in 96.4% of cases with a 3.6% conversion rate and 8.5% complication rate. Disease remission was achieved in 78.7% of patients. An increased number of preoperative medical interventions increased the odds of LS failure. Age did not confer an increased risk of failure or complications. Response to initial steroid therapy was associated with an LS success rate of 90%. LS leads to successful remission of ITP in 78.7% of patients and is safe in patients 65 years of age and older. A greater number of preoperative medical interventions is associated with LS failure. Initial response to steroids is associated with an LS success rate of 90%. LS should be the standard second-line therapy for ITP, especially in patients responding to steroids.

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Factors contributing to successful trauma registry implementation in low- and middle-income countries — a systematic review. ***T. Paradis, E. St-Louis, T. Landry, D. Poenaru.*** **From McGill University, Montreal, Que.**

Trauma registries contribute to quality improvement by providing data informing and supporting decision-makers in resource allocation and planning. These benefits are compounded in low- and middle-income countries (LMICs), where resources are limited and injury remains a leading cause of mortality. The purpose of this systematic review was to identify strategies for successful trauma registry implementation in LMICs. The protocol was registered a priori (CRD42017058586). With librarian oversight, a peer-reviewed search strategy was developed to query all appropriate databases. Adhering to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines, 2 independent reviewers performed the first screen, based on titles and abstracts, and the full-text screen subsequently. Disagreements that could not be resolved by discussion were arbitrated by the senior author. Bibliographies were hand searched. We included studies describing development or implementation of a trauma registry in LMICs, or reviewing the experience of registry users and implementers, with a focus on strategies for successful registry uptake and identifying barriers to registry maintenance. Out of 3842 references identified, 56 articles were included. LMIC authorship was present in 85%, and 50% reported on high-income country (HIC)–LMIC partnerships. Half the registries used computer-based data collection; all software-based registries held funding. Chart review was the method of data collection in over half the registries. The most commonly used injury severity classification was the Glasgow Coma Scale. Outcome and mortality data were collected in 61%. Most registries had dedicated staff, of which 75% held funding. Lack of financial support and incomplete data entry were the most common barriers to registry implementation. Minimal data set use, chronological data collection and the presence of a registry coordinator were associated with success. This work may contribute to the planning of future efforts toward trauma registry implementation in LMICs, where better injury data have the potential to alleviate the burden of morbidity and mortality associated with trauma through advocacy and quality improvement.

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Neoadjuvant therapy and nodal pathologic complete response affects node counts at axillary node dissection in breast cancer. ***E. Mackay, E. McKevitt, C. Dingee, U. Kuusk, J. Pao, R. Warburton.*** **From the University of British Columbia, Vancouver, B.C.**

Recommendations for number of lymph nodes removed during axillary lymph node dissection (ALND) are based on a mathematical model from the 1990s. Since then, management of the axilla has evolved dramatically. Our objective is to characterize the effect of neoadjuvant therapy (NAT) and nodal pathologic complete response (pCR) on number of nodes retrieved at ALND. A retrospective review of a breast cancer database was conducted to identify patients with invasive breast cancer who underwent ALND between January 2012 and March 2016. Lymph node yield at time of ALND in patients treated with NAT was compared with that in patients who underwent surgery first. In the NAT group, patients with a nodal pCR were compared with those with residual disease. A total of 313 patients with node-positive breast cancer requiring ALND were identified; 185 (59%) had surgery first and 128 (41%) were treated with NAT followed by ALND. Average number of nodes removed in the surgery-first group was 11.5 compared with 9.5 nodes in the NAT group ($p = 0.0105$). Average number of positive nodes at ALND in the surgery-first group was 3.9 compared with 2.6 in the NAT group ($p = 0.0285$). In the NAT group, 54% had positive nodes while 46% had nodal pCR. In the NAT group,

node harvest number in residual axillary disease was 12.0, significantly higher than the average of 6.5 nodes when there was a nodal pCR ($p < 0.0001$). While further characterization of the effect that NAT has on axillary nodes is needed, these findings demonstrate that NAT has a significant impact on number of nodes removed at ALND. This seems to significantly affect those patients who achieve a nodal pCR. This questions the utility of node number as a quality indicator for ALND in the setting of NAT, especially when patients achieve a nodal pCR.

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Cost-effectiveness of surgical technique for the management of appendicitis. ***K. Nadia, R. Hilsden, K. Vogt, C. Schlachta.* From Western University, London, Ont.**

Presently, there is equipoise regarding the surgical technique used to manage the appendiceal stump during laparoscopic appendectomy. The purpose of this research was to determine whether the routine use of loop ligature, compared with stapling, is cost-effective from a hospital payer perspective. A retrospective cohort study was conducted among patients undergoing emergency laparoscopic surgery for acute appendicitis at 2 major academic hospitals. To eliminate possible systemic bias arising from one technique being preferentially used with more complex presentations, regardless of how their surgery was conducted, patients were divided into study groups based on the technique routinely used by their surgeon: loop ligature (LLA) versus stapler (LSA). Pediatric patients and patients having open appendectomy were excluded. Costs were determined using a previously published model derived from publicly available data from the Ontario Case Costing Initiative, in conjunction with local cost data. Secondary outcomes included operating room time, length of stay and complication rates. Between Jan. 1, 2014, and Dec. 31. 2015, 567 adult patients had an emergency laparoscopic appendectomy for acute appendicitis. Comparing surgeons routinely using LLA to LSA, there were no significant differences observed in mean operation time (73 ± 4.4 v. 68 ± 2.8 minutes, $p = 0.080$) or mean length of stay (1.5 ± 0.19 v. 1.4 ± 0.11 days, $p = 0.32$). Mean disposable cost was $300 higher for surgeons routinely using LSA ($308 ± $32 v. $608 ± $26, $p < 0.001$), as was total mean hospital cost ($2002 ± $160 v. $2202 ± $99, $p = 0.032$). These findings suggest that surgeons who routinely use loop ligature to secure the appendiceal base during emergency laparoscopic appendectomy offer more cost-effective care than stapler users from a hospital payer perspective, saving their institution $200 per case with no clear disadvantages. A shift from routine use of staplers to loop ligature should result in significant cost savings to the hospital.

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Establishing a Canadian global surgery community: a national survey. ***D. Kim* (University of British Columbia, Vancouver, B.C.), *H. Wong* (University of British Columbia, Vancouver, B.C.), *V. Fawcett* (University of Alberta, Edmonton, Alta.), *M. Hameed* (University of British Columbia, Vancouver, B.C.), *B. Westerberg* (University of British Columbia, Vancouver, B.C.), *E. Ball-Banting* (University of British Columbia, Vancouver, B.C.), *E. Joos* (University of British Columbia, Vancouver, B.C.).**

Surgery has recently gained a prime position on the global health agenda. However, the global surgery community remains fragmented. We sought to map the global surgery offices (GSOs) in Canada and evaluate the scope of their initiatives. This is a scoping review of all Canadian GSOs. They were identified through the Canadian Association of General Surgeons and by word of mouth. Surveys were conducted electronically and by phone interviews. A total of 7 academic institutions have known GSOs. Six out of 7 responded. These GSOs span across 5 provinces and include 6 universities: Dalhousie University, McGill University, McMaster University, University of Calgary, University of Alberta and University of British Columbia. Low- and middle-income countries (LMICs) with involvement included ones in Africa (5/6), the Americas (4/6), Eastern Europe (1/6) and Asia (1/6). Most GSOs have multiple partners: governmental organizations (2/6), nongovernmental organizations (5/6) and private institutions (3/6). Only 2 have formal partnerships between one another. All offer training in international surgery to Canadian residents and most to Canadian medical students (5/6). Only half (3/6) offer training to LMIC trainees. Whereas 1 GSO provides surgical support only, others provide data collection (3/6) and quality improvement initiatives (5/6). All benefit from financial support from their department of surgery/anesthesia, 2 from private funding and only 1 from grants and fundraising activities. Despite a unifying commitment to improve surgical care in LMICs, GSOs in Canada mostly operate independently of one another. We propose to build an epistemic community of Canadian surgeons involved in global health: the "Canadian Global Surgery Initiative." This community could function as a flexible governance structure by providing a platform for networking, sharing of ideas, coordinating initiatives, building research capacity and obtaining political support and sustainable funding. To ensure a more effective collective action, an additional effort should be made to include all surgical specialties.

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Laparoscopic repair of Morgagni hernia. ***V. Nguyen, N. Panton.* From the University of British Columbia, Vancouver, B.C.**

This is a case of a 46-year-old female who presented with postprandial pain for 3 months followed by 1 week of progressive gastric outlet obstructive type symptoms. After a nasogastric tube was placed, a CT scan was performed, demonstrating a large Morgagni hernia with omentum, transverse colon, stomach and duodenum within it. This video demonstrates a laparoscopic repair of a Morgagni hernia with mesh. The patient went home after an uncomplicated recovery in 3 days. Morgagni hernia is the rarest of the congenital diaphragmatic hernias. It is characterized by an anteromedial defect in the diaphragm most commonly containing omentum and transverse colon. It is often asymptomatic and incidentally found; however, it can manifest as nausea, vomiting and chest pain, with more serious presentations being gastric volvulus, bowel obstruction and incarceration/strangulation. Surgical repair is indicated for all Morgagni hernias and a variety of methods are available including open, laparoscopic and thoracoscopic approaches. There is emerging evidence in case reports and case series that laparoscopy is safe and effective in accessing the diaphragm, providing excellent visualization with reduced recovery times and surgical stress to the patient. This video demonstrates a safe, effective treatment of a Morgagni hernia in the setting of gastric outlet obstruction.

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Medication dosing card improves general surgery resident prescribing practices. ***H. Muaddi*** **(University of Toronto, Toronto, Ont.),** ***S. Tung*** **(University of Toronto, Toronto, Ont.),** ***S. Sequeira*** **(University of Toronto, Toronto, Ont.),** ***K. Ramadan*** **(University of Toronto, Toronto, Ont.),** ***J. Stirat*** **(University of Toronto, Toronto, Ont.),** ***K. Yasufuku*** **(University of Toronto, Toronto, Ont.),** ***R. Nenshi*** **(McMaster University, Hamilton, Ont.).**

Pediatric medication prescription errors are as high as 27% and are a common source of adverse events. Most errors occur at the prescription phase and are largely secondary to dosage errors. Surgical pediatric patients are at higher risk of harmful medication errors than nonsurgical patients. We aimed to decrease incorrect medication prescription orders in the surgical pediatric population by facilitating weight-based prescriptions for general surgery residents, using a medication dosing card. Prior to implementation, qualitative surveys and informal feedback sessions were conducted with first-year residents who completed a 2-month rotation at SickKids Hospital. The goal was to evaluate comfort and competency in weight-based prescription practices. Our intervention was to develop a pocket card with commonly prescribed medications and their associated standard dosing ranges in the pediatric population on the general surgery ward. After implementation, the primary outcome was to assess residents' comfort in weight-based prescriptions and frequency of prescription correction. Between 2015 and 2016, 77% (n = 14) of the first-year residents who rotated through SickKids Hospital responded to the preimplementation survey. Over 60% felt unprepared to order weight-based pediatric medications. Over 50% found the SickKids e-formulary difficult to use. The pocket medication card was circulated to all first-year residents in 2016–2017. We obtained 100% (n = 6) response to the post-implementation survey. Eighty-two percent of the residents felt unprepared to order weight-based pediatric medications before starting their rotations, 67% of residents found that the medication card increased their confidence and efficiency in orders, and 83% wanted this medication card to be continued in the future. The medication card is a useful tool to help residents order medications, but it does not replace the SickKids e-formulary. Furthermore, the impact of this tool in reducing medication error and harm remains to be investigated.

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Surgical site infection incidence and risk factors in abdominal surgery. ***A. Alkaaki*****,** ***A. Khoja*****,** ***O. Al-Radi*****,** ***M. Aljiffry*****,** ***A. Alnawawi*****,** ***A. Alnawawi*****,** ***A. Maghrabi*****,** ***A. Altaf*****. From King Abdulaziz University, Jeddah, Saudi Arabia.**

Surgical site infection (SSI) is one of the most common complications of abdominal surgery. It is associated with significant discomfort, morbidity and cost. The goal of this study was to describe the incidence, bacteriology and risk factors associated with SSI in patients undergoing a wide range of abdominal surgery. All patients undergoing abdominal surgery between Feb. 1, 2016, and July 31, 2016, at a single large academic hospital were included in the cohort. Patients were followed prospectively for 30 days. Wound assessment was done using the Centers for Disease Control and Prevention definition of SSI. Appropriate univariable statistics were used to guide the variable selection for a multivariable logistic regression model with SSI as the primary outcome. In the study period, 337 patients had abdominal surgery. The overall incidence of SSI was 55/337 (16%); of these, 55% were deep infections. The incidence in clean, clean-contaminated and contaminated/dirty operations was 5%, 15% and 58%, respectively. The incidence of SSI in open versus laparoscopic operations was 35% versus 4%. In benign pathologies, the incidence of SSI was 11%, whereas in malignant pathologies it was 61%. The most common isolated bacteria were extended-spectrum β-lactamase (ESBL) producing bacteria, *Enterobacter*, *Acinetobacter baumannii* and *Pseudomonas*. Only 23% cultured bacteria were sensitive to the prophylactic antibiotic given preoperatively. The independent predictors of SSI were emergency operation (odds ratio [OR] 8.8, p = 0.0001), malignant pathology (OR 4.9, p = 0.03), longer duration of surgery (OR 2.3, p = 0.003) and contaminated wound classification (OR 14.5, p = 0.03). Receiving prophylactic preoperative antibiotics before skin incision was protective from SSI (OR 0.3, p = 0.05). SSI is a common preventable postoperative complication of abdominal surgery. Potentially modifiable independent risk factors, including prolonged operations, wound contamination and emergency surgery, should be addressed systematically. We recommend tailoring the antibiotic prophylactic regimen to target the commonly isolated organisms.

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Mental toughness in surgeons: How do we measure up? ***D. Percy*** **(University of British Columbia, Vancouver, B.C.),** ***L. Streith*** **(University of Calgary, Calgary, Alta.),** ***C. Ball*** **(University of Calgary, Calgary, Alta.),** ***S. Widder*** **(University of Alberta, Edmonton, Alta.),** ***H. Wong*** **(University of British Columbia, Vancouver, B.C.),** ***M. Hameed*** **(University of British Columbia, Vancouver, B.C.).**

Surgery requires the ability to perform under pressure and recover from setbacks. Mental toughness is a construct that helps individuals deal with stressful situations. It is well established in sports psychology, but not in the surgical literature. The purpose of this study was to quantify mental toughness in surgical residents and staff. The Mental Toughness Index (MTI) is a validated tool to measure mental toughness. A survey containing the MTI was distributed among general surgery residents and staff. Responses were recorded using a 7-point Likert scale standardized to a percentage positive (0% for Likert 1, 100% for Likert 7). There were 60 participants (45 residents, 15 staff) from 2 academic institutions. Average age of residents and staff was 29.3 ± 2.1 years and 45.2 ± 8.8 years, respectively. Residents had a significantly lower percentage positive in all facets of mental toughness: self-belief (85.3% v. 92.4%, $p < 0.01$), attention regulation (79.0% v. 91.4%, $p < 0.001$), emotion regulation (73.7% v. 90.5%, $p < 0.01$), success mindset (88.6% v. 95.2%, $p < 0.05$), context knowledge (75.9% v. 91.4%, $p < 0.001$), buoyancy (76.2% v. 90.5%, $p < 0.01$), optimism (78.4% v. 88.6%, $p < 0.01$) and capacity to deal with adversity (78.4% v. 87.6%, $p < 0.01$). Forty-two percent of residents and 60% of staff reported using specific techniques to deal with stressful situations, the most common being deep breathing, visualization and organization. Ninety-one percent of residents and 67% of staff were interested in developing additional techniques for mental toughness. This is the first study to quantify and compare mental toughness between residents and staff general surgeons. Despite differences between the groups, both residents and staff surgeons expressed a desire to further develop mental toughness.

Participants identified specific techniques may be useful in developing mental toughness. Additional research is required to assess the effectiveness of these techniques and how they may lead to improved resiliency and team dynamics for surgical teams.

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Emergency general surgery in the elderly: a systematic review. ***P. Murphy*** **(Western University, London, Ont.),** ***A. Sherazadishvili*** **(Western University, London, Ont.),** ***K. Vogt*** **(Western University, London, Ont.),** ***N. Parry*** **(Western University, London, Ont.),** ***R. Khadaroo*** **(University of Alberta, Edmonton, Alta.),** ***T. Mele*** **(Western University, London, Ont.).**

Emergency general surgery (EGS) in elderly patients carries significant risk of both morbidity and mortality. The growing population of patients over 65 years of age suggests general surgeons will be tasked with managing increasing numbers of frail and comorbid patients who are at higher risk than younger and nonemergent patients. An electronic literature search of PubMed, Medline, Embase and the Cochrane Database of Collected Research was performed from 1990 to 2016. The search included "frail," "elderly," "octogenarian" and "old" and was limited to English papers within EGS. Observational and experimental studies were included if they included patients over 65 years of age; case reports were excluded. The Newcastle–Ottawa scale was used to assess study quality. Of 11 studies that met the inclusion criteria, 3 were case series and the remaining 8 studies were retrospective cohort studies including 2 using the American College of Surgeons' National Surgical Quality Improvement Program (ACS NSQIP). Case composition indicated a higher proportion of small/large bowel surgery for elderly patients compared with nonelderly patients. Mortality after EGS ranged from 12% to 38%, with morbidity ranging from 28% to 70%. In studies directly comparing patients older than 65 years of age to younger patients undergoing EGS, mortality was almost 3 times higher. Elderly patients undergoing EGS should be considered higher risk than younger patients not only based on age, but also based on frailty and functional status. Case composition, high failure to rescue rate and delayed diagnosis may help explain the elevated mortality rate. Further study is required to identify potentially modifiable risk factors and potential process measures to improve outcomes.

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Comparing the reproducibility of square and reversing half-hitch alternating post knots. ***V. Wu, E. Sykes, G. Sheahan, Z. Mir, E. Tang, B. Zevin, C. Yeung*****. From Queen's University, Kingston, Ont.**

Square knots are the gold standard in hand-tie wound closure, but they are difficult to reproduce in deep cavities, which can compromise wound healing. The reversing half-hitch alternating post (RHAP) knot has comparable strength to the square knot and has been suggested as more reproducible within deep cavities since throws are laid down vertically, instead of parallel and flat. We aimed to evaluate whether the RHAP knot is more reproducible in a simulated deep body cavity as compared with square knots. Twenty medical students with no previous experience in surgical knot tying participated in the study. They were instructed on the construction of both knot variations (using 3–0 silk) by trained surgical residents. Participants were given adequate time to practise constructing knots before proceeding to testing within simulated deep body cavity. Knot strength was assessed via a static pull machine, and the mechanism of failure was recorded (slip v. break). Surveys were collected from each participant to assess their learning experience and ease of reconstructing each knot. There were no differences in maximal failure strength between the RHAP and square knots (mean ± SD: square = 16.5 ± 5.1 N; RHAP = 15.5 ± 6.9 N). However, square knots trended toward more failure by slippage than RHAP (43% ± 21%). As reported by the participants, square knots were easier to learn ($p < 0.05$), but RHAP knots were easier to construct in a simulated deep body cavity ($p < 0.05$). There was no significant difference in the relative difficulty of knot construction on a surface ($p > 0.05$). In summary, the RHAP knot provides comparable tensile strength to the square knot but has the added advantage of being less prone to slippage. In the context of medical education, students with no prior knot tying experience also reported that the RHAP knot is easier to construct in a simulated deep body cavity than the square knot.

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Fibroepithelial lesions with serial growth/stromal cellularity: preop factors suggesting a phyllodes tumour diagnosis. ***R. George, E. Hawkes, S. Ogunbiyi, A. Perry, J. Simpson, A. Scheer, K. Jakate*****. From St. Michael's Hospital, Toronto, Ont.**

Fibroadenomas (FA) are a common benign fibroepithelial tumour of the breast. Phyllodes tumours (PT) are rare fibroepithelial lesions with malignant potential. Radiology and histological assessment are insufficient to reliably distinguish between these entities, creating a tendency to excise growing and histologically uncertain lesions. A better understanding of preoperative risk factors could influence operative decisions around margin width. A total of 201 patients with breast masses and radiological features consistent with a fibroepithelial lesion were assessed in this case–control study. All demonstrated serial growth and/or stromal cellularity. Final pathology was correlated to age, lesion size, race and established breast cancer risk factors. Sixty-seven PT and 134 FA in 201 patients were confirmed on final pathology. The significant predictors of PT diagnosis were older age and increased size at presentation. Size greater than 3.0 cm and older age at presentation, especially beyond the 4th decade, correlated with PT diagnosis and could be used to influence an initial attempt at negative margins in patients with growing fibroepithelial lesions of the breast.

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Implementation of a high-efficiency operating room in general surgery results in increased throughput while simultaneously decreasing per patient OR costs. ***R. Hilsden, K. Vogt, D. Gray, C. Vinden, N. Parry, K. Leslie*****. From Western University, London, Ont.**

We present the results of the implementation of a high-efficiency operating room at our institution known as the Rapid Standardized Operating Room (RAPSTOR). Implementation of RAPSTOR included booking a single type of case during the OR day, training for nursing and anesthesia staff, selection of appropriate patients, a reduction in OR pick-list items and standardization of surgical technique. A prospective cohort study design was used. Adult patients without major comorbidities scheduled for elective cholecystectomy,

inguinal hernia repair or umbilical hernia repair were included. The primary outcome was the average variable OR cost per patient. All OR costs were prospectively collected. Fixed costs were excluded from the analysis. Secondary outcomes included OR time, complications, readmissions and regional wait times. From June 2016 to December 2017, a total of 234 cases were prospectively evaluated. Both the RAPSTOR and control cohorts contained 117 patients. The mean variable OR costs were lower for laparoscopic cholecystectomies performed in a RAPSTOR room compared with those performed in a standard OR ($254 ± $16 v. $299 ± $16, $p < 0.001$). Hernia repairs performed in a RAPSTOR room were also lower than those performed in a standard OR ($220 ± $19 v. $316 ± $34, $p < 0.001$). In addition, there was a significant decrease in OR time (45 ± 2.4 v. 71 ± 4.0 minutes, $p < 0.001$) leading to 1 additional case performed per day in a RAPSTOR room. Regional wait times for these elective procedures decreased simultaneously with the implementation of RAPSTOR, and there were no differences in complication rates between the standard OR cohort and the RAPSTOR cohort. Implementation of a high-efficiency OR lea to a decrease in per patient OR costs while simultaneously increasing the number of cases a surgeon could complete during a day without compromising quality of care

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Risk of appendiceal malignancy following nonoperative management of appendicitis: a population-based study of 61 447 patients. ***M. Furman*** **(University of Toronto, Toronto, Ont.),** ***D. Bischof*** **(Mount Sinai Hospital, University of Toronto, Toronto, Ont.),** ***J. McCart*** **(Mount Sinai Hospital, University of Toronto, Toronto, Ont.),** ***A. Govindarajan*** **(Mount Sinai Hospital, University of Toronto, Toronto, Ont.).**

Many patients diagnosed with appendiceal malignancy endorse a previous history of appendicitis treated nonoperatively. However, there are no data on the absolute risk of appendiceal malignancy in these patients to inform subsequent decision-making. The study objectives were to determine the longitudinal risk of appendiceal malignancy in patients with appendicitis treated nonoperatively and to identify factors associated with increased risk. We conducted a population-based retrospective cohort study using health databases in Ontario. All patients 18 years of age and older diagnosed with appendicitis from 2003 to 2010 were included. Patients were categorized by whether they had perforated (PERF) or nonperforated appendicitis (NONPERF) and by whether they underwent appendectomy during the index admission (OP versus NONOP). The primary outcome was future diagnosis of appendiceal malignancy. Incidence of appendiceal malignancy and time to diagnosis were compared between groups and predictive factors were assessed. Overall, 61 447 patients were included, of whom 33.8% were PERF. Patients in the PERF group were significantly more likely to undergo NONOP management (10.6% v. 2.4%, $p < 0.001$). The overall incidence of appendiceal malignancy varied significantly by PERF versus NONPERF and operative management, with the highest risk in the PERF-NONOP group (1.5% v. 0.9% in NONPERF-NONOP, 0.1% in PERF-OP, and 0.06% in NONPERF-OP, $p < 0.001$). Approximately 18% of patients were diagnosed more than 1 year after the appendicitis episode. Age was significantly associated with risk of malignancy, with the highest risk in patients aged 50–79 years (< 1% in patients aged < 50 years, 2.2% in those aged 50–59 years, 3.5% in those aged 60–69 years, 2.7% in those aged 70–79 years and < 1% in those aged ≥ 80 years, $p < 0.001$). Although the overall incidence of appendiceal malignancy is low, there is a significantly higher risk in patients with appendicitis managed nonoperatively. Patients with perforated appendicitis managed nonoperatively have the highest risk of malignancy, with the risk in certain age groups as high as 3.5%. Follow-up imaging and interval appendectomy should be considered for patients in high-risk subgroups.

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Modelling the learning curves of incoming surgical trainees. ***M. Louridas, T. Grantcharov, N. Seemann, A. Iancu, D. Steele, N. Ahmed, E. Shore*****. From the University of Toronto, Toronto, Ont.**

Studies suggest that not all trainees reach technical competency even after completing surgical training. Thus, the objectives of this study were to define distinct learning curves (LC) for 3 basic laparoscopic tasks, to determine the minimum number of repetitions required to accurately predict an individual's LC and to assess the use of LC assessment to identify nonperformers during selection into surgical training. Predictive LC models were created for laparoscopic pattern cutting (PC), peg transfer (PT) and intracorporeal knots (IC) over 40 repetitions by 65 novice trainees. Trainees were categorized into performers and nonperformers. ROC analysis determined the minimum number of repetitions required to predict an individual's LC. Subsequently, applicants to general surgery (GS) and gynecology (OBGYN) training participated in a skills assessment. The LC models were used to determine the number of nonperformer applicants. The PC, PT and IC tasks required a minimum of 8, 10 and 5 repetitions, respectively, to accurately predict overall performance. Predictive values for each task were excellent, with sensitivity and specificity as follows: 1.00, 1.00 (PC); 1.00, 1.00 (PT); and 0.94, 1.00 (IC). All 94 surgical applicants completed the minimum number of required repetitions. Of those, 11% were identified as nonperformers. Individual LCs for 3 different laparoscopic tasks can be predicted with excellent sensitivity and specificity based on observations of 10 repetitions or fewer. This information can be used for early identification of trainees who may have difficulty with laparoscopic technical skills and may be implemented during selection or early residency training.

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Feasibility of same-day discharge for complex laparoscopic hiatal surgery. ***J. Molina Franjola, A. Misariu, I. Nicolau, J. Spicer, D. Mulder, L. Ferri, C. Mueller*****. From McGill University Health Centre, Montreal, Que.**

Advances in minimally invasive surgery and the development of enhanced recovery pathways have favoured the spread of day-surgery programs. Despite laparoscopic approaches being accepted as the standard of care for benign hiatal diseases, the safety and feasibility of same-day discharges for laparoscopic hiatal surgeries other than fundoplication have yet to be established. The objective of this study was to assess the feasibility of same-day discharge for primary and revisional laparoscopic hiatal surgeries including paraesophageal hernia repairs (PEHR), fundoplication for reflux, and Heller myotomy (± diverticulectomy). A retrospective cohort study

including all patients undergoing elective laparoscopic hiatal procedures between 2011 and 2016 at a Canadian academic tertiary hospital was performed. Planned day-surgery cases (DAYCASE) were compared with planned inpatient (INPATIENT) cohorts with respect to operative and postoperative outcomes, length of stay, readmission and emergency department visits. A total of 261 patients were identified, 161 female (62%), median age 62 ± 20. The case distribution was as follows: PEHR (123; 47.1%), Heller myotomy (94; 36%, 7 diverticulectomy) and fundoplication (44; 16.9%). Twenty patients had revisional procedures (7.7%). Same-day discharge was planned in 98 cases (38%) and was successful in 80 (81.6%). Proportion of DAYCASE increased from 12% before 2013 to 67% in 2016. Patients in the INPATIENT cohort were older (median 66 v. 60 years) and had a higher proportion of PEHR (55% v. 34%, $p < 0.05$). Both cohorts were comparable in gender proportion, American Society of Anesthesiologists (ASA) classification and length of surgery. Complications, readmission and emergency visits did not differ between the cohorts. On multivariate analysis, female gender (OR 37, 95% CI 1.46–936, $p = 0.028$), surgery beginning after noon (OR 5.4, 95% CI 1.1–26.9, $p = 0.038$), intraoperative complications (OR 20.4, 95% CI 1.5–286, $p = 0.025$) and postoperative complications (OR 52.1, 95% CI 4.5–602, $p = 0.002$) were independently associated with unplanned admission. Day-case surgery for complex laparoscopic hiatal procedures is feasible and can be achieved in a significant number of patients without compromising safety.

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Frequency of statistical test usage in general surgery literature. *P. Williams, P. Murphy, K. Vogt, J. Van Koughnett, M. Ott, L. Duboi*. From Western University, London, Ont.

A basic understanding of statistical tests is necessary for critical analysis of medical literature. Surgical literature in particular is dominated by observational research and relies heavily on statistical methodology to address inherent biases. Previous work has identified deficiencies in the abilities of surgical trainees to appropriately interpret statistics. Educational activities can address this knowledge gap; however, there is scant published information regarding which statistical tests are most prevalent and thus most important to teach. The objective of this analysis was to examine a sample of highly disseminated general surgery literature to determine which quantitative statistical tests are most frequently used and therefore are high yield to teach. Ten journals publishing work pertaining to essential areas of general surgery were selected for this study. All manuscripts over a 12-month period (May 2015–April 2016) were reviewed for inclusion. A total of 984 articles were included. Most (824, 83.7%), were retrospective observational studies, 93 (9.5%) were prospective cohorts and 64 (6.5%) were randomized controlled trials. The 5 most frequent tests were χ^2 tests (63%), logistic regression (39%), *t* tests (39%), Fisher's exact tests (37%) and Mann–Whitney *U* tests (34%). The average number of tests used per article was 3.5 (1.1). The total number of different statistical tests identified was 87. Of 157 articles where a sample size calculation was indicated, 64 articles (41%) reported this calculation. In a representative sample of general surgery literature and diverse statistical methodology, a small number of tests appear in a disproportionately large number of articles. Working knowledge of these tests would allow one to effectively interpret the statistical methodology of a significant proportion of the general surgery literature. These tests are basic and commonly appear in introductory statistic texts. This analysis provides valuable information that can be considered when designing the educational curriculum of general surgery trainees.

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Surgical observation as a learning activity for junior residents: Why is it so challenging? *I. Raîche* (University of Ottawa, Ottawa, Ont.), *E. Dionne* (University of Ottawa, Ottawa, Ont.), *S. Hamstra* (Accreditation Council for Graduate Medical Education, Chicago, Il.), *W. Gofton* (University of Ottawa, Ottawa, Ont.), *F. Balaa* (University of Ottawa, Ottawa, Ont.), *C. Seabrook* (University of Ottawa, Ottawa, Ont.).

Surgical observation is an integral part of surgical training. Junior residents, who have limited understanding of the procedure being performed, frequently engage in observation to gain an initial exposure to surgical techniques. This study examines learners' perceptions of the value of surgical observation, the barriers to learning in the surgical environment and the factors that facilitate learning within the context of the operating room. Four focus groups were conducted with 17 general surgery junior residents. Transcripts from these focus groups were analyzed using a qualitative interpretative approach. Surgical observation was perceived by residents as a learning activity with rich potential. However, many barriers were identified, the most common one being lack of guidance and the difficulty in identifying relevant teaching points during a given procedure. Residents also mentioned the key role of preparation before observation in ensuring a rewarding learning experience. The surgical culture, within which observation is perceived as less effective than performing the surgery itself as a learning activity, was also mentioned as a factor that impedes learning during observation. Those findings align well with existing theoretical frameworks, such as the cognitive load theory and the cognitive apprenticeship model and can inform future interventions aiming at optimizing learning during surgical observation. Compared with existing literature on the operating room as a learning environment, this project attempts to explain some of the challenges described in other studies and focus on a population of learners less often studied, the second or third assistants. This study is limited by the facts that it presents the perspective of the residents from a single institution and only the point of view of junior residents. It would be interesting, as an option for future research, to explore the perception of senior trainee and staff surgeons regarding the potential of surgical observation as a learning activity.

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The optimal timeframe for adjuvant chemotherapy in stage II and III colorectal cancer and the impact of delays on survival. *L. Findlay-Shirras, R. Helewa, A. McKay*. From the University of Manitoba, Winnipeg, Man.

Colorectal cancer (CRC) is the second leading cause of cancer-related death around the world. Current treatment guidelines recommend all patients with stage III disease and those with high-risk stage II disease should receive adjuvant chemotherapy (AC) following curative surgical resection. Since the 1990s, research has shown reductions in mortality and disease recurrence in patients who received AC compared with those who

underwent surgery alone; however, there remains no consensus on the optimal timeframe for chemotherapy. Our study seeks to determine whether there is a timeline to adjuvant treatment delay where the improved survival benefit does not outweigh the risks of chemotherapy. Our retrospective cohort study included all patients with stage II or III CRC between April 2004 and December 2006 who had curative surgery and were eligible for AC. Patients were identified through the provincial cancer registry, and demographics, surgical history, pathology and AC treatment were collected from chart review. Patients were divided according to median time to AC initiation (68 or fewer days postoperatively and more than 68 days postoperatively). Of the 1002 eligible patients, 410 (40.9%) underwent AC. Overall survival for patients with stage II/III CRC who underwent AC was 69.5% at 5 years, compared with 54.2% for those who did not undergo AC ($p < 0.0001$). The estimated overall survival for those who started AC 68 or fewer days postoperatively was 95.6% at 1 year and 71.8% at 5 years compared with 95.1% and 67.2%, respectively, for those who initiated AC more than 68 days postoperatively ($p < 0.0001$). Our study shows delayed administration of AC is associated with a statistically significant inferior overall survival. While there is clearly an optimal time to AC initiation (between 5 and 16 weeks postoperatively), our results show the survival benefit remains even when treatment delays are encountered.

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Is microductectomy still necessary for breast cancer diagnosis?
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From the University of British Columbia, Vancouver, B.C.

Spontaneous nipple discharge (SND) is a common symptom referred to breast clinics, accounting for 10% of surgical referrals. SND is a symptom of malignancy in up to 12% of breast cancers and requires investigation to differentiate malignant from benign disease. Patients with SND who have neither palpable masses nor evidence of disease on imaging have traditionally been investigated with galactogram and microductectomy to prevent missing cancer. As imaging has improved it has raised the question of how frequently breast cancer is diagnosed following microductectomy and whether it remains necessary. The aim of this study was to determine the incidence of malignancy in patients presenting with SND who underwent microductectomy after initial clinical and radiological evaluation. A retrospective chart review was conducted for patients referred to our breast clinic for SND between 2009 and 2016. All patients who underwent microductectomy for SND were included in our study and their pathology reports were examined to determine the incidence of malignancy. A total of 219 microductectomies were performed for patients presenting with SND. The majority of patients had benign pathology including intraductal papilloma 54% ($n = 119$) or other (normal/inflammatory/hyperplasia/ectasia) representing 33% ($n = 71$) of cases. Breast cancer was identified in 13% of patients: 3% had invasive carcinoma ($n = 6$) and 10% had carcinoma in situ ($n = 22$). Among breast cancer patients, 21% ($n = 6$) had neither palpable masses nor radiological abnormalities, 54% ($n = 16$) had no palpable masses but positive imaging findings and 25% had palpable masses. At our centre patients presenting with SND who underwent a microductectomy procedure had a 13% risk for malignant lesions; most (79%) malignant cases had imaging or palpable findings. Patients with SND should continue to be evaluated with microductectomy to guide further management and prevent missed cancers.

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QuickSilver: results of a pan-Canadian phase II study using MRI criteria to identify "good prognosis" stage II and stage III patients with rectal cancer eligible for primary surgery.
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Prospective studies from the United Kingdom and Germany have previously reported low rates of positive circumferential resection margin (CRM) when MRI criteria were used to select "good prognosis" stage II and stage III patients with rectal cancer (RC) for primary surgery. Therefore, our group conducted a phase II study to validate the results of these trials in the Canadian context. Newly diagnosed patients with primary RC (i) 0–15 cm from the anal verge and (ii) meeting the MRI criteria for "good prognosis" were included in the study. These MRI criteria included (i) distance to the mesorectal fascia greater than 1 mm, (ii) T2 and T3 tumours with less than 5 mm extramesorectal depth of invasion, (iii) any N (N0–N2), and (iv) extramural venous invasion absent. Standardized MRI and pathology protocols and reports were used and total mesorectal excision (TME) surgery was performed by specialty-trained surgeons. From November 2014 to June 2016, 82 patients from 13 high-volume centres across Canada participated in the study. The majority of the patients were male (74%) and between 56 and 75 years old. Based on MRI, the majority of tumours were mid-rectal (65%), T2/early T3 (59%) and node negative (60%). On final pathology, 96% of TME specimens were complete/near complete, and 38%, 29% and 29% were stage I, II and III, respectively. The positive CRM rate was 4.9% (4/82) (95% CI 0.2%–9.6%). The results of

this study are similar to those from the United Kingdom and Germany and suggest that low rates of positive CRM can be achieved in highly select stage II and stage III patients with RC.

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Surgical costs increase with age in emergency but not elective general surgery. ***G. Eamer*** **(University of Alberta, Edmonton, Alta.),** ***R. Brisebois*** **(University of Alberta, Edmonton, Alta.),** ***F. Clement*** **(University of Calgary, Calgary, Alta.),** ***R. Khadaroo*** **(University of Alberta, Edmonton, Alta.).**

Health care costs are increasing. Aging is associated with increased postoperative complications resulting in increased disability, cost and mortality. Elderly populations are growing as baby boomers age; the cost of caring for them is rising. It is unclear how surgery contributes to costs. Understanding the costs of surgical care for the elderly is crucial for health care services planning. We hypothesized that increasing age predicted increasing surgical inpatient costs. Retrospective analysis of general surgical inpatient costs over 2 fiscal years at 4 hospitals was performed. Cost and number of procedures were reported by age, procedure, hospital, cost category and surgical urgency. Costs were compared between surgical risk profile, urgency and age. Cost differences of 10% or greater were considered clinically significant. Surgical inpatient costs for 12 070 procedures, representing 84% of surgical admissions in the region, were examined. The average cost was $4351 for scheduled admissions and $4054 for unscheduled admissions. Only unscheduled admissions were significantly costlier in older age groups; cost increase is attributed to postoperative care. Overall, scheduled low-risk procedures had costs that were statistically but not clinically significantly lower for both patients who were 65–79 years of age (–8.8%, $p < 0.001$) and 80 years of age or older (–8.8%, $p < 0.001$) and unchanged for moderate and high-risk procedures. However, unscheduled cases were clinically significantly costlier for patients aged 65–79 years (low risk [48.1%, $p < 0.001$], moderate risk [36.8%, $p = 0.045$], high risk [22.6%, $p = 0.04$]) and 80 or more years (low risk [115.3%, $p < 0.001$], moderate risk [103.3%, $p < 0.001$], high risk [46.0%, $p < 0.001$]) when compared with those under 65 years. The predominant driver of cost was postoperative care. Costs increased with age in emergency but not elective surgery. Low-, moderate- and high-risk unscheduled surgery all result in higher cost in the elderly due to increased postoperative care costs. Screening elective surgical candidates may decrease admission costs and innovative programs are needed to reduce emergency admission costs.

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An institutional efficiency analysis of the timing of cholecystectomy in acute cholecystitis. ***D. MacFarlane***, ***P. Yaffe***, ***M. Walsh*****. From Dalhousie University, Halifax, N.S.**

Preoperative delays in definitive management of acute cholecystitis (AC) increase the likelihood for difficult surgery, sometimes requiring conversion to open cholecystectomy, and prolonged hospital stays. A centre-specific analysis of AC can obviate the need for early management and provide insight for this institution regarding potential patient and cost-efficiency benefits to prompt surgical intervention. A chart review of all patients having a cholecystectomy between July 2005 and July 2007 was conducted. This group was then limited to include those with a clinical diagnosis of AC. Preoperative wait times and postoperative hospital admission times were determined. Patient factors, such as age, sex, BMI, and comorbidities, were accounted for. Clinical factors, such as duration of symptoms, laboratory investigations and need for interventions (such as endoscopic retrograde cholangiopancreatography [ERCP]), were extracted from the data. Conversion rates from laparoscopic cholecystectomy to open cholecystectomy were determined based on preoperative wait times. A total of 456 patients underwent a cholecystectomy within the defined dates; 301 patients had the diagnosis of AC and were included for analysis. Fifty-three percent of these patients had a cholecystectomy on the same day as admission, and 5% of patients waited for 4 or more days. The average postoperative admission time increased as the preoperative wait time increased. Patients requiring ERCP stayed in hospital an average of 1.6 days longer. Only 17% of patients who had surgery within the first 3 days of admission required conversion to open cholecystectomy, whereas patients who stayed 4 or more days had a 31% chance of conversion to open cholecystectomy. The data from this centre over a 2-year period support the role for early cholecystectomy as it increases the probability of a successful laparoscopic surgery, decreases the probability of a prolonged hospital stay and ultimately is in the best interests of the patient and institution.

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Identifying narcissistic traits in general surgery residency applicants: Go with your gut. ***N. Gawad***, ***I. Raîche***, ***A. Ibrahim***, ***M. Duffy***, ***C. Nessim*****. University of Ottawa, Ottawa, Ont.**

Certain personality traits assessed during interviews have been shown to negatively predict performance in residency. An informal needs assessment at our institution suggested that it would be particularly important to identify traits associated with narcissism (i.e., entitlement, difficulty accepting criticism, arrogance). The objective of this study was to evaluate an interview station designed to identify narcissistic personality traits among applicants to our general surgery residency program. An interview station was developed in which applicants were provided negative feedback as a simulated evaluation. Two interviewers (1 staff surgeon, 1 senior resident) interviewed 47 applicants at this station. Data were also collected from other interview stations for comparison. The 47 participants were also asked to complete the Narcissistic Personality Index (NPI-40), which assesses 7 traits, 4 of which are considered concerning. NPI-40 scores were compared with scoresheets from all interview stations, which included numerical rating scales and a subjective "red flag" system used to identify concerns related to professionalism or personality. Numerical rating scores from the 8 interview stations did not correlate with the NPI-40 scores. Two stations did identify multiple red-flag applicants: a get-to-know-you station and the negative feedback station. Linear regression demonstrated a significant correlation between red flags on the negative feedback station and a high proportion of concerning traits on the NPI-40 ($p = 0.04$). Red flags on the other stations did not correlate with NPI-40 score. We designed an interview station that successfully identified general surgery applicants displaying high proportions of concerning narcissistic traits. Despite an objective scoring process, the subjective opinion of interviewers was more valuable in identifying these applicants. Our findings suggest the subjective

intuition of surgeons in interview stations designed to identify applicants with difficulty accepting negative feedback may provide valuable information that is not captured elsewhere in the application process.

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Incidence of venous thromboembolic events following major pelvic and abdominal surgery for cancer. ***M. Valencia*, *P. Serrano*, *K. Dhamanaskar*, *L. Elit*, *S. Parpia*, *M. Simunovic*, *L. Ruo*, *M. Bhandari*, *L. Linkins*. From McMaster University, Hamilton, Ont..**

The recommendation to administer extended-duration (28 d) venous thromboembolic events (VTE) prophylaxis with low molecular weight heparin in patients undergoing abdominal and pelvic surgery for cancer has not been widely implemented mainly because most studies focus on asymptomatic events with unknown clinical significance. The objective of this study was to determine the post-hospital discharge VTE incidence in these patients who do not receive post-hospital discharge prophylaxis. We conducted a prospective cohort study of patients undergoing abdominal and pelvic operations for cancer within the gastrointestinal tract, hepatobiliary (HPB) system or gynecological organs, with surgery lasting more than 1 hour, whose postoperative stay was fewer than 28 days and who did not undergo anticoagulant therapy. Patients were evaluated at 1, 3 and 6 months from the index operation for the presence of VTE by means of a screening ultrasound at 28 days and a questionnaire. The proportion with 95% confidence interval (CI) of VTE was calculated. Multivariable logistical regression was performed. Of 284 patients, 79 (28%) had surgery for colorectal cancer, 97 (35%) for HPB cancer and 100 (35%) gynecologic cancer. All patients received pre- and postoperative inpatient prophylaxis. The proportion of VTE at 6 months was 7% (95% CI 4.4–10.7; 20 events). Most events occurred between 3 and 6 months (4.6%, 95% CI 2.46–7.7). Only 1 event occurred at 1 month after surgery (0.35%, 95% CI 0.06–1.97). Fifty percent of the cohort had screening ultrasounds, all of which were negative. Events were evenly distributed according to the type of surgery. The proportion of patients who died was 6.6% (95% CI 3.5–9.4) (17 patients, 2 of whom had a VTE-related death). In the multivariable analysis, postoperative chemotherapy was significantly associated with VTE (OR 2.74, 95% CI 1.07–6.99). Caprini score was also associated with VTE but was not significant when included in the multivariable analysis (OR 1.19, 95% CI 0.99–1.42). Incidence of VTE following abdominal surgery is low. Most events occur 3–6 months from surgery. Postoperative chemotherapy is significantly associated with post-hospital discharge VTE.

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Does the addition of biologic agents to chemotherapy in patients with unresectable colorectal cancer metastases result in a higher proportion of patients undergoing resection? A systematic review and meta-analysis. ***M. Valencia*, *P. Serrano*, *J. Bogach*, *L. Ruo*, *O. Levine*. From McMaster University, Hamilton, Ont.**

The likelihood of converting unresectable metastatic colorectal cancer (CRC) to operable disease with systemic therapy is unknown. The purpose of this study was to determine the proportion of patients with unresectable CRC metastases that become resectable on combination systemic therapy, and whether biologic agents (antiantiogenics, anti-EGFR [epidermal growth factor receptor] and multitargeted agents) improve the rate of resection (primary outcome). We searched Medline, Embase, Central and PubMed for randomized controlled trials comparing chemotherapy and biologics (intervention) versus combination chemotherapy alone (control) in patients with unresectable CRC metastases. Study selection, data abstraction, risk of bias and quality of the evidence assessment were carried out in duplicate. Secondary outcomes included overall survival (OS) and progression-free survival (PFS). Risk of bias was assessed using the Cochrane tool. Statistical heterogeneity was calculated using χ^2 and I^2. Clinical heterogeneity was explored via subgroup analyses. The quality of the evidence was assessed using the GRADE system of the Grades of Recommendation, Assessment, Development and Evaluation Working Group. Protocol was published in PROSPERO. Of 7954 abstracts retrieved, 12 studies were analyzed and 8 reported the primary outcome, with 2604 intervention and 2661 control patients. The proportion of patients resected was higher in the intervention group (relative risk 1.36, 95% confidence interval [CI] 1.08–1.69, $p = 0.008$). The absolute risk of undergoing resection was 48 per 1000 (control), compared with 65 per 1000 (intervention). There was no difference in OS (hazard ratio [HR] 0.91, 95% CI 0.82–1.01). PFS was better in the intervention group (HR 0.83, 95% CI 0.74–0.92). Overall the risk of bias for the included studies was low. Statistical test for heterogeneity was low (I^2 was 0%, $p = 0.72$). There was significant clinical heterogeneity, which was not explained with subgroup analyses. The quality of the evidence (GRADE) was moderate. The addition of biologic agents to systematic chemotherapy in patients with unresectable CRC metastases improves resectability and PFS but not OS.

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Predicting readiness for discharge in the Enhanced Recovery after Surgery (ERAS) era. ***M. McKenzie* (University of Toronto, Toronto, Ont.), *E. Pearsall* (University of Toronto, Toronto, Ont.), *A. Romaschin* (University of Toronto, Toronto, Ont.), *O. Rotstein* (University of Toronto, Toronto, Ont.), *J. Victor* (University of Toronto, Toronto, Ont.), *J. Marshall* (University of Toronto, Toronto, Ont.), *A. Morris* (University of Toronto, Toronto, Ont.), *M. Aarts* (University of Toronto, Toronto, Ont.), *I. Stiell* (University of Ottawa, Ottawa, Ont.), *A. Okrainec* (University of Toronto, Toronto, Ont.), *S. McCluskey* (University of Toronto, Toronto, Ont.), *R. McLeod* (University of Toronto, Toronto, Ont.).**

There is increased pressure for early discharge yet surgeons may be concerned about patients' readiness and that complications may occur after discharge. The objective of this study was to determine whether C-reactive protein (CRP) and procalcitonin (PCT) levels could identify patients with unrecognized infectious complications. Patients enrolled in the ERAS pathway at 15 academic hospitals were included between February and September 2015. All patients had CRP and PCT levels measured preoperatively and daily until postoperative day 4 (POD4). CRP and PCT levels in patients who had an anastomotic leak or intra-abdominal infection (IAI), wound infection (SSI) or

urinary tract infection (UTI) (group 1) were compared with those with no infections (group 2). Data are presented as means and SDs. A total of 166 patients (mean age 66 years, 52% male) were included. The 2 groups were similar, with 52% versus 69% patients having surgery for cancer, 64% versus 63% having laparoscopic surgery and 48% versus 56% having a colon procedure in groups 1 and 2, respectively. In group 1, 25 patients had an infectious complication: IAI in 13, SSI in 11 and UTI in 3. The mean preoperative CRP level in group 1 was 7.0 ± 15.5 mg/L versus 6.7 ± 11.5 mg/L in group 2 ($p > 0.05$). On POD4, the mean CRP in group 1 was 154.8 ± 91.1 mg/L versus 88.7 ± 63.1 mg/L in group 2 ($p = 0.001$). CRP levels can be useful postoperatively to identify patients with unrecognized infectious complications and may assist in postoperative discharge decisions.

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Compliance with surgical site infection prevention bundle within an Enhanced Recovery after Surgery (ERAS) pathway improves outcome in patients. ***E. Pearsall*** **(University of Toronto, Toronto, Ont.),** ***C. Eskicioglu*** **(McMaster University, Hamilton, Ont.),** ***O. Rotstein*** **(University of Toronto, Toronto, Ont.),** ***A. Okrainec*** **(University of Toronto, Toronto, Ont.),** ***M. Aarts*** **(University of Toronto, Toronto, Ont.),** ***J. Victor*** **(University of Toronto, Toronto, Ont.),** ***M. McKenzie*** **(University of Toronto, Toronto, Ont.),** ***R. McLeod*** **(University of Toronto, Toronto, Ont.).**

With bundled care pathways becoming the new standard, this study aimed to determine the impact of surgical site infection (SSI) prevention guideline recommendations within an Enhanced Recovery after Surgery (ERAS) program on SSI rates. All patients having colorectal surgery at 15 academic hospitals were enrolled in an ERAS implementation program. Outcome data and compliance to guideline recommendations were collected prospectively. SSI guideline recommendations included (1) appropriate antibiotic administration (1 h before incision, re-dosed appropriately if applicable, no postoperative antibiotics), (2) use of warming fluids or warming blanket intraoperatively, (3) clipping or no hair removal and (4) use of chlorhexidine gluconate with 70% alcohol for skin preparation. Between September 2012 and April 2015, 2876 patients (48% female; mean age 60 years) were enrolled. With regards to compliance, 67.3% were compliant with recommendation 1, 80.1% with recommendation 2, 81.6% with recommendation 3 and 97.1% with recommendation 4. Overall, 250 (8.7%) patients had an SSI with rates ranging from 2.0% to 17.9% across hospitals. SSI rates remained similar if patients were compliant with recommendation 1 or 1 and 2 (6.6%), 1 and 3 (8.2%) or 1 and 4 (8.3%). However, when all 4 recommendations were used, the SSI rate decreased to 4.9%. On multivariate analysis, other factors significantly associated ($p < 0.01$) with SSIs were increased body mass index (RR 1.03, 95% CI 1.01–1.05), female gender (0.78, 0.67–0.92), laparoscopic surgery (0.42, 0.31–0.55) and increased operative time (for every 10-minute increase) (1.02, 1.01–1.03). Lastly, length of stay (LOS) was significantly longer in patients who had an SSI (6.7 v. 9.9 days, $p < 0.05$). Compliance with a predetermined "bundle" of SSI recommendations is associated with a decreased risk of SSI and LOS.

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Incidence of delayed venous thromboembolic events in patients undergoing abdominal and pelvic surgery for cancer, a systematic review. ***M. Valencia, P. Serrano, K. Dhamanaskar, L. Elit, S. Parpia, L. Ruo, M. Bhandari, L. Linkins.*** **From McMaster University, Hamilton, Ont.**

The recommendation to administer extended-duration (28 d) venous thromboembolic events (VTE) prophylaxis with low molecular weight heparin in patients undergoing abdominal and pelvic surgery for cancer has not been widely implemented mainly because most studies focus on asymptomatic events with unknown clinical significance. A recent prospective cohort study on 284 patients conducted by our group suggested a VTE incidence of 0.35% (95% confidence interval [CI] 0.06–1.97) at 1 month following surgery. The objective of this study was to determine the post-hospital discharge VTE incidence in the published literature in patients not receiving post-hospital discharge VTE prophylaxis. We searched Medline, Embase, Central and Pubmed for any clinical study evaluating the incidence of VTE following abdominal and pelvic cancer surgery. Study selection, data abstraction, assessment of risk of bias and quality of the evidence assessment were carried out in duplicate. Risk of bias was assessed using the Cochrane tool for randomized and observational studies. Statistical heterogeneity was calculated using the χ^2 and I^2. Clinical heterogeneity was explored via subgroup analysis. The quality of the evidence was assessed using the GRADE system of the Grades of Recommendation, Assessment, Development and Evaluation Working Group. Of 4214 abstracts retrieved, 94 studies were analyzed and 14 reported the primary outcome (κ value of 0.66), with a total of 6436 patients. The proportion of VTE at 3 months following surgery was 3.79% (95% CI 2.21–5.37, 149 events). At 1 month, the proportion was 0.39% (95% CI 0.05–0.74, 5 events). Heterogeneity was high ($I^2 = 94\%$). Subgroup analysis of randomized controlled trials versus retrospective cohort studies revealed a proportion of VTE of 12% (95% CI 10–15, 66 events) versus 2% (95% CI 0.01–3, 83 events), which partially explained heterogeneity ($p < 0.001$). Incidence of VTE follow abdominal cancer surgery is low. Most events occur at 3 months after surgery. The use of VTE prophylaxis for 28 days following discharge does not seem to be clinically justified.

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The emergence of the physician assistant role in a Canadian acute care surgery setting. ***A. Lack, R. Nenshi, M. Valencia.*** **From McMaster University, Hamilton, Ont.**

The role of a physician assistant (PA) on an acute care surgery (ACS) team is continuously adapting to the needs of the emergency general surgery setting. To quantify the involvement of the PA, we have created an ACS database starting in September 2016, and data collection is ongoing. A prospective database has been maintained, including total patient encounters, total surgical consults, total ACS admissions, total number of operations (total ORs), total PA patient encounters and total family and multidisciplinary meetings. This project aims to define the role of a PA on an ACS team within an academic tertiary care centre. This project will also serve as a method of quantifying the involvement of the PA role in a particular health care setting, which may be used to help the emergence of the PA role throughout the Canadian

health care system. The ACS team is responsible for a mean of 33.5 patient encounters per day (range 23–48), with a total of 3191 patient encounters in the 3.5-month study period to date. The mean for total consults in a day was 6 (range 1–16). Total surgeries performed in a week had a mean of 15, with a mean of 2.5 surgeries per day. The PA currently works daytime hours only; this equates to 24% of the total working hours in a week. Despite this, the PA was directly involved in 63% of the total patient encounters. Multidisciplinary meetings were conducted by the PA 97% of the time. Family meetings were conducted or attended by the PA 80% of the time. Alternate level of care (ALC) patients were seen by the PA 95% of the time. The PA was directly involved in only 2% of the total ORs in the study period. Further research is needed to further define the role of the PA in the emergency general surgery setting.

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A prospective analysis of surgery using the operating room black box: a pilot study. *J. Jung, T. Grantcharov*. From the University of Toronto, Toronto, Ont.

Errors resulting in adverse events are a common cause of death among hospitalized patients, and a significant number occur in the operating room (OR). Traditional methods to investigate adverse events rely on post-event analyses using patient charts and incident reports, which often lack details. Prospective intraoperative observation is a more sensitive method to detect variations that can accumulate to result in harm. We conducted a prospective pilot study of consecutive elective laparoscopic cases using a multiport synchronized recording system called the Operating Room Black Box (ORBB). Two analysts reviewed the recordings and annotated data along the timeline. Inter-rater reliability was assessed. We analyzed 129 recordings. Cases took a mean (SD) of 83.8 (32.0) minutes. Fellows held the role of primary surgeon the longest, with a mean of 33.0 (25.2) minutes compared with the attending (27.5 [24.9]) and residents (23.3 [23.3]) ($p < 0.01$). The OR door opened a median 42 times (interquartile range [IQR] 32–54), loud noise was heard 18 (6–29) times and pagers or telephones rang 6 (3–8) times per case. Collectively, disruption occurred once every 75 seconds. The attending had the highest mean Objective Structured Assessment of Technical Skills score at 32.0 (1.7) out of 35, compared with fellows (29.8 [2.0]) and residents (28.0 [3.8]) ($p < 0.01$). A total of 1181 intraoperative events were identified and the majority were inadvertent bleeding. There was moderate to good inter-rater reliability. The ORBB platform enabled prospective and reliable assessments of surgery with a level of detail and comprehensiveness that were never obtainable with traditional research methods.

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Interventional radiology-assisted endoscopic transmural drainage of pancreatic fluid collections — an image-guided alternative to EUS-assisted drainage. *H. McFadgen, J. Hawel, T. El-Ghazaly, A. Al Awashez, J. Ellsmere*. From Dalhousie University, Halifax, N.S.

Endoscopic transmural drainage of pancreatic fluid collections (PFCs) is a minimally invasive and effective treatment modality for collections adjacent to the stomach or duodenum. However, when the location of the fluid collection cannot be seen endoscopically or when collateral blood vessels are present, imaging guidance is required. The limited availability of endoscopic ultrasound (EUS)-guided drainage in many tertiary centres worldwide, including North America, continues to prohibit widespread access to this technique. An alternative image-guided approach is required to allow safe endoscopic drainage of PFCs. We present our novel technique, performed in 2 separate stages. The first stage involves percutaneous insertion of a transgastric drain into the PFC under CT guidance by interventional radiology (IR). The second stage is performed in the endoscopy suite under endoscopic and fluoroscopic guidance. With direct endoscopic visualization, the posterior gastrotomy is cannulated and a guidewire delivered into the collection. The posterior gastrotomy is then serially balloon dilated, and double pigtail plastic stents are deployed. The anterior gastrotomy closes spontaneously. A retrospective chart review was conducted for all patients at our centre who underwent IR-assisted endoscopic transgastric PFC drainage over a 10-year period, from 2007 to 2017. All patients had successful resolution of their PFCs on follow-up cross-sectional imaging and were pain free. Mean length of follow-up was 14 months (range 2–29 months). Complications included bleeding, pneumothorax and pneumoperitoneum. Complication rates were comparable, with reported series in the literature using EUS-guided approaches. IR-assisted endoscopic transgastric drainage of PFCs is technically feasible and safe. It provides an image-guided alternative to EUS-assisted drainage, with a comparable safety profile and favourable clinical outcomes.

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An analysis of collaboration and sustainability in global surgery. *J. Margolick, M. Hameed, E. Joos*. From the University of British Columbia, Vancouver, B.C.

There is a major gap in access to surgery between high-income countries (HICs) and low- and middle-income countries (LMICs). Building surgical capacity through sustainable global partnerships can help reduce this disparity. This is the only systematic review identifying all published studies on North American global surgery initiatives. The objective is to quantify collaboration in global surgery and propose a model for international cooperation and sustainability based on 6 pillars: multidisciplinary collaboration, bilateral authorship, effective training, broad community engagement, sustainable funding and outcomes reporting. This systematic review uses the methodology established by the Preferred Reporting Items for Systematic Reviews and Meta-analysis (PRISMA-P). PubMed, Embase and Medline databases were searched. Selected studies were independently reviewed by 2 authors and assessed based on the Newcastle–Ottawa scale. A total of 4489 citations were reviewed. Only 82 (1.8%) met our inclusion criteria. Excluded studies were nonsurgical, unilateral, military or initiatives not arising from a North American partnership. Of the 82 initiatives, 44% had bilateral authorship. Sixty-eight (83%) involved North American academic institutions, 53 (65%) involved LMIC academic centres and 11% partnered with civil society organizations. Fifty-four percent of initiatives provided training for practitioners from LMICs. Thirty-three percent of initiatives were multidisciplinary, and only 6% explicitly demonstrated sustainable funding. Whereas 36 (44%) provided data collection, only 13 (16%) were involved in quality improvement initiatives and reported outcomes. We identified 82 studies reporting true global surgery collaborative initiatives. The nature

of the collaboration ranged from single teaching seminars to full fellowship training. None of the studies fulfilled all 6 proposed pillars of sustainability. To be more collaborative and sustainable, global surgical partnerships should consider beginning with a foundation of thoughtful, bilateral exchange of ideas and knowledge, clear and measurable objectives, training and capacity building, and continuous evaluation of program outcomes.

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Early pain and surgical outcomes after laparoscopic ventral and incisional hernia repair. ***M. Ahmed*, *C. Schlachta*, *Q. Tawfic*, *N. Alkhamesi*. From the London Health Sciences Centre, Western University, London, Ont.**

Pain after laparoscopic ventral and incisional hernia repair (LVIHR) pain have been largely attributed to the method of mesh fixation. This study aims to compare early postoperative pain and surgical outcomes with absorbable tacks (AT) and nonabsorbable tacks (NAT) mesh fixation techniques in LVIHR. This is a retrospective study of patients who underwent LVIHR between September 2011 and August 2016. Two types of tacks (absorbable and nonabsorbable) and 2 types of mesh (Physiomesh and Proceed mesh) were used. The groups were compared with respect to early postoperative pain scores using a visual analogue score (VAS), operative time, hospital stay, the incidence of seroma/hematoma and recurrence rates. Fifty-six patients with LVIHR were enrolled (41 in the AT group and 15 in the NAT group), Physiomesh was used in 12 and Proceed mesh in 46 patients. Both groups were demographically similar. Mean VAS was significantly higher in the AT as compared with the NAT group, 5.75 versus 4.4 at 6 hours ($p = 0.02$) and 5.4 versus 4.4 at 24 hours ($p = 0.04$). Mean pain score was similar after 24 hours and at 4 weeks postoperatively. The fixation method had no effect on the incidence of seroma and hematoma; however, the incidence was significantly higher with Physiomesh ($p = 0.02$). Operative time and hospital stay were similar in all groups. The recurrence rate was higher with Physiomesh as compared with Proceed mesh ($p = 0.01$) independently from methods of mesh fixation. AT mesh fixation was associated with higher postoperative pain intensity during the first 24 hours independent of mesh type. However, it was similar after that up to 4 weeks in all groups. Physiomesh was associated with higher recurrence rate regardless of the fixation technique.

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Outcomes of gastrectomy for patients with disseminated gastric cancer: an analysis of the American College of Surgeons' National Surgical Quality Improvement Program (ACS NSQIP). ***Y. Jeong* (University of Toronto, Toronto, Ont.), *N. Coburn* (University of Toronto, Toronto, Ont.), *C. Wallis* (University of Toronto, Toronto, Ont.), *A. Mahar* (Sunnybrook Research Institute, Toronto, Ont.), *R. Satkunasivam* (University of Toronto, Toronto, Ont.), *P. Karanicolas* (University of Toronto, Toronto, Ont.), *C. Law* (University of Toronto, Toronto, Ont.), *J. Hallet* (University of Toronto, Toronto, Ont.).**

The benefits of gastrectomy for metastatic gastric cancer (GC) remain controversial. While improved survival and quality of life have been suggested, increased mortality and morbidity remain a concern. We sought to examine short-term postoperative outcomes of gastrectomy for GC patients with disseminated cancer (DC). We conducted a multi-institutional retrospective cohort study using the ACS NSQIP registry including patients undergoing gastrectomy for GC from 2007 to 2015. We excluded patients missing data on key variables (age, gender, body mass index, functional status and operative time). Primary outcome was 30-day major morbidity, including postoperative infectious, cardiac, respiratory, venous thromboembolic, renal failure, and death events. Multivariable analysis examined the association between DC and results are reported as odds ratios (OR) with 95% confidence intervals (95% CI) adjusted for relevant demographic and clinical covariates. Sensitivity analyses were conducted for a complete case cohort (no exclusions) and a cohort restricted to years with minimal missing data. Of 5341 patients included, 377 (7.1%) had disseminated cancer. Overall, 22.5% of patients experienced major complications, including 3.3% mortality. Major morbidity was more common with DC (31.3% v. 21.8%; $p < 0.001$), mostly driven by higher respiratory and death events. Prolonged length of stay (beyond 75th percentile: 11 days) was more likely with DC (41.9% v. 28.3%; $p < 0.001$). After adjustment, DC was independently associated with major morbidity (OR 1.45, 95% CI 1.14–1.85). This association remained for respiratory events (OR 1.58, 95% CI 1.07–2.33), death events (OR 2.1, 95% CI 1.38–3.48) and prolonged length of stay (OR 1.65, 95% CI 1.31–2.07). Sensitivity analyses did not alter the results. Gastrectomy for GC with DC leads to worse short-term postoperative outcomes, independent of other clinical characteristics. These data should inform decision-making regarding palliative gastrectomy, so that risks of morbidity are carefully weighed against the potential benefits.

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Laparoscopic cholecystostomy as a bailout manoeuvre in difficult cholecystectomy for acute cholecystitis. ***E. Hempel* (Schulich School of Medicine and Dentistry, Windsor Campus, Windsor, Ont.), *V. Khokhotva* (Windsor Regional Hospital, Windsor, Ont.).**

Management of acute cholecystitis can be challenging. Early cholecystectomy has improved outcomes compared with delayed cholecystectomy. This is despite the risk of conversion to open cholecystectomy and common bile duct injury. We present a novel operative technique of laparoscopic cholecystostomy as a "bailout manoeuvre" in the management of severe acute cholecystitis. This is ideal for cases where proper visualization of anatomy cannot be attained, or where inflammatory adhesions or ileus prevent adequate exposure. A cholecystostomy tube is inserted intraoperatively through an incision in the fundus of the gallbladder. This tube will remain in situ for 6–8 weeks, when definitive management with laparoscopic cholecystectomy occurs. A complete survey of patients from 2013 to 2017 at a community hospital by a single surgeon was done to collect perioperative data. All 9 patients had preoperative diagnosis of acute cholecystitis and were brought to the operating room for urgent laparoscopic cholecystectomy. Their procedure was converted to a laparoscopic cholecystostomy secondary to severe inflammation. There were 6 males and 3 females with an average age of 59 years (range 31–79 years). Mean operative time for laparoscopic cholecystostomy procedure was 45 minutes, and mean length of hospital stay was 4.2 days. Four patients suffered minor complications.

Two cholecystostomy drain occlusions and 2 instances of drain-site pain occurred. Definitive treatment, laparoscopic cholecystectomy, followed after an average of 62 days. Mean operative time for laparoscopic cholecystectomy was 75 minutes. One major complication occurred: cystic duct stump leak. This was successfully treated with endoscopic retrograde cholangiopancreatography, sphincterotomy and a stent placement. No cases were converted to open cholecystectomy. In conclusion, laparoscopic cholecystostomy is a viable alternative to conversion to open cholecystectomy in cases of difficult acute cholecystitis. This efficient manoeuvre saves operating time, prevents complications related to subcostal incision and allows for a relatively straightforward planned laparoscopic cholecystectomy.

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Enhancing leadership development in general surgery residents. ***M. Delisle, C. Leung, M. Ward, M. Chan, C. ffrench, D. Wirtzfeld.*** **From the University of Manitoba, Winnipeg, Man.**

Leadership development has become increasingly important since the transition of Manager to Leader in the CanMEDS 2015 framework. Sanokondu, an international network fostering health care leadership development, created a website containing 9 resident competency-based leadership modules influenced by LEADS. These modules were intended for local adaptation and served as a springboard to develop a curriculum for general surgery residents. The local general surgery academic curriculum was reviewed to determine how leadership was taught and assessed. Three general surgery residents reviewed the Sanokondu modules to determine appropriate content for implementation given curricular gaps. Two faculty members with expertise in leadership development and 1 in simulation reviewed the curriculum. The Sanokondu modules were adapted to include a 5-part curriculum, each focusing on a leadership competency. The first and second sessions will occur in PGY1 and use self-reflection and journaling to teach how to lead self and engage others. The third session, in PGY2, uses case-based discussions to teach accountability. The fourth and fifth sessions, in PGY3, use simulation and a group capstone project to consolidate developing coalitions and transforming systems. Evaluation methods will include 360° multisource feedback, self-evaluation and portfolios. Curriculum review and use of existing resources helped to develop a local discipline-specific leadership curriculum. Longitudinal, competency-based curricula that incorporate established leadership frameworks, such as LEADS, are one strategy to ensure leadership is being taught and assessed.

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B-SAFE anatomic landmarks for orientation during elective laparoscopic cholecystectomies. ***J. Schendel, C. Ball, E. Dixon, F. Sutherland.*** **From the University of Calgary, Calgary, Alta.**

Proper surgeon orientation and navigation in the operative field during laparoscopic cholecystectomy may prevent bile duct injuries. Using the landmarks around the gallbladder, B-SAFE (B-Bile duct, S-Sulcus of Rouviere, A-hepatic Artery, F-umbilical Fissure, E-Enteric/duodenum) may help surgeons orient. We studied the frequency of these 5 landmarks during elective laparoscopic cholecystectomies. Between 2015 and 2017 in 128 elective laparoscopic cholecystectomies, the prevalence of B-SAFE landmarks was prospectively recorded. Percentage of cases where each landmark was visualized was calculated and standard errors were used to estimate 95% confidence intervals. Data are presented as number unless otherwise specified (percentage). Fisher's exact test was used to determine significance between groups. All cases (128) had at least 1 B-SAFE landmark visualized. Ninety-eight percent had 2, 91% had 3, 65% had 4 and 56% had all 5 landmarks present. In 99 of 128 cases (77%) at least 1 portion of the bile duct (upper, middle or lower) was visualized. The sulcus of Rouvier was present in 102 of 128 cases (80%). Careful observation revealed the pulsation of the left hepatic artery in 103 cases (84%). The position of the umbilical fissure (covered or uncovered) was the most common landmark as it was found in 97% of cases. In obese patients the duodenum was less often visualized than in nonobese patients (89% v. 99%; $p = 0.04$). There was no statistical difference when identifying the other 4 B-SAFE landmarks between obese and nonobese patients. The B-SAFE landmarks are commonly present in the anatomy around the gallbladder. Taking a "bile duct time out" to identify these landmarks before proceeding with a laparoscopic cholecystectomy may help orient the surgeon and prevent navigation error and bile duct injuries.

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CHIVA — a novel minimally invasive vein-sparing technique for the treatment of varicose veins. ***M. Zmudzinski*** **(University of British Columbia, Vancouver, B.C.),** ***P. Malo*** **(Island Health, Victoria, B.C.),** ***C. Hall*** **(University of British Columbia, Vancouver, B.C.),** ***A. Hayashi*** **(University of British Columbia, Vancouver, B.C.).**

Varicose vein disease (VVD) affects approximately one-third of adults and is characterized by a spectrum of sequelae, including leg pain, edema, pruritus, dermatitis, hemosiderosis, lipodermatosclerosis, thrombophlebitis and ulcers in severe cases. Varicose vein stripping has been the standard treatment but carries with it a high documented recurrence rate (35%–53%). CHIVA is a minimally invasive technique that instead spares the great saphenous vein (GSV) from total ablation and is emerging as an alternative for treating VVD. Our research shows favourable recurrence and complication rates when compared with vein stripping. CHIVA requires skill performing real-time duplex ultrasound examination of the venous anatomy and identification of the refluxing vessels. In this video, we demonstrate the process of CHIVA. Based on our experience, CHIVA is a cost-effective alternative to the more costly and invasive ablative surgical methods for the treatment of varicose vein disease.

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Laparoscopic removal of migrated intrauterine device. ***C. Wetzel, Z. Siddiqui, A. Santos.*** **From Texas Tech University Health Sciences Center, Amarillo, Tex.**

The intrauterine device (IUD) is a popular, long-acting, reversible contraceptive device with an estimated rate of use of about 5.3%. It is inexpensive, highly effective and reversible but not without complication. Complications of IUD placement include abdominal pain, pelvic inflammatory disease, expulsion, retraction into cervix or uterus and uterine perforation. Uterine perforation

occurs at a rate of approximately 0 to 1.3 per 1000 individuals secondary to IUD placement. A total of 179 cases are documented in the literature highlighting IUD removal via laparoscopy, of which 64.2% were successfully completed. The mean age of these patients was 26 years, and the most common presenting signs were pain and unexpected pregnancy. The omentum (26.7%), pouch of Douglas (21.5%) and colonic lumen secondary to perforation (10.4%) were the most common sites where the IUDs were found. Adhesions were correlated with higher rates of failure and conversion to laparotomy. This case examines a 32-year-old woman who presented with right upper quadrant pain due to acute cholecystitis; an IUD was seen incidentally on x-ray in the left upper quadrant. An intact uterus was observed on CT. Patients with migrated IUDs, while sometimes presenting with symptoms, are frequently asymptomatic. The patient will usually report lost strings. It is imperative that an ultrasound and possibly an abdominal x-ray be performed before the conclusion is made that it has fallen out. If the IUD is found incidentally on imaging when the patient has other surgical complaints, the IUD can be safely removed laparoscopically at the same time, given the patient is a good surgical candidate. This case emphasizes the importance of a thorough history and accurate imaging in the surgical setting to provide the best care.

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Impact of acute care surgery service on critically ill emergency general surgery patients. ***B. He, E. St-Louis, D. Deckelbaum, J. Grushka, T. Razek, K. Khwaja*. From McGill University, Montreal, Que.**

Acute care surgery (ACS) services have flourished across Canada with evidence of improved care. We hypothesized a dedicated ACS service improves the outcomes of emergency general surgery patients admitted to a closed intensive care unit (ICU) in a busy university hospital system. This retrospective study reviewed all consecutive emergency general surgery ICU admissions at 2 hospital sites of a quaternary institution from 2011 to 2015, before and after the implementation of the ACS service. Patient demographics, diagnosis, Acute Physiology and Chronic Health Evaluation (APACHE II) scores, ICU death and length of stay (LOS) were recorded. Univariate and multivariable regression analyses were performed to evaluate whether presence of an ACS service independently predicted ICU death and ICU LOS. We reviewed 648 ICU admissions; 57% were male and median age was 66 years. Median APACHE II score was 20. Median ICU LOS was 2 days and overall ICU mortality was 12%. The top 3 admitting diagnoses before and after ACS service implementation were identical: sepsis, bowel resection and septic shock. After adjusting for confounders, admission before ACS implementation was found to be significantly predictive of increased ICU mortality (OR 4.03, $p < 0.001$) on multivariate analysis (Table 1). Furthermore, there was a trend of decreased ICU LOS after ACS implementation (by 2.1 days). Our study has shown that ACS service implementation is associated with a significant decrease in the risk of ICU death for emergency general surgery patients, with a trend of lower length of ICU stay. Further analysis is needed to determine the impact on complications and to determine the factors to which the decrease in mortality following ACS service implementation are attributable.

Table 1. Results of multi-variable logistic regression Variable

Variable	Adjusted OR (95% CI)	*p* value
Age	1.01 (0.99, 1.03)	0.263
Male gender	0.54 (0.31, 0.93)	0.026
Hospital site	1.31 (0.71, 2.38)	0.377
APACHE-II score	1.07 (1.04, 1.10)	< 0.001
Pre-ACS service	4.03 (2.17, 7.50)	< 0.001

ACS = acute care surgery; APACHE = Acute Physiology and Chronic Health Evaluation; CI = confidence interval; OR = odds ratio.

66

Followership styles: a systematic review of the literature in medicine and health care. ***C. Leung, A. Lucas, L. Gillman*. From the University of Manitoba, Winnipeg, Man.**

Surgical culture has classically focused on the role of the surgeon as leader. Conversely, the role of the follower has not been well studied within the surgical hierarchy. Kelley (1992) argued that organizational success depends on the characteristics of its followers. He describes 5 followership styles based on 2 characteristics: active engagement and independent critical thinking. Our objective was to provide a systematic review on the association between followership style and health care practitioner outcomes (e.g., job satisfaction or workplace performance). A secondary objective was to review the health care literature on followership. All articles from Medline, CINAHL, Embase and reference lists of relevant articles were searched. Given the paucity of studies found in this initial search, the search strategy was expanded beyond health care databases. Two additional non–health care databases were included: ProQuest Dissertations and Business Source Premier. Two independent reviewers identified all studies examining followership styles and their association with job satisfaction and/or performance outcomes. Included studies were evaluated using the Grading of Recommendations Assessment, Development and Evaluation (GRADE) approach. A total of 10 observational studies met the inclusion criteria: 4 studies examined followership styles within health care and 6 studies examined the concept in non–health care settings. Measured outcomes were survey-based and heterogeneous, ranging from individual practitioner outcomes to organizational level outcomes; therefore, no synthesized analysis was performed. Followership styles demonstrating greater active engagement and independent critical thinking were associated with increased job satisfaction, decreased burnout and adherence to workplace best practices, such as infection prevention or safety guidelines. Despite limited studies, followership styles demonstrating greater independence appear to be associated with positive individual and performance outcomes. Further research should assess followership style and associated individual outcomes across surgical trainee levels to investigate whether followership styles are innate or learned.

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Adult bowel obstruction secondary to Meckel's associated congenital band: a case report and literature review. ***N. Austin, R. Gill*. From the University of Calgary, Calgary, Alta.**

Bowel obstruction in the adult population accounts for 300 000 hospital admissions in the United States annually with postoperative adhesions as the primary etiology. Congenital etiologies

of bowel obstruction are rare in comparison but should not be discounted based on the history of previous abdominal surgery. Meckel's diverticulum and its associated anomalies can cause bowel obstruction via intussusception, internal hernia, inflammation or direct bowel compression. The number of complications associated with Meckel's diverticulum decreases with age. In this review we analyze the cases of bowel obstruction in adults secondary to congenital bands associated with Meckel's diverticulum. A literature search was conducted using the Medline (Ovid) database with MeSH terms vitelline duct, Meckel diverticulum, and intestinal obstruction. Fifty-one cases of bowel obstruction secondary to Meckel's associated bands in adults were identified from 20 papers. The age of reported cases ranged from 18 to 83 years with a mean of 37.7 years. Males were involved in 76% of the cases while females were involved in 24%. The number of reported cases decreased with advancing age. Internal hernia was the main etiology of bowel obstruction associated with Meckel's bands. Bowel obstruction secondary to a congenital band associated with Meckel's diverticulum is rare in the adult. Internal hernia is the primary etiology of obstruction; however, direct compression of the distal bowel is possible. Congenital etiologies should always remain on the differential diagnosis for bowel obstruction even in the context of previous abdominal surgery.

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Assessing long-term change in the culture of communication on the surgical ward. ***H. Smith, S. Yeh, S. Bennett, L. Williams, J. Greenberg, K. Lacelle, M. McGrath, P. Glen, D. Carver, H. Moloo*. From the University of Ottawa, Ottawa, Ont.**

In 2014, our surgical quality improvement team aimed to create a sustainable improvement in communication between nurses and resident physicians on the surgical ward by implementing a change in patient handover and communication methods. Here we summarize the long-term changes in perceived collaboration and communication by nurses and residents following this intervention. A validated survey assessing perceived communication, collaboration and shared decision-making was distributed to general surgery residents and ward nurses before, 9 months after and 2.5 years after the intervention. The surveys before, 9 months after and 2.5 years after the intervention were completed by 28, 12 and 20 nurses, respectively, and 21, 15 and 21 residents, respectively. A Fisher's exact test was used to indicate statistical significance in change of survey results before and after the intervention. Immediately after the intervention, nurses' perceived collaboration with physicians significantly improved (39% pre-intervention, 84% post-intervention, $p = 0.01$). Significantly more nurses felt their input was well received (57% pre-intervention, 92% post-intervention, $p = 0.01$). On the delayed survey, however, only 65% of nurses continued to feel their input was well received ($p = 1.0$). The resident group perceived a significant change in how well important issues were communicated between team members (17% pre-intervention, 60% post-intervention, $p = 0.039$). This remained statistically significant 2.5 years later (66% delayed post-intervention, $p = 0.001$). Overall, we found significant improvements in communication between nurses and residents 9 months after the intervention. However, these changes were not well preserved over time, particularly as perceived by the nursing staff. This suggests that our current interventions are inadequate to make a sustainable change in communication on the surgical ward. In keeping with the other quality initiatives, implementing a more robust, iterative process of evaluation with root cause analysis may enhance the sustainability of such initiatives in improving the culture of interprofessional communication on the wards.

Canadian Association of Thoracic Surgeons (CATS)

01

Independent predictors of progression to parapneumonic empyema: a retrospective cohort study of 1766 cases. ***C. Yeung* (University of Ottawa, Ottawa, Ont.), *A. McGuire* (University of British Columbia, Vancouver, B.C.), *D. Mousadoust* (University of British Columbia, Vancouver, B.C.), *R. Myers* (University of British Columbia, Vancouver, B.C.), *K. Grant* (University of British Columbia, Vancouver, B.C.), *B. Nasir* (University of British Columbia, Vancouver, B.C., and Duke University, Durham, N.C.), *J. Yee* (University of British Columbia, Vancouver, B.C.)**

Both community- and hospital-acquired pneumonia (CAP and HAP) have the potential to progress to parapneumonic empyema, with serious associated morbidity. The objectives of the current study were 3-fold: to determine the annual incidence risk of empyema at our institution, to identify independent predictors of progression from pneumonia to parapneumonic empyema and to understand current local practice management patterns for parapneumonic empyema. A retrospective cohort study was conducted. A total of 1766 consecutive adult cases of pneumonia between Nov. 1, 2014, and Oct. 31, 2015, met the inclusion criteria. The primary outcome of interest was incidence risk of progression to empyema. Secondary outcomes included frequency of diagnostic and therapeutic pleural intervention (thoracentesis, chest tube placement, surgical drainage). Variables of interest included basic demographics, and comorbidities as measured by the validated Charlson Comorbidity Index. Statistical analysis involved descriptive, univariable and multivariable logistic regression analysis to achieve study objectives. The local incidence risk of parapneumonic empyema was 10.76% ($n = 190$) over the study period. The majority of these cases arose secondary to HAP (72%). On multivariate analysis, variables associated with the development of parapneumonic empyema included peripheral vascular disease ($p = 0.002$), chronic obstructive pulmonary disease (COPD) ($p = 0.04$) and high Charlson Comorbidity Index score ($p = 0.005$). With a local parapneumonic empyema incidence risk of 10.76%, we identified HAP, COPD and high Charlson Comorbidity Index score as important clinical variables portending an association of pneumonia with empyema. Future research directions should include prospective study on the impact of smoking history and current substance dependence on empyema, in addition to inquiry into why HAP is more likely to progress to empyema.

02

Intraoperative steroid use during pneumonectomy is not associated with increased bronchopleural fistulae or infectious complications. ***S. Kaaki*, *B. Kidane*, *G. Darling*, *A. Pierre*, *S. Keshavjee*, *K. Yasufuku*, *M. DePerrot*, *T. Waddell*, *M. Cypel*, *Y. Shen*, *N. Jacob*, *V. Gupta*. From the University of Toronto, Toronto, Ont.**

Despite evidence suggesting that intraoperative steroid use may reduce the incidence of acute respiratory distress syndrome after pneumonectomy, surgeons are reluctant to use intraoperative steroids because of concern about potential increased risk of bronchopleural fistula (BPF) and infectious complications. Our objective was to assess the safety of intraoperative steroid use during pneumonectomy with respect to BPF and infectious complications. We performed a retrospective cohort study using prospectively collected data on consecutive pneumonectomies between 2005 and 2015. Anesthetic records were reviewed for type and dose of steroid administered intraoperatively. Univariable and multivariable analyses were performed. Of the 251 pneumonectomies performed during the study period, 8 (3.2%) were performed for non-cancer indications and 121 (48.2%) were extrapleural pneumonectomies for mesothelioma or thymoma. Fifty-three patients (21.1%) were exposed to intraoperative steroids at the following doses: 92.4% (n = 49) dexamethasone (4–8 mg IV), 7.5% (n = 4) hydrocortisone (100 mg IV) and 3.8% (n = 2) methylprednisolone (1 g IV). BPFs were uncommon and occurred in 3.8% (n = 2) of patients who received intraoperative steroids versus in 3.0% (n = 6) of those who did not (p = 0.68). There was no difference in infectious complications between those who did (17.0%, n = 9) and did not receive intraoperative steroids (11.6%, n = 23) (p = 0.35). Non-cancer indication for resection was the only factor significantly associated with infectious complications on univariable (p = 0.0001) and multivariable analyses (adjusted odds ratio [aOR] 13.83, 95% CI 3.01–63.57, p = 0.001). Intraoperative steroid use was not significantly associated with infectious complications on multivariable analysis (aOR 0.96, 95% CI 0.31–2.97, p = 0.95). There were no significant differences in 90-day mortality (p = 0.51) and respiratory failure (p = 0.19) rates between the 2 groups. The use of intraoperative steroids during pneumonectomy appears reasonably safe, recognizing the limitation of sample size and a single centre experience. Multicentre studies are required to evaluate the trade-offs between reducing respiratory/nausea complications and the potential for wound healing impairment.

03

A comparison of uniportal versus multiportal video-assisted thoracoscopic surgery in the treatment of lung cancer: a Canadian single-centre retrospective study. ***T. Bin Yameen*, *A. Behzadi*. From the University of Toronto, Toronto, Ont.**

Observational studies comparing the clinical outcomes of uniportal and multiportal video-assisted thoracoscopic surgery (VATS) lobectomies for lung cancer have produced conflicting results in terms of overall rates of complications, length of hospital stay and duration of postoperative chest tube drainage. The aim of this study was to identify value propositions, if any, for uniportal over multiportal VATS in the treatment of resectable lung cancer. We conducted a retrospective study evaluating 128 patients who underwent VATS from September 2012 to August 2016 at a single institution. Data collected included patient demographics, comorbidities, smoking history, baseline forced expiratory volume and diffusing capacity of the lungs for carbon monoxide (DLCO), tumour pathology, tumour size, tumour location, duration of operation, length of hospital stay, rates of complications, conversion to thoracotomy, duration of postoperative chest drainage, blood loss, lymph nodes removed, positive margins, 24-hour and duration of patient-controlled analgesic use, 24-hour visual analogue score, and inpatient and 90-day mortality. Differences were evaluated with an independent t test for means, Mood's median test for medians and Fisher's exact test or χ^2 test for categorical variables. Patients who underwent uniportal VATS benefitted from a 1-day statistically significant reduction in median hospital stay (2 v. 3 days, p = 0.013) and median duration of postoperative chest drainage (2 v. 3 days, p = 0.012). Furthermore, patients in the uniportal VATS arm experienced a 44% reduction in rates of complications (26% v. 46%, p = 0.027). All other differences in clinical outcomes were not statistically significant. Our findings indicate that uniportal VATS confers a significant improvement in clinical and safety outcomes without compromising oncologic principles or increasing resource utilization. Larger multicentre studies are required to corroborate our findings.

04

Gastrectomy with extended lymphadenectomy: a North American perspective. ***A. Gosselin-Tardif* (McGill University, Montreal, Que.), *J. Lie* (McGill University, Montreal, Que.), *I. Nicolau* (McGill University Health Centre, Montreal, Que.), *J. Cools-Lartigue* (McGill University Health Centre, Montreal, Que.), *L. Feldman* (McGill University Health Centre, Montreal, Que.), *J. Spicer* (McGill University Health Centre, Montreal, Que.), *C. Mueller* (McGill University Health Centre, Montreal, Que.), *L. Ferri* (McGill University Health Centre, Montreal, Que.).**

Despite growing evidence of oncological benefits from extended (D2) lymphadenectomy in gastric cancer, there is persistent debate over its use in the West, mainly due to perceived high rates of morbidity and mortality. This study evaluates the safety and efficacy of D2 dissection in a high-volume North American centre. A prospectively entered database of all patients undergoing nonbariatric gastrectomy at a North American referral centre from 2005 to 2016 was reviewed. The operating surgeon decided on the extent of lymphadenectomy, standard practice for gastric adenocarcinoma resection at our institution being D2 for all tumours beyond cT1N0. Data are presented as median (IQR); Mann–Whitney U or Fisher's exact tests determined significance (*p < 0.05). Of the 366 nonbariatric gastrectomies over this period, 206 met the inclusion criteria. Age was 70 (18) years, and 65% of patients were male. D2 dissection was performed in 151 patients (73%); the rest had D1. Postoperative complication rates were similar (40% for D1 and D2), with equivalent rates of severe (Clavien–Dindo > 2) complications (D1 = 22%; D2 = 17%). There was no difference in anastomotic leak rate (D1 = 7%; D2 = 5%) and same-admission or 30-day mortality rate (D1 = 5%; D2 = 2%). D2 dissection was associated with higher pathological stage (71% > stage 1 v. 38% > stage 1)* and lymph node yield (30 [19] v. 13 [15])*, with no difference in complete resection (R0) rate (D1 = 98% v. D2 = 92%). Laparoscopic

approach was used in 32% (48/151) of D2 cases, resulting in shorter length of stay (5 [6] v. 9 [7])* and equivalent oncologic outcomes compared with the open D2 approach, with nodal yield of 31 (13) and an R0 resection rate of 91%. This study supports the use of D2 lymphadenectomy, by either open or laparoscopic approach, in high-volume North American centres as a safe and effective oncologic procedure for gastric cancer, with equivalent complication rates and superior lymph node yield to traditional D1 dissection.

05

Feasibility of comprehensive frailty assessment prior to thoracic surgery for lung or esophageal cancer. *D. Hirpara* (University of Toronto, Toronto, Ont.), *B. Kidane* (University of Manitoba, Winnipeg, Man.), *A. Grindlay* (Toronto General Hospital, Toronto, Ont.), *F. Allison* (Toronto General Hospital, Toronto, Ont.), *P. Rogalla* (Toronto General Hospital, Toronto. Ont.), *G. Darling* (Toronto General Hospital, Toronto, Ont.).

Frailty assessment has been shown to be a good method of preoperative risk assessment but has not been thoroughly explored in thoracic surgery. The primary objective of this study was to assess the feasibility of comprehensive preoperative frailty testing in patients undergoing lung or esophageal cancer surgery, with a secondary objective of determining if various measures provide a clinically important contribution to risk assessment. Patients completed a battery of physiotherapy tests (6-min walk, gait speed, hand-grip strength), risk stratification (Charlson Comorbidity Index, Revised Cardiac Risk Index, Modified Frailty Index [MFI]) and health-related quality of life (QoL) questionnaires (FACT-E or FACT-L). Core muscle size was assessed using the lean psoas area (LSA) by a radiologist on preoperative PET/CT scans. Univariate statistics were used. A total of 48 patients were screened over a 4-month period. Forty patients (83%; esophagus $n = 20$; lung $n = 20$) provided consent to participate. A majority of participants were white (83%) and male (63%), with a median 26 pack-year smoking history. Fourteen patients (35%) experienced postoperative complications, of which only 5 (36%) were Clavien–Dindo class III or IV. The sole class III complication was pleural effusion, requiring chest drainage. Class IV complications consisted of respiratory failure ($n = 3$) and cardiogenic shock ($n = 1$). The median length of hospital stay was 9 days (interquartile range 3–14.5). One patient died within 90 days. The MFI approached statistical significance ($p = 0.06$) in its ability to predict postoperative complications. Comprehensive frailty testing is feasible preoperatively for thoracic surgery patients. Risk stratification questionnaires and assessment of LSA had virtually 100% completion rates. Physiotherapy and QoL tests proved challenging to coordinate, with lower completion rates, and may not provide a clinically meaningful contribution to risk assessment. The MFI is easy to administer and seems promising as an isolated measure of preoperative risk. Larger studies are needed to validate these findings.

06

Patterns of practice in mediastinal lymph node staging for non–small cell lung cancer in Canada. *S. Turner* (Memorial Sloan Kettering Cancer Center, New York, N.Y.), *N. Seyednejad* (University of British Columbia, Vancouver, B.C.), *B. Nasir* (Université de Montréal, Montreal, Que.).

Accurate assessment of lymph node status is an integral part of the staging of patients with non–small cell lung cancer (NSCLC). The objective of this study is to delineate the current practice of Canadian thoracic surgeons in the nodal staging of patients with potentially curable NSCLC in comparison to published guidelines. An online questionnaire was sent out to all Canadian Association of Thoracic Surgeons members ($n = 86$). Items in the questionnaire addressed the use of imaging, thresholds and methods for invasive staging (IS), and intraoperative nodal staging. Comparison was made against National Comprehensive Cancer Network, American College of Chest Physicians and European Society of Thoracic Surgeons guidelines. Forty-seven thoracic surgeons completed the survey (55%): 31 practised in an academic setting and 15 had a community practice. Most had been in practice more than 10 years (67%). Most respondents order a positron emission tomography (PET) scan in every patient (87.2%). Most respondents perform IS more selectively (87.2%). Indications for IS were highly variable; the most commonly identified were suspected nodal involvement on imaging (80.5%), tumour within the central third of the lung (67.5%) and tumour larger than 3 cm (34.2%). Endobronchial ultrasound (EBUS) was selected as the initial IS procedure of choice by 47.9% of respondents, while 43.5% selected mediastinoscopy first. Of surgeons selecting mediastinoscopy, most (61.9%) reported a lack of availability of EBUS. There was also wide variation in which nodes respondents routinely harvested intraoperatively for given lobectomies. A sizeable minority of surgeons (13%) did not routinely harvest any lymph nodes during resection for NSCLC. The selection of NSCLC patients for curative-intent therapy relies on proper staging. Although most surgeons stated they derived their practices in nodal staging from 1 or more established guidelines, a significant proportion of respondents' practices did not reflect those recommendations. This may result in inaccurate staging and suboptimal care.

07

Pulmonary metastasectomy for colorectal cancer: the role of lymph nodes, and independent predictors of survival in routine surgical practice. *S. Karim* (Queen's University, Kingston, Ont.), *E. Tang* (Queen's University, Kingston, Ont.), *K. Brennan* (Queen's University, Kingston, Ont.), *A. McGuire* (University of British Columbia, Vancouver, B.C.), *C. Booth* (Queen's University, Kingston, Ont.), *S. Nanji* (Queen's University, Kingston, Ont.)

Surgical resection of lung metastases is considered standard treatment for patients with metastatic colorectal cancer. However, there is a lack of data describing current practice and outcomes in the general population. Here, we describe surgical management, prognostic factors and outcomes in routine clinical practice. All cases of resected colorectal cancer lung metastases (CRCLM) in Ontario from 2002 to 2009 were identified using the population-based Ontario Cancer Registry and linked electronic records. Pathology reports were used to identify extent of disease and surgical procedure. Cox proportional models were used to explore factors associated with cancer-specific (CSS) and overall (OS) survival. The study population included 420 patients; median age was 64 years and 60% were male. Sixty-one percent (256/420) of patients had a solitary metastasis. Mean size of the largest resected

metastasis was 2.4 cm. Regional lymph nodes were retrieved in 63% (263/420) of patients; mean/median number of resected nodes was 5/4. Five-year CSS and OS was 42% (95% CI 37%–47%) and 40% ((95% CI 35%–45%), respectively. On adjusted analyses, greater number ($p < 0.001$) and size ($p = 0.001$) of lesions and lymph node involvement ($p < 0.001$) were associated with inferior CSS and OS. Lymph node positivity is the strongest negative predictor for survival (adjusted CSS HR 2.19 [95% CI 1.48–3.25]; adjusted OS HR 2.08 [95% CI 1.41–3.07]). Unadjusted 5-year CSS/OS are 49%/47% and 19%/19% for node-negative and node-positive disease, respectively. The negative prognostic effect of size (> 2 cm) and number (> 1) of lesions are additive: 5-year CSS/OS ranges from 57%/55% (single lesion < 2 cm) to 24%/20% (multiple lesions, largest lesion > 2 cm). Long-term survival of patients with resected CRCLM in this population-based cohort is comparable to outcomes reported in institutional case series. Lymph node positivity is the strongest negative predictor for survival. Combining size and number of metastatic lesions in advance of surgery may facilitate treatment decision-making.

08

Digital air leak monitoring for patients undergoing anatomic lung resection: a randomized controlled clinical trial. ***A. Jad, M. Plourde, K. Harris, A. Mujoomdar, H. Henteleff, D. Bethune*****. From Dalhousie University, Halifax, N.S.**

Previous trials have compared digital pleural collection devices to nondigital devices. Almost all trials result from Europe and the United States. Most trials had the limitations of small sample sizes, inclusion of nonanatomic lung resections and lack of follow-up following discharge from hospital. Our objective is to present data reflecting a Canadian perspective for comparison of these chest tube devices with follow-up 1 month after discharge from hospital. This is a single-centre randomized trial comparing the use of digital chest tube devices to nondigital devices in patients undergoing anatomic lung resection from November 2013 to July 2016. We compared the mean number of days in hospital, chest tube duration and number of chest x-rays (CXR) using a *t* test. Chest tube clamping, pneumothorax after chest tube removal and need for chest tube reinsertion were compared using a χ^2 test. A total of 214 patients were randomized, with 106 in the digital group and 108 in the nondigital group. The groups were well matched with regards to Charlson Comorbidity Index, age and type of surgery. We did not find a significant difference in outcomes for number of CXR performed ($p = 0.299$), chest tube duration ($p = 0.141$) and length of hospital stay ($p = 0.211$). There was also no difference in pneumothorax after chest tube removal ($p = 0.279$) or need for chest tube reinsertion ($p = 0.294$). The only significant finding was that of a higher number of patients having their chest tube clamped before removal, 47% in the nondigital group and 18% in the digital group ($p < 0.001$). The digital devices did not result in reduced chest tube duration or hospital length of stay. Almost half of cases in the nondigital group had their chest tube clamped before removal. This is likely a result of more subjectivity with the nondigital devices. However, this did not result in any change in clinical outcomes.

09

Impact of *KRAS* mutations in early stage non–small cell lung cancer. ***P. Sadeghi*** **(Dalhousie University, Halifax, N.S.),** ***R. Nayak*** **(Queen's University, Kingston, Ont.),** ***M. Plourde*** **(Dalhousie University, Halifax, N.S.).**

Lung cancer is the leading cause of cancer mortality among Canadians. It is estimated that up to 10% of patients with non–small cell lung cancer (NSCLC) will subsequently develop a second primary NSCLC. Multiple mutations are now analyzed in NSCLC, with *EGFR* and *ALK* genes resulting in the use of targeted therapy. The presence of a *KRAS* mutation has been shown to be a negative prognostic indicator in colorectal cancer. The results in NSCLC are mixed. It has been suggested that *KRAS* mutations may be associated with a higher likelihood of developing a second primary NSCLC. This study is a retrospective cohort study looking at NSCLC specimens obtained following resections for stage I and II disease from Feb. 28, 2005, to Dec. 31, 2015. The primary objective is to determine the incidence of second primary lesions in *KRAS* positive compared with negative individuals. Secondary objectives are to determine prognostic implication of *KRAS* status on overall survival and disease-free survival. Incidence rates of a second primary NSCLC were calculated and compared using a Fisher's exact test. Overall and disease-free survival were compared using the Kaplan–Meier method, with the log-rank test implemented to evaluate differences in outcome. *KRAS* positive individuals are more likely to have synchronous lesions found after resection (OR 2.61, $p < 0.05$), with 74% of these occurring within the same lobe. *KRAS* positive individuals have a higher number of synchronous lesions than negative individuals (1.3 v. 1.12, $p < 0.05$). There was no statistical difference in the rate of metachronous lesions (OR 1.20, $p = 0.67$), overall survival (HR 0.69, $p = 0.30$) and disease-free survival (HR 0.85, $p = 0.56$) between *KRAS* positive and negative individuals. Though *KRAS* status does not appear to impact prognosis, it should be considered when deciding between lobectomy or sublobar resection given the propensity for synchronous lesions in the same lobe.

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Impact of perioperative fluid administration on postoperative adverse events following thoracic oncologic surgery. ***N. Ahmadi, S. Sundaresan, P. Villeneuve, D. Maziak, F. Shamji, S. Gilbert, A. Seely*****. From the University of Ottawa, Ottawa, Ont.**

Some studies have advocated strict perioperative fluid regimens to prevent postoperative adverse events (AEs); however, the importance of this approach in pulmonary versus gastroesophageal resection remains controversial. The aim of this study was to evaluate perioperative fluid administration patterns in thoracic oncology patients, to assess the association between perioperative fluid administration rate and postoperative AEs following anatomic pulmonary and foregut resection for cancer. This is a retrospective cohort study with prospective AE collection of patients undergoing lung and foregut resections for malignancy at a single institution from June 2015 to July 2016. Total intravenous fluid administered to the patients in the operating room was calculated. Multivariate logistic regression analysis was used to adjust for incision type, gender, age, body mass index and comorbidities. Of 347 oncological resections during the study period, 194 (56%) lung resections (lobectomy, segmentectomy and pneumonectomy) and 50 (14%) foregut resections (esophagectomy and gastrectomy) were performed. Pneumonectomy patients received the

least amount of fluid, with a median rate of 2.6 mL/kg/h (IQR 1.7–4.6), followed by segmentectomy at 3.5 mL/kg/h (2.5–5), lobectomy at 4.0 mL/kg/h (2.8–5.3), gastrectomy at 5.0 mL/kg/h (4.0–5.5) and esophagectomy at 5.3 mL/kg/h (4.1–6.9). Lung resection patients who developed postoperative pulmonary and cardiac AEs received significantly higher rates of fluids (5.5 mL/h/kg v. 4.2 mL/h/kg, p = 0.04; 6.0 mL/h/kg v. 4.3 mL/h/kg, p = 0.03). In patients undergoing foregut resections, there was no association between fluid administration rate and incidence of postoperative AEs, including anastomotic events. In lung resection patients, multivariable analysis demonstrated increased odds of incidence of pulmonary AEs (OR 1.32, p = 0.09) and cardiac AEs (OR 1.35, p = 0.08) with increased perioperative fluid administration. Over 1 year in 1 centre, we observed a wide range of perioperative fluid administration practices in patients undergoing thoracic oncologic resection. Albeit limited by potential confounders, we observed an association between increased perioperative fluid administration and postoperative cardiac and pulmonary AEs in patients undergoing major lung but not foregut resections, supporting the view that different fluid administration approaches may be appropriate in these 2 distinct populations.

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Multidisciplinary simulation of primary tracheal anastomosis and cross-field ventilation — scenario development and feasibility assessment. ***P. Villeneuve*** **(University of Ottawa, Ottawa, Ont.),** ***Y. Frechette*** **(University of Sherbrooke, Sherbrooke, Que.),** ***P. Rao*** **(University of Ottawa, Ottawa, Ont.),** ***S. Moffett*** **(University of Ottawa, Ottawa, Ont.),** ***Y. Gu*** **(University of Ottawa, Ottawa, Ont.),** ***K. Tardioli*** **(University of Ottawa, Ottawa, Ont.),** ***M. Chiu*** **(University of Ottawa, Ottawa, Ont.).**

Tracheal resection and primary anastomosis is a relatively uncommon procedure. Team-based, high-fidelity simulation is an ideal way to teach and maintain the technical and nontechnical skills needed during critical periods of this procedure. The surgical and anesthetic management is technically demanding, requiring a high level of collaboration and communication between the surgical and anesthesiology teams. We developed a scenario that incorporated a technically challenging surgical task with the complex airway management decision-making. Tasks and objectives for learners were linked to Royal College objectives of training and CanMEDS roles (Medical Expert, Collaborator, Professional and Communicator). The scenario was developed by experts from thoracic surgery, thoracic anesthesia and medical education/simulation. The scenario was 12 minutes, with a 30-minute debrief discussing technical and nontechnical aspects of the learners' performance. The scenario involved 2 concurrent tasks: (1) end-to-end anastomosis of a porcine trachea, emphasizing surgical technique, and (2) management and troubleshooting of oxygen desaturation following 3 successive periods of apnea and cross-field ventilation, emphasizing anesthetic management and team communication. The physical model consisted of a transected porcine trachea, draped as a surgical field, laid on top of the Laerdal SimMan. Learners filled out pre- and postscenario questionnaires scored on a 5-point Likert scale, related to the familiarity of the techniques of tracheal anastomosis and cross-field ventilation. Mean scores increased (from 2.5 to 3) with regards to familiarity and comfort with the technique. Trainees strongly agreed (5) that the simulation was relevant to their practice, that it was realistic, and that they gained knowledge and confidence from participating in the session. This scenario highlights the utility of high-fidelity simulation for learning techniques of primary tracheal anastomosis and cross-field ventilation and for practice of nontechnical crisis resource management skills and confirms the feasibility of the scenario. Future studies will assess how this translates into the real clinical environment.

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Feasibility, safety and added margin length of near-infrared fluorescence guided robotic pulmonary segmentectomy for early-stage lung cancer: a phase I study. ***W. Hanna*** **(McMaster University, Hamilton, Ont.),** ***C. Fahim*** **(McMaster University, Hamilton, Ont.),** ***K. Yasufuku*** **(University of Toronto, Toronto, Ont.),** ***T. Waddell*** **(University of Toronto, Toronto, Ont.),** ***Y. Shargall*** **(McMaster University, Hamilton, Ont.).**

Pulmonary segmental resection (segmentectomy) is a challenging operation due to the difficulty in identifying intersegmental planes within a single pulmonary lobe. We evaluated the safety, feasibility and added value of a novel operative technique that utilizes near-infrared fluorescence (NIF) with indocyanine green (ICG) dye to clearly delineate intersegmental planes and facilitate pulmonary segmentectomy. Patients older than 18 years presenting with T1aN0 non–small cell lung cancer confined to 1 bronchopulmonary segment were eligible to participate in this prospective phase I study. The tumour-containing target segment was first isolated from blood supply by division of the segmental vein, artery and bronchus. Then the "predicted" intersegmental plane was marked with cautery. An ICG bolus of 25 mg was injected systemically, allowing the entire lung to fluoresce, except for the target segment, which remained dark. The "true" intersegmental plane was then identified as the line between the fluorescent and dark parenchyma. The operation was concluded if the excised segment contained the tumour with clear margins; otherwise, the patient received a completion lobectomy. The procedure was successful if the patient scored 7/7 on a predefined evaluation scale. The distance between the "true" versus "predicted" intersegmental plane was measured to determine the added margin length achievable by NIF. Descriptive statistics were generated. Ten patients have been enrolled in this study to date (expected n = 30 by September 2017). Median tumour size was 1.6 cm (SD 0.68 cm). Two patients (2/10, 20%) proceeded directly to lobectomy. Eight patients (8/10, 80%) underwent an NIF-guided procedure, with 7/8 (88%) successfully completing a segmentectomy and 1/8 (13%) proceeding to completion lobectomy for positive margins. The median added margin length was +2.2 cm (range 1.3–3.0). Median hospital stay was 4 days (range 2–6). There were no deaths or complications greater than grade II. NIF can enhance the visualization of intersegmental planes, allowing for easier segmentectomy with added margin length.

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Preliminary results of a national survey on the current treatment practices of empyema. ***A. Laliberté*** **(University of Toronto, Toronto, Ont.),** ***C. McDonald*** **(University of Toronto, Toronto, Ont.),** ***K. Yasufuku*** **(University of Toronto, Toronto, Ont.),** ***T. Waddell*** **(University of Toronto, Toronto, Ont.),** ***B. Kidane*** **(University of Manitoba,**

Winnipeg, Man.), *Y. Hasnain* (University of Toronto, Toronto, Ont.).

Treatment of empyema involves multiple approaches, including tissue plasminogen activator (TPA), DNAse and decortication. The purpose of this study was to assess practices and beliefs among Canadian thoracic surgeons regarding empyema. A national survey was sent by email to 140 members of the Canadian Association of Thoracic Surgeons using a modified Dillman method. Criteria for empyema diagnosis, treatment, and treatment response were evaluated. There were 44 respondents. The majority were male (n = 34, 79.1%) and working at university teaching hospitals (n = 37, 84.1%). Forty-three respondents consider a CT scan to be the imaging modality of choice for empyema. Initial treatment approach was as follows: video-assisted thoracoscopic (VATS) decortication (n = 9/41, 22%), open decortication (n = 2/41, 4.9%), intrapleural TPA alone (n = 14/41, 35%) and a combination of intrapleural TPA and DNAse (n = 15/41, 37.5%). Reasons for adopting a primary surgical approach were as follows: most effective (n = 5/5), more cost effective (n = 3/5) and fibrinolytic therapy may work but it takes too much time (n = 3/5). The 2 most common doses of TPA used are 4 mg (n = 13/37, 35.1%) and 10 mg (n = 9/37, 24.3%) daily for 3 days. Most respondents used a combination of clinical and radiological improvement to evaluate treatment success (n = 35/38, 92.1%). Lung expansion (n = 38/38, 100%) and reduction in the area of opacity between 60% and 70% at the CT scan (n = 19/36, 52.8%) were considered to be markers of significant improvement. Need for decortication (n = 10/17, 58.8%) was considered to be the best outcome measure. The most common indications of decortication were trapped lung (n = 31/37, 83.7%), poor radiological improvement after 3 days (n = 27/37, 73%) and no clinical improvement after 3 days (n = 23/37, 62.2%). This survey demonstrates heterogeneity in the attitudes and approaches to treatment of empyema among Canadian thoracic surgeons. The most common TPA dose (4 mg) used is not described in the available literature. There is no clear consensus among respondents. More studies are needed to investigate practice patterns and their driving factors.

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A qualitative analysis of barriers to preoperative aerobic conditioning in the thoracic surgery population. *D. Hylton, W. Hanna, C. Finley, Y. Shargall, C. Fahim*. From McMaster University, Hamilton, Ont.

Postoperative pulmonary complications (PPC) are common and serious complications of thoracic surgery. It is thought that preoperative aerobic conditioning (PAC) through exercise may reduce the incidence of PPC in the thoracic surgery population, which is characteristically older, comorbid and engages in unhealthy behaviours like smoking and lack of exercise. These factors have not been considered in the design of existing PAC trials, leading to high attrition rates, underpowered analyses and noninformative conclusions. In preparation for a pragmatic prospective trial on PAC, we sought to identify patient barriers to participation in PAC programs. Semistructured interviews were conducted with patients who underwent lung resection between January and September 2016. A 14-item interview guide was developed to evaluate trends in aerobic exercise and assess barriers to participation in PAC programs. Interviews were audiotaped and transcribed verbatim. Two researchers analyzed the transcripts using a grounded theory approach to identify emergent themes. Descriptive statistics were generated. Over 200 minutes were transcribed from 21 participants. Common barriers to PAC included pain and limited mobility (11/21, 52.4%) and lack of motivation (14/21, 66.7%). Qualitative content analysis indicated that patients who exercise periodically demonstrate more interest in a PAC program than those who do not exercise or those who exercise regularly. Participants highlighted family support, surgeon encouragement and intrinsic drive as sources of motivation toward PAC. When asked, 85.7% (18/21) of participants were agreeable to using a wearable activity tracker as part of a home-based PAC program. In the thoracic population, a successful PAC program must be tailored to participants' baseline level of exercise and should be designed using behaviour modification theory to address barriers related to lack of motivation. These findings will be used to design a pragmatic, patient-informed, prospective trial to assess the impact of PAC using wearable technology in the thoracic population.

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Chest wall reconstruction with sternal allograft: report of 2 cases. *F. Sadegh Beigee, A. Abbasi Dezfouli, K. Sheikhy*. From Shahid Beheshti University of Medical Sciences, Tehran, Iran.

Radical resection of the sternum is indicated in different situations, such as primary and secondary malignant tumours or benign neoplasms. In most cases surgical resection of a sternal lesion is not problematic, but reconstruction of this part of the chest wall is challenging for most thoracic and reconstructive surgeons. In this group of patients, reconstruction of the chest wall is very important for prevention of flail chest and ventilation impairment. Cosmetic issues must also be considered. Two patients were referred to our centre with a sternal tumour. The first case was a 20-year-old female with a sternal aneurysmal bone cyst and the second one was a 5-year-old girl with a sternal hemangioma. In both cases complete resection of the sternum was required, and after resection, reconstruction was done by sternal allograft prepared from cadaveric donors. Follow-up was 22 and 3 months. There was no need for mechanical ventilation assistance after surgery. Both cases were extubated in the operation room. There was no flail chest, displacement or infection in follow-up. Cosmetic result was achieved. Sternal and rib allografts are good choices for chest wall reconstruction. Their superiority to current materials is that they have natural properties close to native bone, offer the chance of neovascularization and are associated with no danger of infection and rejection.

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Our experience with treatment of idiopathic laryngotracheal stenosis. *F. Sadegh Beigee, K. Sheikhy, A. Daneshvar kakhaki, S. Pojhan, S. Saghebi, M. Shadmehr, A. Abbasi Dezfouli*. From the Shahid Beheshti University of Medical Sciences, Tehran, Iran.

Resection-anastomosis (RA) and nonresectional interventions (NRI) are the current treatments for idiopathic laryngotracheal stenosis (ILTS). RA can lead to a permanent cure, with the risk of

damaging the vocal cords or the need for a tracheostomy. On the other hand, NRI require repeat interventions and do not cure the patient. We present our experience with the treatment of this disease. Patients included in this study are those whom we treated between 1996 and 2016 with a diagnosis of ILTS. Two types of treatment were included: RA or NRI. The surgery was performed by resection of the stenotic area, anterior arc of cricoid cartilage, and anastomosis of the trachea to the thyroid and cricoid cartilages. If stenosis remained in the subglottic area after resection of the anterior arc, posterior cricoidotomy was done followed by insertion of an autologous rib cartilage within the cricoidotomy. NRI included repeated dilatation depending on the patient's symptoms, with or without laser and insertion of a T or tracheostomy tube in some patients. Results of treatment were rated as good, acceptable or failure. Data were analyzed using Mann–Whitney and Fisher's exact tests. An $\alpha < 0.05$ was significant. Twenty-seven patients were women and 3 were men. Average age was 34 years. Symptoms included dyspnea on exertion in 28 patients and resting dyspnea in 22. Sixteen patients were treated with RA and 14 with NRI. In 3 patients, posterior cricoidotomy was performed. In the RA group, results were good in 14 patients, acceptable in 1 and failure in 1. In the NRI group, results were good in 8 patients and failure in the remaining patients. According to Fisher's exact test, the difference in the results between the 2 types of treatment was significant ($p < 0.05$). RA had better results than NRI, even though in some patients good results were also achieved by NRI.

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All patients with a giant hiatal hernia require referral to a surgeon. ***A. Ednie*, *D. French*. From Dalhousie University, Halifax, N.S.**

A giant hiatal hernia is defined as having greater than 50% of the stomach herniated into the chest. Giant hernias have an increased risk of gastric volvulus causing acute gastric obstruction and strangulation. Controversy exists regarding surgical intervention for asymptomatic giant hiatal hernias. The goals of this study are to determine the incidence of giant hiatal hernias found on computed tomography (CT) and the number of these patients referred for surgical assessment and/or needing emergent surgical intervention. A diagnostic imaging database for the health district was searched from January 2010 to January 2015. Surgical interventions, emergency department (ED) encounters and surgical referrals were reviewed using personal health records. A total of 357 213 CT chest/abdomen reports were searched, yielding 388 patients reported to have a diaphragmatic hernia. Hiatal hernias were identified in 185 patients (50.2%). Type III and IV hiatal hernias were reported in 75 patients (40%), including 30 (16.2%) giant hernias. Type IV hernias had the highest percentage of ED visits (36.4%). However, only 5 (6.7%) patients with type III and IV hernias were referred for surgical assessment. Five (16.7%) patients with a giant hiatal hernia required emergent repair compared with no patient with a non-giant hernia ($p < 0.001$). However, only 4 (13.3%) patients with a giant hiatal hernia were referred for elective surgical assessment. Congenital and type I hiatal hernias make up the majority of diaphragmatic hernias. ED encounters and need for emergent surgical intervention were highest among type III and IV hiatal hernias. Patients with a giant hiatal hernia are at increased risk for needing emergent surgery. Patients with type III and IV hernias, and especially those with a giant hiatal hernia, should be referred for surgical assessment because of an increased risk of needing emergent surgical intervention.

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Lung cancer and circulating microRNAs: a cohort risk score analysis. ***E. Bedard*, *J. Gyoba*, *W. Roa*, *L. Guo*, *S. Ghosh*. From the University of Alberta, Edmonton, Alta.**

Screening high-risk populations for lung cancer using CT scans has recently been recommended in Canada despite its high false-positive findings. Biomarkers, such as circulating microRNAs (miRNAs), may allow improved accuracy in these patients. miRNAs are small, noncoding strands of RNA shown to lead to carcinogenesis when dysregulated. They have been shown to be stable in various biofluids and detectable in small quantities and thus are promising biomarkers. We hypothesized that analysis of plasma using a panel of miRNAs would be able to distinguish cases of non–small cell lung cancer (NSCLC) (pre- and postoperative) from controls. We examined the expression of a panel of 4 miRNAs (miR-21, 155, 210 and 223) in blood plasma in 64 NSCLC specimens (before and 4–7 months after resection) versus plasma from 110 controls. Cases were stage I/II NSCLC, and both cases and controls had similar age, gender and smoking history. Case samples were obtained from tumour bank specimens and controls from Alberta's Tomorrow Project. miRNA was isolated and quantified via RT-PCR using *Caenorhabditis elegans* miR-39 as an endogenous control. A combined risk score (CRS) of the patients' risk of lung cancer was developed through binary logistic regression (SPSS version 15). Risk categories were determined by receiver operating characteristic (ROC) curves based on the sensitivity and specificity. Comparing preoperative cases to controls, there was a significant difference (OR 3, $p = 0.003$) when the CRS was dichotomized at –0.4169 into high- and low-risk categories (sensitivity 81%, specificity 41%, area under the curve [AUC] 72.3%). When comparing case postoperative samples to controls, the CRS was dichotomized at –0.3255 (sensitivity 77%, specificity 41%, AUC 67%), resulting in a significant difference (OR 2.3, $p = 0.023$). There was no significant difference between the preoperative and postoperative samples. miRNAs have the potential to act as noninvasive biomarkers to assist in the early detection of lung cancer in high-risk populations.

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Predictors of 90-day readmission following resection for esophageal cancer. ***V. Gupta* (University of Toronto, Toronto, Ont.), *B. Kidane* (University of Manitoba, Winnipeg, Man.), *G. Darling* (University of Toronto, Toronto, Ont.), *N. Coburn* (University of Toronto, Toronto, Ont.).**

A high proportion of patients undergoing resection for esophageal cancer are readmitted. We sought to identify factors predictive of readmission within 90 days of hospital discharge after esophagectomy. A population-based retrospective cohort study using linked health administrative data in Ontario included patients over 18 years undergoing surgery for adenocarcinoma or squamous cell esophageal or esophagogastric junction cancer between 2002 and 2015. Factors associated with patients (age, sex, histology, comorbidity burden [number of Hopkins Aggre-

gated Diagnosis Groups], length of stay in hospital and intensive care unit, income, rural residence, medical frailty, discharge disposition) and systems (treatment at designated thoracic centre, local health integration network [LHIN] of treatment, era of treatment [2002–2008 v. 2009–2014]) were examined using multivariable logistic regression for their association with 90-day readmission. Of 3670 patients included in the study, average age was 63.6 ± 11.1 years, 23% were female (n = 853), 85% had adenocarcinoma (n = 3106), 58% had surgery at a designated thoracic centre (n = 2133) and 28% were readmitted within 90 days (n = 1016). Median hospital length of stay was 12 days (IQR 9–20). On multivariable analysis, female sex (OR 1.23, 95% CI 1.04–1.47, p = 0.019), high comorbidity burden (OR 1.48, 1.17–1.87, p = 0.001) and hospital stay greater than 21 days (OR 1.90, 1.51–2.38, $p < 0.0001$) were independent predictors of 90-day readmission. No other factors (including surgery at a designated thoracic centre and LHIN of treatment) were independently associated with readmission. We found a 28% 90-day readmission rate following esophageal resection for esophageal cancer. Readmission rates did not vary across LHINs. Surgery at a thoracic centre did not appear to reduce the risk of readmission. Highly comorbid patients are at increased risk of readmission; further research is needed to determine if increased supports for these patients reduce readmission rates.

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Is there a role for curative-intent multivisceral resections for clinical T4b esophagogastric adenocarcinomas? *J. Molina Franjola, A. Al-Hinai, A. Gosselin-Tardif, D. Mulder, J. Spicer, C. Mueller, L. Ferri.* From the McGill University Health Centre, Montreal, Que.

For clinical T4b tumours with adhesion to adjacent organs, a multivisceral en bloc resection is required to achieve R0. However, the oncologic benefit of such major operations has been brought into question, particularly given a perceived unacceptable morbidity for patients with such high disease burden. We thus sought to investigate the surgical and oncologic outcomes of en bloc multivisceral resections for locally advanced gastric and esophagogastric junction (EGJ) carcinomas. A prospective North American institutional upper GI cancer database was queried from 2005 to 2015. Out of 515 patients who underwent resection for EGJ and gastric cancer, we identified the curative intent en bloc resection of adjacent organs for cT4b lesions. Primary outcomes were perioperative complications, mortality and overall survival. Cox proportional hazards model and multivariate logistic regression were used. Data are presented as medians (IQR). Thirty-five patients were included. The most common resected organs were the pancreas (17, 49%), spleen (12, 34%) and liver (10, 29%). More than 1 organ other than stomach/esophagus was resected in 15 (43%). Although all tumours were adherent to resected organs, only 14 (42%) had confirmed organ invasion (pT4b). R0 resection rate was 94% (33). Eighty percent (28) had lymph node involvement with a high nodal disease burden (positive/resected lymph nodes = 9 [2–14]/33 [19–47]). Postoperative complications occurred in 16 (46%), 10 of which were Clavien–Dindo > 2 (anastomotic leak [3, 9%], duodenal stump and pancreatic leak [3, 9%]). Length of stay was 10 days (7–20) and 90-day mortality was 0%. One-, 3- and 5-year survival was 82%, 47% and 31%. On multivariate analysis, tumours greater than 7 cm, lymph-node involvement and residual tumour after resection were independently associated with lower survival. Multivisceral resections for esophagogastric cancer can achieve good long-term survival and are associated with an acceptable morbidity. R0 resection should remain the ultimate goal for the curative-intent treatment for locally advanced gastric and EGJ carcinomas even if the tumour is adherent to adjacent organs.

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Feasibilty and safety of ultra-fast track pathway for video-assisted thoracoscopic lobectomy. *J. Molina Franjola, T. Dumitra, J. Mouhana, I. Nicolau, D. Mulder, L. Ferri, J. Spicer.* From the McGill University Health Centre, Montreal, Que.

Video-assisted thoracoscopic (VATS) lobectomy has demonstrated several benefits over open surgery. The purpose of this study was to assess the feasibility and safety of short admissions for VATS lobectomy before implementation of an ultra-fast track pathway. All patients who underwent VATS lobectomy at our institution from 2006 to 2016 were retrospectively reviewed (n = 205). Clinicopathologic variables were collected along with perioperative outcomes. Patients discharged within 24 hours (LOS1) were compared with those discharged on day 2 or later (LOS2+). Statistical analysis was done using χ^2 and t tests. Multivariate logistic regression was performed to identify predictors of LOS. Perioperative 30-day mortality for our cohort was 0% and the major complication rate (Clavien–Dindo III–IV) was 8.3%. The median LOS was 3 days (IQR 2). In total 102 (48.9%) patients were discharged within 48 hours, and 34 within 24 hours (LOS1 16.6%). None of these patients required readmission (5.3% for LOS2+, p = 0.17). LOS1 proportion increased in 2016 compared with previous years (25.8% v. 12.05%, p = 0.05). Few differences existed between LOS1 and LOS2+ patients. Univariate analysis showed that LOS2+ was associated with longer chest tube duration (OR 4.9, 95% CI 0.2–11.2, $p < 0.001$), higher clinical (OR 13.5, 95% CI 1.8–101, p = 0.011) and pathological stage (OR 3.9, 95% CI 1.1–13.5, p = 0.035), presence of surgical complications (OR 25.2, 95% CI 3.4–188, p = 0.002), operative time > 120 minutes (OR 2.4, 95% CI 1.05–5.4, p = 0.04) and air leak (OR 26, 95% CI 1.6–438, p = 0.02). Age, pulmonary function, smoking status and distance from the treatment centre were not associated with LOS. On multivariate analysis, longer chest tube duration (OR 2.9, 95% CI 1.1–8.1, p = 0.04), clinical stage (OR 7.7, 95% CI 1.3–45, p = 0.02) and surgical complications (OR 17.9, 95% CI 1–327, p = 0.05) were significant predictors of LOS2+. A significant proportion of patients can be discharged safely within 24 hours after VATS lobectomy. The only preoperative factor that predicts shorter LOS in our cohort is clinical stage. Thus, most patients can safely be enrolled in an ultra-fast track VATS lobectomy pathway.

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Incentive spirometry with physiotherapy versus physiotherapy alone for the prevention of postoperative pulmonary complications after lung resection: a randomized controlled trial. *P. Malik* (McMaster University, Hamilton, Ont.), *C. Fahim* (McMaster University, Hamilton, Ont.), *J. Vernon*

(University of Toronto, Toronto, Ont.), *P. Thomas* (McMaster University, Hamilton, Ont.), *C. Finley* (McMaster University, Hamilton, Ont.), *C. Schieman* (University of Calgary, Calgary, Alta.), *Y. Shargall* (McMaster University, Hamilton, Ont.), *F. Farrokhyar* (McMaster University, Hamilton, Ont.), *W. Hanna* (McMaster University, Hamilton, Ont.).

Incentive spirometry (IS) is believed to be useful in reducing rates of postoperative pulmonary complications (PPC), the most common cause of morbidity after lung resection. However, this has yet to be established using high-quality evidence. The objective of this trial is to evaluate whether the addition of IS to standard physiotherapy after lung resection leads to a reduction in the rate of PPC when compared with standard physiotherapy alone. A single-blind, parallel, randomized controlled trial was conducted at a tertiary centre for thoracic oncology. Eligible participants were adults undergoing lung resection, who had never had lung surgery and who were not on home oxygen. After surgery, participants were randomized to receive either routine physiotherapy care (control arm, PH), consisting of deep breathing and shoulder exercises, or routine physiotherapy in addition to IS (intervention arm, PH/IS). The primary outcome was incidence of PPC within 30 days after lung resection. Student's t test was used for continuous variables and χ^2 for categorical variables, with a $p < 0.05$ level of significance. The trial was powered to detect a 10% difference in the primary outcome. Intention-to-treat analysis was performed. A total of 389 participants (n = 194 PH, n = 195 PH/IS) were randomized between August 2014 and March 2017. Baseline characteristics were comparable in both arms. There were no significant differences in history of chronic obstructive pulmonary disease (PH = 29.4%, PH/IS = 27.7%, p = 0.71) or smoking status (PH = 29.9%, PH/IS = 30.1%, p = 0.85). The majority of patients underwent a pulmonary lobectomy (PH = 60.1%, PH/IS = 59.5%, p = 0.79). There were no significant differences in those who developed PPC at 30 days (PH = 18%, PH/IS = 14.7%, p = 0.38), pneumonia (PH = 7.7%, PH/IS = 4.6%, p = 0.20), mechanical ventilation (PH = 1.0%, PH/IS = 2.1%, p = 0.41), home oxygen (PH = 15%, PH/IS = 13.8%, p = 0.76), hospital length of stay (PH = 4.79 days, PH/IS = 5.03 days p = 0.59), or readmission to hospital (PH = 9.8%, PH/IS = 10.3% p = 0.89). The addition of IS to standard postoperative physiotherapy does not reduce the rate of PPC after lung resection.

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Idiopathic subglottic stenosis: outcomes with or without the use of protective tracheostomy in single-stage cricotracheal resection. ***V. Cheung, G. Gelfand, S. McFadden, J. Bosch*. From the University of Calgary, Calgary, Alta.**

Idiopathic subglottic stenosis can be treated successfully with single-stage cricotracheal resection and reconstruction. Practice varies on the use of a temporary protective tracheostomy at the time of surgery to mitigate the risk of airway obstruction from postoperative laryngeal edema. Benefits of a protective tracheostomy include airway protection and improved secretion clearance, but with potential complications associated with the tracheostomy. The effects of a protective tracheostomy on outcomes are unclear, and the subject of this study. A retrospective single-institution review of patients who underwent a cricotracheal resection with or without a protective tracheostomy from Jan. 1, 1994, to Aug. 31, 2015, is underway. Postoperative complications, recurrence of stenosis and postoperative course will be evaluated for both groups. Follow-up is 2 years. Preliminary results from patients operated on between Jan. 1, 2007, and March 30, 2015, included 7 patients without a protective tracheostomy and 21 patients with a protective tracheostomy. A similar number of patients have been identified but not fully analyzed for the remaining time period. From the preliminary analysis, the rate of postoperative complications in both groups was 29%. The rate of stenosis recurrence was greater in the group without tracheostomy (43% v. 0%). Hospital length of stay was similar (10.7 v. 11.9 days), but duration of stay in the intensive care unit (ICU) was shorter in the tracheostomy group (4.1 v. 1.3 days). It is hypothesized that when all the cases have been reviewed, there will not be an increased rate of complications or restenosis, and a shorter ICU stay in the tracheostomy group. The final results will be available shortly and final analysis will be performed.

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Prognostic role of positive circumferential resection margins after curative-intent surgery for locally advanced esophageal adenocarcinoma. ***J. Molina Franjola, E. Di Lena, C. Huynh, J. Spicer, D. Mulder, C. Mueller, L. Ferri*. From the McGill University Health Centre, Montreal, Que.**

There is controversy regarding the prognostic role of positive circumferential resection margins (CRM) after esophagectomy. The aim of this study is to evaluate the influence of positive CRM on local recurrence and survival outcomes after esophagectomy. A prospective esophageal database from a North American referral centre was queried. Patients with curative-intent resections of locally advanced adenocarcinoma (T3/4, any N) were included. Demographic, perioperative and oncologic outcomes were assessed. We employed and compared 2 definitions of CRM: that of the College of American Pathologists (CAP: cancer cells at margin) and that of the Royal College of Pathologists (RCP: < 1 mm from margin). Primary outcomes were overall survival (OS) and local recurrence. Data are expressed as median (range). The Kaplan–Meier method and Cox proportional hazard model were used. Of 517 patients in the database from 2005 to 2015, 174 met the inclusion criteria; 140 were male (80%). Seventy-four percent received neoadjuvant therapy (93% chemotherapy). Tumour size was 4.5 cm (range 0.9–15) and lymph node harvest was 34 (23–44), 6 (1–9) of which were positive. CRM+ was found in 7/174 (4%) by CAP and 42/135 (31%) by RCP. Mean follow-up for the whole cohort was 23 (range 1–121) months, and 79/174 patients (45%) developed recurrence, only 9 (5%) of whom had local recurrence. CRM status, irrespective of definition, did not predict recurrence patterns as only 1/7 (14%) CAP+ and 2/56 (4%) RCP+ developed local recurrence. Estimated OS was not significantly impacted by RCP+ (45 v. 44 months, NS) nor CAP+ (40 v. 25 months, NS); however, no CAP+ patients survived > 25 months.

Neoadjuvant (HR = 0.6) and adjuvant (HR = 0.5, $p < 0.05$) therapy and lymph-node positivity (LN+, HR = 2.3, $p < 0.05$) predicted OS. None of the variables studied affected local recurrence, including CRM status. Positive CRM is not associated with an increased risk of local recurrence after esophagectomy for adenocarcinoma regardless of CRM definition, although CAP+ resulted in a decrease in OS, suggesting that it might be a marker of advanced disease.

Canadian Hepato-Pancreato-Biliary Association (CHPBA)

01

Laparoscopic approaches to the duodenum. ***S. Jayaraman*. From the University of Toronto, Toronto, Ont.**

The duodenum poses challenges in laparoscopic surgery due to its anatomic location. This video highlights laparoscopic approaches to the duodenum and particularly introduces the medial trans-mesenteric approach to the duodenum.

02

Laparoscopic redo cholecystectomy. ***S. Jayaraman*. From the University of Toronto, Toronto, Ont.**

Subtotal cholecystectomy is a safe method for performing laparoscopic cholecystectomy in the face of severe inflammation in the cystohepatic triangle. In rare cases, new stones and new symptoms may occur due to the remnant gallbladder. This video highlights the laparoscopic management of recurrent biliary colic in a morbidly obese patient with a remnant gallbladder after subtotal cholecystectomy.

03

Three-point transfusion risk score in hepatectomy: an external validation from the American College of Surgeons' National Surgical Quality Improvement Program (ACS NSQIP). ***M. Lemke*, *A. Mahar*, *P. Karanicolas*, *N. Coburn*, *C. Law*, *J. Hallet*. From the University of Toronto, Toronto, Ont.**

A three-point transfusion risk score (TRS) was previously developed to predict risk of perioperative red blood cell transfusions (RBCT) for patients undergoing hepatectomy. The TRS considers only 3 factors: preoperative anemia (hemoglobin ≤ 125 g/L), major liver resection (≥ 4 segments) and primary liver malignancy. The objective of this project was to externally validate the TRS to predict receipt of RBCTs for patients undergoing hepatectomy. Transparent reporting of a multivariable prediction model for individual prognosis or diagnosis (TRIPOD) guidelines were followed. A validation cohort (VC) was created with the 2014 hepatectomy ACS NSQIP data set. Characteristics of the VC and development cohort (DC) were compared. Risk groups for RBCT within 72 hours of surgery were created using anemia (hematocrit ≤ 36%), major liver resection (≥ 4 segments) and primary liver malignancy according to the TRS. The association between TRS variables and RBCT was examined with univariable logistic regression. Area under the receiver operating characteristic curve (AUROC) assessed discrimination. Hosmer–Lemeshow test for goodness of fit assessed calibration. Of 3064 hepatectomies in VC, 18.9% received RBCT compared with 23.3% in DC. The TRS stratified patients from low (8.5%) to very high risk (40.6%) of RBCT. All TRS variables were independently associated with RBCT in VC and DC. The final TRS was associated with RBCT in VC (OR 2.23; 95% CI 1.99–2.51) and DC (OR 2.29; 95% CI 1.92–2.73). AUROC was 0.68 (95% CI 0.66–0.70) in VC compared with 0.66 (95% CI 0.63–0.69) in DC. Hosmer–Lemeshow test and calibration curves supported good predictive performance of the model in VC. The TRS adequately discriminated risk of RBCT in an external sample of patients undergoing hepatectomy. It provides a simple method to identify preoperatively patients at high transfusion risk. Tailored patient blood management initiatives can be used to reduce the use of RBCT.

04

Reducing repeat imaging in hepatico-pancreatico-biliary cancer care through shared diagnostic imaging repository. ***J. Hallet*** **(Sunnybrook Health Sciences Centre, Toronto, Ont.),** ***N. Coburn*** **(Sunnybrook Health Sciences Centre, Toronto, Ont.),** ***A. Alberga*** **(Institute for Clinical Evaluative Sciences, Toronto, Ont.),** ***L. Fu*** **(Institute for Clinical Evaluative Sciences, Toronto, Ont.),** ***S. Tharmalingam*** **(Canada Health Infoway, Toronto, Ont.),** ***C. Law*** **(Sunnybrook Health Sciences Centre, Toronto, Ont.).**

With regionalization of cancer services, patients often undergo treatment in institutions other than where the initial investigation is conducted. The hospital diagnostic imaging repository services (HDIRS) facilitate electronic sharing of imaging. We assessed the impact of HDIRS on processes of care and outcomes of hepatopancreatico-biliary (HPB) cancer surgery. We conducted a retrospective cohort study linking administrative data sets at the Institute for Clinical Evaluative Sciences. We included HPB cancer patients operated at a tertiary cancer centre (2003–2014). HDIRS and non-HDIRS groups were based on where initial imaging (CT or MRI within 6 months of surgical consultation) was conducted. Outcomes were repeat imaging before surgery, divided into same (e.g., repeat CT after initial CT) and different modality (e.g., repeat CT after initial MRI), wait time for surgery from initial imaging and surgical consultation, 90-day postoperative morbidity and overall survival. Univariate and multivariate analyses examined the association between HDIRS and outcomes. Of 839 patients, 474 (56.5%) were from HDIRS institutions. HDIRS had lower use of repeat imaging overall (57.6% v. 76.2%; $p < 0.01$). Median wait time to surgery from initial imaging (64 v. 79 days; $p < 0.01$) and surgical consultation (39 v. 45 days; $p = 0.046$) was shorter for HDIRS. Postoperative morbidity and survival did not differ. After adjusting for demographic, social and clinical factors, HDIRS had lower odds of repeat imaging (OR 0.22 [0.15–0.33]), whether same (OR 0.43 [0.30–0.60]) or different modality (OR 0.65 [0.46–0.93]). Repeat imaging using the same modality and the same protocol was less likely for HDIRS (OR 0.45 [0.32–0.64]). Imaging sharing with HDIRS significantly reduced repeat cross-sectional imaging for HPB cancer surgery, including repeat imaging with the same protocol, which is less likely to add information. It shortened wait time to surgical

care. HDIRS could improve quality and efficiency of care. Future studies should focus on patient and provider experience.

05

3D segmentation as a surgical planning tool for residents in liver resection surgery. *C. Yeo* (Queen's University, Kingston, Ont.), *A. MacDonald* (Queen's University, Kingston, Ont., and University of Alberta, Edmonton, Alta.), *T. Ungi* (Queen's University, Kingston, Ont.), *A. Lasso* (Queen's University, Kingston, Ont.), *D. Jalink* (Queen's University, Kingston, Ont.), *G. Fichtinger* (Queen's University, Kingston, Ont.), *S. Nanji* (Queen's University, Kingston, Ont.).

Liver surgery requires identification of tumour(s) in relation to key vessels to preserve healthy tissue while obtaining negative margins. Current methods of surgical planning rely on interpreting and mentally reconstructing 2D CT/MR images. This creates significant cognitive loading for learners as it relies on mental 3D reconstruction, anatomic and surgical knowledge, spatial sense, and experience. The objective of this study is to determine if 3D segmentation improves resident ability to devise appropriate liver resection plans. Senior general surgery residents were recruited. Preoperative CT/MR images were selected if they reflected actual surgeries performed. Half the images were segmented to create interactive digital 3D models. Residents were asked to devise surgical plans for case-matched 2D and 3D models in an alternating, randomly generated order. The primary outcome was correct preoperative plan based on actual surgery performed, with consensus from 2 hepatobiliary surgeons. The secondary outcome was time (seconds) to devise plan. Planning data were analyzed using the Wilcoxon test, and time was analyzed using a paired *t* test. Fourteen senior residents from our institution participated. The average correct response was 1.7 of 5 (34%; range 1 to 4) for the 2D group and 3.1 of 5 (62%; range 0 to 4) for the 3D group ($p < 0.01$). The average time to complete each plan was 156 ± 107 s for the 2D group and 84 ± 73 s for the 3D group ($p < 0.01$). The results show that 3D segmentation increases the accuracy of surgical planning and decreases the amount of time required. 3D segmentation is useful as a teaching tool as it reduces the cognitive load required to interpret and reconstruct 2D images, allowing the resident to focus on surgical planning. It improves understanding of spatial liver anatomy and serves as an adjunct to current 2D planning methods. This has the potential to be developed into a module for teaching liver surgery in a competency-based curriculum.

06

Predictive efficacy of the NSQIP risk calculator for early postoperative outcomes after Whipple. *E. Kohtakangas*, *H. Jiang*, *J. Shum*, *K. Asai*. From the Northern Ontario School of Medicine, Sudbury, Ont.

The National Surgical Quality Improvement Program (NSQIP) risk calculator was developed based on surgical procedures and specific patient indices to quantify the risks of individual patient complications and predicted length of stay (LOS). However, it has been criticized for its generality. Subspecialties, such as hepato-pancreato-biliary (HPB) surgery, lack evidence with regards to its efficacy. A determination of the predictive efficacy of the National Surgical Quality Improvement Program (NSQIP) risk calculator with respect to Whipple's resections was therefore needed. A retrospective review of patients who underwent elective Whipple's resection for pancreatic head lesions between February 2014 and August 2016 was conducted. Postoperative complications and LOS between NSQIP-predicted and actual outcomes were compared. Predicted complication rates were obtained using the NSQIP risk calculator through predefined risk factors. Outcomes defined by NSQIP were examined at 30 days after surgery. A total of 40 patients underwent Whipple's resection. The average age was 68 years and the majority of patients had independent baseline functional status (39/40) with minimal preoperative comorbidities. The NSQIP risk calculator was predictive for the majority of postsurgical complication types, including pneumonia, skin and soft tissue infections, venous thromboembolism, return to surgery, readmission, and disposition to long-term care. A higher rate of urinary tract infections and cardiac complications than predicted was observed. There was an overestimation with respect to readmission rates and renal failure. The average LOS was comparable, with 80% of discharges fewer than or within 3 days of that predicted by NSQIP. The NSQIP risk calculator is mostly predictive of postoperative complications and LOS for patients who have undergone Whipple's resection. A more HPB-focused NSQIP calculator may accurately project postoperative complications. Nevertheless, the generic NSQIP has allowed the examination and improvement of existing practice of postoperative care to reduce future complications.

07

Liver transplantation to salvage patients with HCC recurrence following curative treatments. *H. Muaddi* (University of Toronto, Toronto, Ont.), *D. Aladra* (University of Toronto, University Health Network Hospital, Toronto, Ont.), *J. Shaw* (University of Toronto, University Health Network Hospital, Toronto, Ont.), *R. Beercroft* (University of Toronto, University Health Network Hospital, Toronto, Ont.), *A. Ghanekar* (University of Toronto, University Health Network Hospital, Toronto, Ont.), *C. Moulton* (University of Toronto, University Health Network Hospital, Toronto, Ont.), *A. Doyle* (University of Toronto, University Health Network Hospital, Toronto, Ont.), *M. Selzner* (University of Toronto, University Health Network Hospital, Toronto, Ont.), *A. Wei* (University of Toronto, University Health Network Hospital, Toronto, Ont.), *I. McGilvray* (University of Toronto, University Health Network Hospital, Toronto, Ont.), *S. Gallinger* (University of Toronto, University Health Network Hospital, Toronto, Ont.), *D. Grant* (University of Toronto, University Health Network Hospital, Toronto, Ont.), *M. Cattral* (University of Toronto, University Health Network Hospital, Toronto, Ont.), *P. Greig* (University of Toronto, University Health Network Hospital, Toronto, Ont.), *J. Kachura* (University of Toronto, University Health Network Hospital, Toronto, Ont.), *S. Cleary* (University of Toronto, University Health Network Hospital, Toronto, Ont.), *G. Sapisochin* (University of Toronto, University Health Network Hospital, Toronto, Ont.).

Liver resection (LR) and radiofrequency ablation (RFA) represent curative therapies for early-stage hepatocellular carcinoma (HCC). If tumour recurrence occurs, salvage liver transplant (SLT) may constitute a treatment option. We aimed to compare the long-term

outcomes of patients transplanted for recurrent HCC after curative-intent therapies (LR or RFA) to those of patients transplanted as initial therapy. We conducted a matched-control (1:1) cohort study comparing patients with HCC treated with primary liver transplant (PLT) to patients treated with SLT after HCC recurrence following LR or RFA. Matching was performed by size and number of viable tumours at explant pathology following liver transplant. Patients who received LR or RFA as a "bridge to transplant" were excluded. Between November 1999 and December 2014, 559 patients with HCC were transplanted at our institution. A total of 193 patients were treated with PLT and 50 patients were treated with SLT for HCC recurrence after primary treatment with LR (n = 25) or RFA (n = 25). Median length of follow-up from transplant was 66 (0.5–195) months. The median time from curative-intent treatment of HCC with RFA or LR to recurrence was 11 (1–36) and 20 (3–143) months, respectively (p = 0.09). The matched-cohort was composed of 49 SLT patients (24 LR and 25 RFA) and 49 PLT patients. The median time to recurrence after LR and RFA in the SLT group was 13 (1–143) months. No significant differences were observed in demographic or tumour characteristics between the PLT and SLT groups, except for the median model for end-stage liver disease (MELD) at time of transplant (PLT 13 [6–29] v. SLT 8 [6–19], p < 0.005). The 5-year rate of recurrence after LT was 21% in the PLT group versus 33% in the SLT group (p = 0.28). The 5-year actuarial survival after PLT was 69% versus 68% in the SLT group (p = 0.68). SLT is an acceptable treatment for recurrent HCC following curative-intent therapies, with comparable long-term recurrence rates and patient survival.

08

Gemcitabine/taxane adjuvant therapy in resected pancreatic cancer: A novel strategy for improved survival? *Z. Kanji, A. Edwards, M. Mandelson, N. Sahar, B. Lin, A. Alseidi, T. Biehl, R. Kozarek, S. Helton, V. Picozzi, F. Rocha*. From the Virginia Mason Medical Center, Seattle, Wash.

Gemcitabine/taxane combination chemotherapy has demonstrated a survival benefit in metastatic pancreatic cancer (PC). We present our experience with gemcitabine/docetaxel (gem/tax) based adjuvant treatment (Rx) following curative-intent surgery. Patients with upfront resectable PC from January 2010 to December 2015 were identified from our institutional database and registry. We only included those who received gem/tax as initial Rx administered exclusively at our institution with or without chemoradiation (CRTx). Survival analysis was performed by Kaplan–Meier methods and prognostic factors were investigated by Cox proportional hazard modelling. Of 185 eligible patients, 58 met the study criteria. Median age of diagnosis was 65 years with 55% of patients undergoing an R1 resection (margin ≤ 1 mm). Tumour characteristics included median tumour size 28 mm, poor differentiation 54% and 67% lymph node positivity. Most patients (52/58) completed at least 80% of 24-week Rx. Of those, 71% received post gem/tax CRTx treatment. Grade 3/4 toxicity was observed in 52% of patients. Median disease-free survival (DFS) and overall survival (OS) were 35 months (95% CI 20.7–NR) and 52 months (95% CI 27.4–NR), respectively. Five-year OS was 49% (95% CI 33.7–63.4). On multivariate analysis (HR, 95% CI), margin status (4.55, 1.46–14.2, p = 0.01), American Joint Committee on Cancer (AJCC) stage (10.9, 2.46–47.9, p = 0.002) and CRTx (0.08, 0.03–0.24, p < 0.000) were factors independently associated with OS, while tumour size (2.59, 1.11–6.04, p = 0.03), AJCC stage (3.29, 1.15–9.41, p = 0.03) and CRTx (0.23, 0.09–0.56, p = 0.001) were associated with DFS. Adjuvant gem/tax with or without CRTx is feasible with favourable DFS and OS. Future prospective studies of gem/tax-based adjuvant Rx in PC are warranted.

09

Extended neoadjuvant chemotherapy (CT) in borderline resectable pancreatic cancer (BRPC): updated results. *Z. Kanji, F. Rocha, A. Edwards, M. Mandelson, B. Lin, R. Kozarek, B. Rose, T. Biehl, A. Alseidi, S. Helton, V. Picozzi*. From the Virginia Mason Medical Center, Seattle, Wash.

Optimum therapy (Rx) for borderline resectable pancreatic cancer (BRPC) is unknown. Since 2008, we have used neoadjuvant treatment (Rx) with extended-course chemotherapy (CT) but not routine neoadjuvant chemoradiation (CRT). We present our single-institution findings. Patients were prospectively identified in our institutional database and inclusion criteria were (1) biopsy-proven BRPC, (2) radiographic staging per AHPBA/NCCN criteria, (3) no prior Rx, (4) negative staging laparoscopy, (5) all neoadjuvant Rx at our institution, (6) follow-up ≥ 24 weeks from initial Rx. Unless disease progression or Rx intolerance were noted, patients received gemcitabine/docetaxel (G/D) as neoadjuvant CT for 24 weeks. Among 129 patients, the median age was 66 years (range 33–88 years); 86, 36 and 7 patients had Eastern Cooperative Oncology Group performance status (ECOG PS) 0, 1 and 2+, respectively; and 97% had venous and 43% had arterial involvement. Seventy-eight percent of patients (101/129) completed at least 80% of the intended CT; 38% (6/16) patients were aged > 80 years and/or ECOG PS 2+ (p < 0.01); and 51% (66/129) patients were resected (44 R0, 22 R1 ≤ 1 mm margin) and 49% of patients (63/129) were not (24 because of disease progression, 17 because of the surgeon's decision (anatomy/safety), 11 because of Rx toxicity/comorbidity, 6 because the patient was unresectable at surgery, 5 because the patient withdrew). Forty-five percent (31/66) and 23% (16/66) of resected patients received postoperative CRT/CT, respectively. Median follow-up was 47 months. Fifty-eight percent of resected patients (38/66) had a recurrence: 18% (12/66) local, 41% (27/66) systemic. For resected patients, median progression-free survival is 25.0 (95% CI 16.2–32.7) months, and median overall survival (OS) is 37.6 (95% CI 27.4–58.5) months. Five-year OS is 28% (95% CI 14%–44%). Median OS for nonresected patients is 13.1 (95% CI 10.9–16.9) months. Median OS for all patients is 22.1 (95% CI 18.7–28.4) months. Our series is distinctive with respect to size, use of laparoscopic staging and neoadjuvant G/D CT as standards. Reported OS compares favourably with other BRPC and de novo resectable PC cooperative group results. Detailed analysis of our study will aid future clinical research in BRPC.

10

Lymphadenectomy in resected node-negative pancreatic cancer: Are some patients being understaged? *J. Abou-Khalil, A. Alseidi, S. Helton, M. Mandelson, T. Biehl, V. Picozzi, B. Lin, F. Rocha*. From the Virginia Mason Medical Center, Seattle, Wash.

Validated benchmarks for adequate lymphadenectomy (LAD) are well established for gastric and colon cancers to avoid stage

migration. Although a harvest of 15 nodes has been proposed for pancreatic cancer, this number has not been confirmed in a large, multi-institutional setting. We examined the relationship between LAD and survival in node-negative patients having undergone pancreatectomy for pancreatic adenocarcinoma to identify whether some N0 patients are understaged. We identified all node-negative patients undergoing pancreaticoduodenectomy (PD) and distal pancreatectomy (DP) for pancreatic adenocarcinoma within the National Cancer Database (NCDB) between 2004 and 2014. We excluded patients with clinical or pathologic M1 disease, patients who died within 90 days of surgery and those with no data on lymph node (LN) harvest. Univariate and multivariate quantile regression were used to identify the effect of lymph node harvests and other patient- and tumour-specific variables on survival. We identified 7329 and 2071 patients undergoing PD and DP, respectively, staged as pN0 and meeting the inclusion criteria. Median survival was 21.5 months (95% CI 21.1–21.9) and 21.2 months (95% CI 20.1–22.1) in the PD and DP groups, respectively. In the PD group, LAD ≥ 15 was not associated with a higher median survival (21.6 [95% CI 20.9–22.4] and 21.3 [95% CI 20.7–21.9] months in the < 15 LN and ≥ 15 LN, respectively, $p = 0.223$.). In the DP group, median survival was 20.2 months (95% CI 19.2–21.6) and 22.6 months (95% CI 20.9–24.4) in the LAD < 15 and LAD ≥ 15 groups ($p = 0.068$). On univariate quantile regression, age, higher tumour grade, lymphovascular invasion, higher T stage, positive margin and not receiving chemotherapy or radiation were associated with decreased survival and retained that association on multivariate regression. We did not identify a group of patients who were understaged as a function of low lymph node harvests. A benchmark of 15 lymph nodes for pancreatic cancer cannot be recommended as a quality measure.

11

Pylorus-preserving versus conventional pancreaticoduodenectomy: an expertise-based comparison in the enhanced-recovery era. ***J. Abou Khalil*** **(Virginia Mason Medical Center, Seattle, Wash.),** ***A. Alseidi*** **(Virginia Mason Medical Center, Seattle, Wash.),** ***F. Rocha*** **(Virginia Mason Medical Center),** ***T. Biehl*** **(Virginia Mason Medical Center, Seattle, Wash.),** ***K. Bertens*** **(The Ottawa Hospital, Ottawa, Ont.),** ***S. Helton*** **(Virginia Mason Medical Center, Seattle, Wash.).**

Two reconstruction techniques are typically used for resectable tumours of the pancreatic head: the conventional pancreaticoduodenectomy with a gastrojejunostomy (CW) and the pylorus-preserving approach (PP). Despite concerns of increased delayed gastric emptying with PP, multiple randomized trials and meta-analyses have demonstrated equivalence with regards to surgical morbidity. We therefore set out to compare the morbidity experience of patients undergoing PP and CW at our institution. From a prospectively collected complications database, all patients undergoing pancreaticoduodenectomy between 2013 and 2016 were included. Patients were stratified by CW versus PP by surgeons who perform each approach exclusively. Preoperative characteristics and postoperative complications were compared using Student's *t* tests, χ^2 tests, and the Wilcoxon rank-sum test. During the study period, 133 CW and 147 PP were identified. Their preoperative characteristics were similar, but more patients in the CW group underwent a portal vein resection compared with the PP group (24.8% v. 14.3%, $p = 0.026$.). Delayed gastric emptying (DGE) developed in 21.7% and 17.7% of patients in the CW and PP groups, respectively ($p = 0.457$.) Of the perioperative variables, DGE was associated with diabetes on univariate logistic regression (OR 2.9, $p = 0.03$). Patients developing a pancreatic fistula had higher odds of DGE (OR 2.9, $p = 0.001$). At our institution, where both PP and CW are performed in a setting akin to an expertise-based trial and under an enhanced recovery after surgery protocol, PP did not result in higher DGE.

12

Medial open transversus abdominis plane (MOTAP) catheters reduce opioid requirements, pain and length of stay following open liver resection: a multicentre, blinded, randomized controlled trial. ***P. Karanicolas*** **(Sunnybrook Health Sciences Centre, University of Toronto, Toronto, Ont.),** ***S. Cleary*** **(University Health Network, University of Toronto, Toronto, Ont.),** ***P. McHardy*** **(Sunnybrook Health Sciences Centre, University of Toronto, Toronto, Ont.),** ***A. Kiss*** **(Sunnybrook Health Sciences Centre, Toronto, Ont.),** ***J. Sawyer*** **(Sunnybrook Health Sciences Centre, Toronto, Ont.),** ***R. Behman*** **(University of Toronto, Toronto, Ont.),** ***S. Ladak*** **(University Health Network, University of Toronto, Toronto, Ont.),** ***S. McCluskey*** **(University Health Network, University of Toronto, Toronto, Ont.),** ***C. Srinivas*** **(University Health Network, Toronto, Ont.),** ***J. Katz*** **(University Health Network, University of Toronto, Toronto, Ont.),** ***N. Coburn*** **(Sunnybrook Health Sciences Centre, University of Toronto, Toronto, Ont.),** ***C. Law*** **(Sunnybrook Health Sciences Centre, University of Toronto, Toronto, Ont.),** ***A. Wei*** **(University Health Network, University of Toronto, Toronto, Ont.),** ***P. Greig*** **(University Health Network, University of Toronto, Toronto, Ont.),** ***J. Hallet*** **(Sunnybrook Health Sciences Centre, University of Toronto, Toronto, Ont.),** ***H. Clarke*** **(University Health Network, University of Toronto, Toronto, Ont.).**

Conventional management of pain following open liver resection involves intravenous, patient-controlled analgesia (IV PCA) or epidural analgesia, both of which have limitations. The objective of this trial was to assess the efficacy of a regional technique called medial open transversus abdominis plane (MOTAP) catheter analgesia for reducing postoperative opioid requirements. We conducted a double-blind, randomized controlled trial at 2 high-volume centres. Patients undergoing liver resection through a subcostal incision were enrolled. Using a standardized technique, 2 catheters were placed in each patient after resection: 1 in the plane between internal oblique and transversus abdominis, and the other in the posterior rectus sheath. Patients received either ropivacaine 0.2% (ROP) or saline (NS) through both catheters for 72 hours following surgery. All patients received IV PCA with hydromorphone. Primary outcome was hydromorphone use over the first 48 hours. A total of 153 patients were included in the trial (71 ROP, 82 NS). Patients receiving ROP used significantly less opioid than patients with NS at 48 hours (median 39.6 mg morphine-equivalent v. 49.2 mg, $p = 0.033$) and at 72 hours (median 50.0 mg v. 66.4 mg, $p = 0.046$). Patients receiving ROP had significantly less pain at rest and with coughing compared with patients with NS through the

postoperative period ($p = 0.002$). Median length of hospital stay was 5 days in patients receiving ROP and 6 days in patients who received NS ($p = 0.035$). Two patients experienced catheter-related complications, both of which resolved before discharge. MOTAP catheter analgesia reduces opioid requirements, pain and length of hospital stay compared with IV PCA following open liver resection.

13

Retrospective analysis of LIRADS observations: correlation with clinical and pathological outcomes. ***E. Tang*** **(Queen's University, Kingston, Ont.),** ***G. Hall*** **(Queen's University, Kingston, Ont.),** ***D. Yu*** **(Queen's University, Kingston, Ont.),** ***W. Hopman*** **(Kingston General Hospital, Kingston, Ont.),** ***A. Menard*** **(Queen's University, Kingston, Ont.),** ***S. Nani*** **(Queen's University, Kingston, Ont.).**

The Liver Imaging Reporting and Data System (LIRADS/LR) standardizes reporting of liver lesions in patients at risk for hepatoma. We sought to clarify the natural history of LR 3–5 lesions. Our radiology database was searched for observations in cirrhotic patients. Chart review was performed on cirrhotic patients with 2 or more liver protocol CT/MRI studies. Radiographic features were assigned by a staff radiologist. The primary end point was diagnostic confirmation, a composite end point of radiographic progression, clinical progression or histologic confirmation. The database search identified 638 relevant studies. Chart review resulted in 138 lesions in 96 patients. Causes of cirrhosis were hepatitis C (40%), alcoholism (25%) and nonalcoholic fatty liver disease (22.5%). Assigned LR categories were LR 3 ($n = 57$, 41%), LR 4 ($n = 38$, 27.5%) and LR 5 ($n = 39$, 28.3%). Multiple observations and liver segment were not associated with confirmation, while male gender and underlying diagnosis were (both $p < 0.05$). Radiographic features (hyperenhancement, washout, interval growth, pseudocapsule) were all associated with diagnostic confirmation (all $p < 0.05$), as were lesions visible on ultrasound (LR 7.5, $p = 0.02$). Of these, 19/52 (36.5%) LR 3, 25/35 (71%) LR 4 and 35/35 (100%) LR 5 were confirmed hepatocellular carcinoma (HCC). Median times to confirmation were 1395, 334 and 130 days for LR category 3, 4 and 5 observations, respectively. Compared with other series, our rates of HCC in LR 3/4 lesions were lower. The true incidence of HCC is probably higher than what we report given loss to follow-up. Our results represent a probable lower limit of incidence.

14

Comparison of outcomes in invasive IPMN and sporadic pancreatic ductal adenocarcinoma in patients who have undergone pancreatic surgery. A matched cohort analysis of the NCDB. ***E. Tang*** **(Providence Portland Medical Center, Portland, Ore.),** ***J. Grendar*** **(Providence Portland Medical Center, Protland, Ore.),** ***Z. Jutric*** **(City of Hope Cancer Center, Duarte, Calif.),** ***L. Wang*** **(Providence St. Vincent Medical Center, Protland, Ore.),** ***S. Chang*** **(Providence St. Vincent Medical Center, Protland, Ore.),** ***P. Hansen*** **(Providence Portland Medical Center, Protland, Ore.),** ***P. Newell*** **(Providence Portland Medical Center, Protland, Ore.),** ***R. Wolf*** **(Providence Portland Medical Center, Protland, Ore.).**

Controversy exists regarding outcomes of sporadic pancreatic ductal adenocarcinoma (PADC) and invasive intraductal papillary mucinous neoplasm (inv-IPMN). We sought to perform an updated analysis using current histologic codes for IPMN. We queried the National Cancer Database for cases of resected inv-IPMN and PDAC. We excluded patients who received neoadjuvant chemo/radiation therapy. The American Joint Committee on Cancer (AJCC) 7th edition TNM stage was calculated using size, nodal status and extrapancreatic extension. Cox regression and Kaplan–Meier analysis was performed, stratified by stage. Analysis was first unadjusted, then matched by age, gender and Charlson score. We identified 12 083 cases of PDAC and 461 of inv-IPMN from 2004 to 2011. The 2 cohorts showed small differences in their demography and tumour characteristics. There were no differences in 30- or 90-day mortality. Patients with PDAC had higher T stage and node positivity. Unadjusted Cox regression analysis showed significant improvement in survival for inv-IPMN at each stage except stage IIB (HR 0.78). The difference was most pronounced in stage Ib (inv-IPMN v. PDAC: HR 0.34, 95% CI 0.24–0.47). The 2 cohorts were then matched exactly on age, gender and Charlson score. After adjustment, patients with inv-IPMN continued to have improved survival at all stages. Kaplan–Meier analysis with follow-up out to 10 years showed that the survival lines crossed only for stage IIB, suggesting that over time the survival advantage is diminished. Using a precise histologic definition, we demonstrate that inv-IPMN does have a survival advantage over sporadic PDAC. This is less pronounced with extracapsular extension, and nodal disease. In the presence of nodal disease, long-term outcomes may be similar between the 2. The largest difference in HR was seen in stage IB (T2N0), suggesting that size may be less important as a prognostic factor for IPMN when compared with PDAC. The relatively favourable survival for inv-IPMN reported may have implications regarding recommendations for adjuvant therapy.

15

REctal and Hepatic ReSEction for Rectal Cancer with Synchronous Liver MeTastases (RESECT): simultaneous versus staged. A systematic review. ***A. Giles, M. Valencia, E. Fu, J. Hawkins, L. Ruo, M. Simunovic, P. Serrano.*** **From McMaster University, Hamilton, Ont.**

Staged surgical resection has been the preferred approach to treat synchronous rectal cancer with liver metastases; however, newer reports suggest that simultaneous resection is feasible and safe. This systematic review seeks to determine differences in overall postoperative complications (primary outcome) between staged and simultaneous resections. We searched Medline, Embase and PubMed for all study designs comparing simultaneous (intervention) versus staged (control) resection of synchronous rectal cancer with liver metastases. Study selection, data abstraction, risk of bias and quality of the evidence assessment were carried out in duplicate. Secondary outcomes were comparison of major complications between groups and overall complication rate for simultaneous resection. Risk of bias was assessed using the Cochrane Collaboration tool. The quality of evidence was assessed using Grading of Recommendations Assessment, Development and Evaluation (GRADE). Statistical heterogeneity was calculated using χ^2 and I^2. Clinical heterogeneity was explored via subgroup analyses. The protocol was published in PROSPERO. Of the 4456 abstracts retrieved, 17 studies were analyzed and 6 reported the primary outcome (all retrospective cohort studies). There

were 288 intervention and 287 control patients in total. The odds ratio (OR) for overall complications (intervention v. control) was 0.93 (95% confidence interval [CI] 0.64–1.35); the OR for major complications was 0.77 (95% CI 0.40–1.50). There was no significant statistical or clinical heterogeneity. Single-arm analysis of simultaneous resections demonstrated an overall complication rate of 38% (95% CI 34%–42%) and significant study heterogeneity. The risk of bias for the included studies was moderate and the quality of the evidence (GRADE) was very low. Simultaneous resection of synchronous rectal cancer with liver metastases carries a similar risk of overall and major complications compared with the staged approach. Evidence from randomized trials is needed.

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Laparoscopic versus open liver resection: a single-centre study. ***A. Giles, J. Daza Vargas, S. Strauss, H. Alturki, S. Silva, C. Tan, C. Bos, F. Naji, S. Kennedy, L. Ruo, P. Serrano, M. Marcaccio, V. Tandan, D. Datb.*** **From McMaster University, Hamilton, Ont.**

Laparoscopic liver resection (LLR) has undergone cautious adoption. This investigation analyzes the initial experience at our institution, comparing LLR to open liver resection (OLR) with respect to safety, length of stay and oncologic outcomes. All liver resections from 2007 to 2015 were reviewed retrospectively. Major hepatectomy was defined as resection of 3 or more contiguous segments, per Brisbane classification. Laparoscopy was analyzed on an intent-to-treat basis. Comparison of major to minor resections and LLR to OLR was made using parametric and nonparametric statistical methods. Multivariable logistic regression was performed to determine factors associated with 90-day mortality. A total of 434 hepatectomies were performed, with 209 (48%) LLR (187 [43%] completed; 22 [5%] converted) and 225 (52%) open. Demographic and clinical characteristics were similar between all groups. Equivalent major hepatectomies were performed laparoscopically and open (114 and 121, respectively; $p = 0.95$). Operative length was similar between all groups (minor: LLR 214 v. OLR 209 minutes, $p = 0.72$; major: LLR 373 v. OLR 348 minutes, $p = 0.10$). LLR patients experienced a shorter median length of stay for both minor and major hepatectomies (4 v. 6 days, $p < 0.01$; 6 v. 8 days, $p < 0.01$). Multivariable analysis demonstrated increased odds of 90-day all-cause mortality for age (by increasing deciles; odds ratio 2.3 [95% CI 1.3–4.1]; $p < 0.01$), major resection (6.3 [1.2–33.5], $p = 0.03$) and postoperative complications (18.0 [2.3–140.8], $p < 0.01$), while laparoscopic technique decreased the odds of death (0.2 [0.1–0.6], $p < 0.01$). R0 resection rates for LLR and OLR were 76% and 77% ($p = 0.83$), respectively, for minor resections, and 89% and 79% ($p = 0.09$) for major resections. Minor and major hepatectomy were performed with equal frequency laparoscopically and open in this series. On retrospective analysis, LLR was oncologically equivalent to OLR and associated with a reduced length of stay and decreased risk of 90-day mortality.

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The geography of treatments: a population-based study of primary hepatic tumours in Canada between 2002 and 2013. ***M. Cwinn*** **(Dalhousie University, Halifax, N.S.),** ***M. Molinari*** **(University of Pittsburgh, Pittsburgh, Pa.).**

Population-based studies of treatment modalities of primary hepatic tumours in Canada are lacking. Therefore, the primary aim of this study was to analyze the age-standardized incidence of hepatic resection, ablation, transplantation and embolization for primary hepatic tumours in Canada during the period between 2002 and 2013 in different geographical areas. The secondary aim was to evaluate temporal trends for common treatment modalities. Data were extracted from national databases, including the Canadian Chronic Disease Infobase at the Public Health Agency of Canada and the Canadian Institute for Health Information's acute and ambulatory care data holdings (Discharge Abstract Database and National Ambulatory Care Reporting System). Age-standardized incidence of treatment ratios (SIR) was calculated and comparisons were performed by clustering provinces and territories into 4 areas: Atlantic Canada, Ontario, the Prairies and British Columbia. British Columbia recorded the highest value of SIRs for ablation (1.9; 95% CI 1.8–2.0), hepatic resection (1.2; 95% CI 1.1–1.3) and transarterial locoregional therapies (2.8; 95% CI 2.4–3.2). For hepatic resection, the lowest SIR was found in Atlantic Canada (0.7; 95% CI 0.6–0.9) while the Prairies recorded the lowest estimate for transarterial locoregional therapies (0.2; 95% CI 0.1–0.4). Liver transplantation had the highest SIR in Ontario (1.5; 95% CI 1.3–1.6) and the lowest in British Columbia. There were no significant temporal changes of SIRs for any of the treatments except for transarterial locoregional therapies, which experienced a significant decline after 2004 and remained underutilized. Significant geographic-specific differences in treatment patterns for primary hepatic tumours exist in Canada. On the other hand, except for transarterial locoregional therapies, the number of transplants, resections and ablations equaled the expected number of procedures during the study period.

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Impact of endoscopic ultrasound staging on the management of patients with pancreatic adenocarcinoma. ***B. Do, F. Khazoom, F. Vandenbroucke-Menu, M. Plasse, A. Roy, M. Dagenais, R. Létourneau, R. Lapointe, S. Paquin, A. Sahai, S. Turcotte.*** **From Centre hospitalier de l'Université de Montréal, Montreal, Que.**

Guidelines generally recommend the selective use of endoscopic ultrasound (EUS) as an adjunct to CT scan in the assessment of pancreatic ductal adenocarcinoma (PDAC) resectability, without an established role in the detection of liver metastases or carcinomatosis. Our main objective was to evaluate the impact of EUS staging on the management of PDAC patients, since the majority of them underwent this procedure at our high-volume centre. We used a prospectively maintained database of consecutive patients who underwent EUS staging for PDAC. We retrospectively analyzed the rate of intra-abdominal metastases suspected on pre-EUS CT scan, preoperative categorization of patients for resectable, borderline or locally advanced tumour, EUS detection rate of intra-abdominal metastases, resection rate and causes of nonresection. From January 2010 to October 2014, 599 patients underwent EUS staging for suspected PDAC. Intra-abdominal metastases were not detected on initial CT scan in 457 (76.3%) patients. Of these 457 patients, there were EUS-detected and cytologically confirmed liver metastases in 6 (1.3%), and carcinomatosis was highly suspected in 8 (1.8%). Of the 188 patients with potentially resectable PDAC based on the initial CT scan, EUS detected liver metastases in 4 (2.1%) and carcinomatosis in 1 (0.5%). Of the 149 patients who underwent surgery with curative intent, resection was not performed due to local invasion in 17 (11.4%), liver metastases in 14

(9.4%) and carcinomatosis in 2 (1.3%). Portal venous reconstruction was done in 31 (29.0%) of the 107 pancreatectomies. EUS staging prevented futile laparotomies in 2.6% of PDAC patients by the detection of early intra-abdominal metastases. Preoperative EUS and CT scan combined with a low threshold for portal venous resection may have accounted for the relatively low rate of pancreatectomies aborted for local invasion. Liver metastases were still found at the time of surgery in 9.4% of patients, arguing for the development of more sensitive preoperative staging tools.

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Easily identifiable patient factors may be valuable predictors of postoperative pain and opioid consumption. ***R. Behman, H. Clarke, S. Cleary, P. McHardy, A. Kiss, J. Sawyer, S. Ladak, S. McCluskey, C. Srinivas, J. Katz, N. Coburn, C. Law, A. Wei, P. Greig, J. Hallet, P. Karanicolas.*** **From the University of Toronto, Toronto, Ont.**

Adequate postoperative pain management is a critical component of perioperative care. Inadequate pain control is associated with cardiovascular and pulmonary complications. Identification of patients at greater risk for poorly controlled postoperative pain may allow for early measures to optimize pain management. We sought to identify risk factors for postoperative pain in patients undergoing open liver resection. This is a multi-institutional cohort study performed as part of a randomized trial of patients undergoing open liver resection. Pain scores at rest and with coughing were collected following surgery, beginning in the post-anesthesia care unit and continuing 3 times per day for the first 3 postoperative days. To estimate the effects of patient factors and the procedure type on pain scores we used generalized linear models, which allowed us to account for clustering by surgeon. Covariates in the model included patient age, sex, body mass index, history of painkiller use and procedure type. A total of 152 patients who underwent open liver resection between 2013 and 2016 were included in the study. The mean patient age was 62.2 years (SD 12.1 years) and 43.3% of patients were female. Patient factors significantly associated with increased pain included younger patient age ($\beta = -0.024$/year at rest, $\beta = -0.028$/year with cough, $p < 0.01$ for both) and a history of painkiller use ($\beta = 0.56$ at rest, $\beta = 0.98$ with cough, $p = 0.05$ and $p < 0.01$, respectively). Younger patients also had significantly higher opioid consumption at 24, 48 and 72 hours after surgery (all $p < 0.001$). Additionally, patients undergoing right posterior sectionectomy were more likely to report higher postoperative pain with coughing ($\beta = 1.3$, $p = 0.01$). Younger patients, those with a history of painkiller use and those undergoing right posterior sectionectomies are more likely to report higher postoperative pain. Early identification of these patients, and measures to better manage their pain, may contribute to optimal perioperative care.

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The evolving role of neoadjuvant therapy in locally advanced pancreas cancer. ***Y. Wang, A. Kamath, A. Charest-Marcotte, A. Cuggia, C. Wong, J. Asselah, N. Bouganim, N. Kopek, P. Chaudhury, J. Barkun, P. Metrakos, G. Zogopoulos.*** **From McGill University, Montreal, Que.**

Resection of locally advanced pancreatic adenocarcinoma (LAPC) with portomesenteric vein involvement results in comparable survival outcomes to standard pancreatectomy. However, previously reported data have not supported a role for extended pancreatectomy with arterial resection. The advent of modern chemotherapy (FOLFIRINOX, gemcitabine/nab-paclitaxel) has renewed interest in neoadjuvant strategies for LAPC with arterial involvement. We have hypothesized that a neoadjuvant FOLFIRINOX-based chemoradiation protocol can identify LAPC patients with favourable tumour biology who would benefit from extended pancreatectomy with en bloc arterial resection (PEAR). Between January 2011 and September 2016, patients diagnosed with pancreatic adenocarcinoma at the McGill University Health Centre and enrolled in our research registry were included. Clinicopathologic data were retrospectively reviewed using our prospectively maintained pancreatic cancer database. Ninety-six patients were included: 23 patients presented with stage I/II disease and underwent upfront surgery; 12 patients had LAPC limited to portomesenteric vein involvement and underwent curative-intent surgery (surgery with venous reconstruction); 13 patients had arterial involvement and completed the PEAR protocol; and 48 patients with unresectable LAPC were treated with chemotherapy alone. Demographic characteristics were similar between all groups. There was no 90-day mortality across all surgical arms. The PEAR group demonstrated favourable pathological characteristics compared with S-V, including a significantly lower rate of positive lymph nodes (38% v. 92%, $p = 0.01$) and of lymphovascular invasion (46% v. 92%, $p = 0.03$). Median overall survival was 26.7 months with upfront resection for stage I/II disease and 18.3 months for S-V. The PEAR group had significantly longer survival compared with patients receiving chemotherapy alone (25.6 v. 18.5 months, $p = 0.04$). Our findings challenge the role for upfront resection of LAPC, including in the absence of arterial involvement. These results advocate for neoadjuvant treatment strategies using modern chemotherapeutic regimens to identify patients with favourable tumour biology for extended pancreatectomy.

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Preoperative CA 19-9 as a predictor of recurrence and survival in resected pancreatic ductal adenocarcinoma. ***C. Garcia-Ochoa*** **(Western University, London Health Sciences Centre, London, Ont.),** ***A. Skaro*** **(Western University, London Health Sciences Centre, London, Ont.),** ***J. M. Sontrop*** **(Institute for Clinical Evaluative Sciences, London Health Sciences Centre, London, Ont.),** ***E. McArthur*** **(Institute for Clinical Evaluative Sciences, London Health Sciences Centre, London, Ont.),** ***K. Leslie*** **(Western University, London Health Sciences Centre, London, Ont.).**

Preoperative levels of CA 19-9 for pancreatic ductal adenocarcinoma (PDCA) have been extensively studied as a prognostic tool in recurrence and survival; however, contradictory evidence has prevented its role from being defined. We retrospectively examined data from 287 patients diagnosed with PDCA between 2007 and 2016. From these patients, 117 had preoperative CA 19-9 levels and only 90 were resected. A threshold above 37 U/mL for serum levels of CA 19-9 was used to compare "normal levels" and "elevated levels." CA 19-9 levels were standardized using total bilirubin. Early tumour recurrence (recurrence within the first 6 months after surgery), survival and postoperative complications

using Clavien–Dindo classification were assessed as primary outcomes. Kaplan–Meier curves were used to visually present time to early recurrence and mortality. The curves for early recurrence and survival were compared between CA 19-9 groups using the log-rank test. We created a Cox proportional hazards model to estimate the association of elevated levels of CA 19-9 with mortality, adjusting for total bilirubin and tumour stage. The median CA 19-9 for the normal-level group was 12 (3–19) U/mL and for the elevated level group it was 118 (70–398) U/mL. The early recurrence distribution was not significantly different between groups ($p = 0.32$), nor was the survival distribution over 5 years ($p = 0.56$. Elevated CA 19-9 had no statistically significant association with survival (HR 0.96, 95% CI 0.90–1.038, $p = 0.35$). Postoperative complications in the groups with normal and elevated CA 19-9 were 56.8% v. 62.3% ($p = 0.86$). Tumour stage did not differ between groups ($p = 0.48$). Preoperative levels of CA 19-9 have no predictive capacity on postoperative outcomes in PDCA. Future prospective studies with greater sampling could support the creation of a composite model, including CA 19-9, capable of predicting outcomes and selecting patients who might benefit from neoadjuvant therapy and spare others the morbidity of surgery.

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Perioperative blood transfusion following hepatectomy for colorectal cancer liver metastases: practice patterns and outcomes in routine clinical practice. ***S. Nanji, S. Karim, S. Patel, S. Merchant, K. Brennan, C. Booth*. From Queen's University, Kingston, Ont.**

Perioperative red blood cell transfusion (RBCT) has been associated with inferior long-term survival in patients with resected colorectal cancer liver metastases (CRCLM). Here, we describe RBCT utilization and association with short- and long-term outcomes in routine clinical practice. All cases of resected CRCLM in Ontario from 2002 to 2009 were identified using the population-based Ontario Cancer Registry and linked electronic records. Pathology reports were used to identify extent of disease and surgical procedure. Cox proportional models were used to explore factors associated with cancer-specific (CSS) and overall (OS) survival. The study population included 1310 patients; median age was 63 years and 62% were male. The rate of RBCT was 31% (403/1310). Factors independently associated with transfusion included female sex ($p < 0.001$), greater comorbidity ($p = 0.002$) and more extensive liver resection ($p < 0.001$). Compared with patients not requiring RBCT, transfused patients had a greater median length of stay (7 v. 9 days, $p < 0.001$), higher postoperative mortality (30-day: 0% v. 6%; 90 day: 1% v. 9%; $p < 0.001$), more frequent 30-day readmission (8% v. 23%; $p < 0.001$) and inferior 5-year CSS (48% v. 41%; $p < 0.001$) and OS (47% v. 38%; $p < 0.001$). On adjusted analysis, advanced age ($p = 0.004$), greater comorbidity ($p < 0.001$), shorter disease-free interval ($p = 0.007$) and greater number ($p < 0.001$) and size ($p < 0.001$) of lesions were associated with inferior CSS and OS. Transfusion was also associated with inferior CSS (HR 1.31, 95% CI 1.08–1.59) and OS (HR 1.28, 95% CI 1.08–1.51). However, in a sensitivity analysis, when we excluded postoperative deaths within 90 days, the adverse effect of RBCT on both CSS and OS is attenuated and no longer significant. Perioperative RBCT is common in routine clinical practice. Transfusion is associated with greater morbidity, mortality and inferior overall survival. However, when accounting for early postoperative deaths, RBCT is no longer independently associated with survival.

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Surgical outcomes and costs of pancreaticoduodenectomy in octogenarians. ***M. Valencia*** **(McMaster University, Hamilton, Ont.),** ***Y. Fang*** **(University of Virginia, Charlottesville, Va.),** ***L. Ruo*** **(McMaster University, Hamilton, Ont.),** ***D. Dath*** **(McMaster University, Hamilton, Ont.),** ***M. Marcaccio*** **(McMaster University, Hamilton, Ont.),** ***V. Tandan*** **(McMaster University, Hamilton, Ont.),** ***P. Serrano*** **(McMaster University, Hamilton, Ont.).**

The risk of postoperative complications following pancreaticoduodenectomy is thought to be higher in octogenarians than in younger patients. Despite higher complication rates, the costs of pancreaticoduodenectomy in this population are thought to be similar. We conducted a retrospective chart review of patients undergoing pancreaticoduodenectomy at a single institution from 2009 to 2014. Patient demographics, operative details and postoperative complications were obtained from patients' charts. Hospitalization and emergency department costs up to 90 days following surgery were obtained from hospital administrative databases. Risk factors associated with postoperative complications were analyzed using univariable and multivariable analyses. There were 276 patients included, and they were divided into 2 age groups: 253 younger patients (< 80 years, median age 65 years) and 23 octogenarians (≥ 80 years, median age 82 years). Pancreatic cancer was the most common indication for surgery (58% v. 65%). The mean American Society of Anesthesiologists (ASA) class was higher in the octogenarian group (3.2 v. 3.4, $p = 0.026$). The length of hospital stay was longer in this group also (9 v. 11 days, $p = 0.042$). The overall postoperative complication rate (47% v. 74%, $p = 0.015$) and the major complication rate (18% v. 39%, $p = 0.016$) were higher in the octogenarian group, mainly due to a higher rate of pneumonia (5% v. 22%, $p = 0.011$). The rehospitalization rate and the postoperative mortality were not statistically different between groups. In the multivariable analysis, factors associated with major complications were age greater than 80 years (OR 3.2, 95% CI 2.27–4.13) and a diagnosis other than pancreatic cancer (OR 2.65, 95% CI 2.02–3.27). There was a trend for a higher overall mean cost in the octogenarian group, \$32 616 ± \$32 616 v. \$34 649 ± \$42 340 mainly driven by a higher cost of primary surgery: \$28 053 ± \$23 241 v. \$33 271 ± \$42 559. Pancreaticoduodenectomy in octogenarians is associated with higher rates of overall and major postoperative complications, which lead to a longer length of hospital stay and higher costs for the health care system.

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Post-procedural ERCP image interpretation by radiologists. ***S. Ollek, H. Roy, J. Shaw*. From the University of Saskatchewan, Saskatoon, Sask.**

Endoscopic retrograde cholangiopancreatography (ERCP) plays an essential role in the diagnosis and treatment of biliary and pancreatic diseases. Endoscopists are required to interpret images and make therapeutic decisions during the procedure. The images are subsequently reviewed and reported on by a radiologist, after therapeutic interventions have been performed. Previous studies

have demonstrated high rates of discrepancy between endoscopy and radiology reports. We aim to determine the rate of discrepancy at our centre. A retrospective review was performed of patients who underwent ERCPs between Sept. 1, 2015, and Aug. 31, 2016. Findings reported by endoscopists were compared with the final radiology report. Discrepancies are reported as proportions, with 95% confidence intervals (CI). A total of 133 eligible patients were included in our study. Discrepancies occurred between endoscopy and radiology reports in 53% of cases (95% CI 44%–61%). Radiologists did not report on 82% (95% CI 71%–92%) of cases with choledocholithiasis, 67% of bile leaks (95% CI 13%–100%) and 55% of strictures (95% CI 33%–77%). ERCP has essential diagnostic and therapeutic roles. Currently most endoscopists perform therapeutic interventions based on their own intra-procedural image interpretation. Despite this, it remains common practice for radiologists to interpret and report after the fact. Our study shows that discrepancy rates between endoscopy and radiology reports are high. Selective interpretation by radiologists may be more appropriate and cost effective.

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An analysis of surgical decisions made during laparoscopic cholecystectomy in patients with incidental gall bladder cancer. *M. Horkoff, J. Bowes, F. Sutherland, E. Dixon, C. Ball, O. Bathe*. From the University of Calgary, Calgary, Alta.

Prognosis for gallbladder cancer (GB cancer) is poor, and surgical resection remains the only modality to offer a chance of cure. Up to 30% of GB cancers are discovered incidentally during histopathologic examination of gallbladders following cholecystectomy. Tumour seeding can occur if there is bile spillage during these cases. Thus, if GB cancer is suspected intraoperatively or preoperatively, specialist consultation is advised. We sought to identify if errors in surgical decision-making were common in these cases. We completed a retrospective analysis on patients who had GB cancer and a high risk event (HRE; GB perforation or bile spillage) during their laparoscopic cholecystectomy. We identified modifiable surgical decisions that may have resulted in prevention of a HRE. Between 2008 and 2012, 100 patients were treated for GB cancer in our referral catchment, of which 49 were treated surgically. Of these, 27 patients were diagnosed with GB cancer on pathology after cholecystectomy. We identified HREs during the cholecystectomy in 11 of these 27 cases. The median survival of patients with a HRE was 21.9 months versus 31.3 months in those without a HRE. GB decompression was intentional in 7 of 11 HRE cases to aid in the cholecystectomy. In 3 of these cases, malignancy was suspected before GB decompression, and thus bile spillage should have been avoidable. One out of the 11 patients did not have recent preoperative imaging that may have shown evidence of malignancy. Of the other 10, only 1 patient had evidence of a possible GBC on preoperative imaging. In summary, we identified 5 out of 27 cases of incidental GBC where different surgical decisions may have prevented a HRE. Surgeons performing cholecystectomies must be aware of the signs of GB cancer and be prepared to alter the surgical plan based on a high index of suspicion.

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The effect of resection margin distance on survival following pancreaticoduodenectomy for pancreatic ductal adenocarcinoma. How close is too close? T. Kuper, *A. Skaro, K. Vogt, D. Driman, K. Leslie*. From Western University, London, Ont.

Negative resection margins (R0) for pancreatic ductal adenocarcinoma (PDAC) have traditionally been defined as 0 mm in North American centres. However, it has been advocated that a more conservative definition of R0 resection be employed given the microscopically diffuse nature of PDAC at its borders. We conducted a retrospective cohort study of adult patients undergoing pancreaticoduodenectomy between 2010 and 2015 to evaluate the effect of resection margin distance (0 mm, 0 to ≤ 2 mm v. > 2 mm) on overall and disease-free survival. Mean survival times were calculated. Kaplan–Meier curves were constructed and evaluated using the log rank test. Ninety-six deaths were observed in 136 patients over 207.5 person years. Mean follow-up time was 18.3 months. Seventy-six patients were noted to have a recurrence. Forty-eight patients (35%) were found to have involved margins. Both overall and disease-free survival were found to be statistically different in patients with 0 mm margins compared with those patients whose closest margin was measured to be 0 to ≤ 2 mm and > 2 mm (log rank = 0.001 and 0.004, respectively). Mean overall survival was 14.7 months (95% CI 11.9–17.5), 27.3 months (95% CI 20.9–33.8) and 32.7 months (95% CI 22.3–43.0) and mean disease-free survival was 13.2 months (95% CI 10.5–16.0), 26.0 months (95% CI 18.7–33.3) and 33.0 months (95% CI 23.0–43.0) in the 0 mm, 0 to ≤ 2 mm and > 2 mm groups, respectively. Seven patients survived 5 years postoperatively; of those, none had 0 mm margins, 4 had a margin between 0 and ≤ 2 mm and 3 had a margin > 2 mm. Given the high incidence of patients with involved resection margins following pancreaticoduodenectomy and the associated negative outcomes, greater consideration should be given to neoadjuvant therapy for treatment of PDAC to optimize the likelihood of complete resection and select patients most likely to benefit from surgery.

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Surgical practice patterns and outcomes in T3 gallbladder cancer: insights from a population-based study. *S. Tharmalingam, J. Flemming, H. Richardson, S. Nanji*. From Queen's University, Kingston, Ont.

Gallbladder cancer (GBC) is a lethal malignancy. Surgery remains the only option for cure. We aim to describe management and outcomes in patients with resected T3 GBC in the general population of Ontario, Canada. All cases of surgically resected GBC in Ontario from 2002 to 2012 were identified using the population-based Ontario Cancer Registry. Electronic records of treatment were linked to the registry to identify surgical procedures and utilization of chemo/radiotherapy. Pathology reports were used to identify T3, M0 GBCs and to collect details regarding extent of disease and surgical procedure. Type of resection was classified as extended (cholecystectomy plus liver and/or bile duct resection) or simple (cholecystectomy only). Five-year overall survival (OS) based on type of resection was determined using the Kaplan–Meier technique and the log-rank test. The association between type of surgical resection and OS was explored using Cox proportional hazards regression model. A total of 138 patients underwent surgical resection for T3M0 GBC, of which 37% (51/138) had an extended resection. Overall 5-year survival was 13.5% for simple cholecystectomy

and 22.8% for extended resection (p = 0.05). In adjusted analysis, only sex and age were significant predictors for overall survival, with female sex (HR = 0.66; CI 0.43–1.00) being protective and increasing age (HR = 1.04; CI 1.02–1.06) associated with worse survival. Extended resection demonstrated a trend toward significance among node-negative cases (HR = 0.20; CI 0.03–1.06). Post-hoc analysis of margin status showed that repeat resection following simple cholecystectomy for T3 GBC with negative margins did not confer any additional survival benefit. The use of extended resection for T3 GBC in Ontario is modest and OS in this population-based cohort is comparable to that in high-volume centres. Extended resection maybe beneficial in node-negative T3 disease.

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Phlebotomy with controlled hypovolemia is associated with decreased red blood cell transfusion in liver surgery. ***L. Baker, G. Martel, S. Bennett, S. Saeed, C. Wherrett, K. Bertens, F. Balaa*. From the University of Ottawa, Ottawa, Ont.**

Perioperative red blood cell transfusion is associated with poor outcomes in liver surgery. Phlebotomy with controlled hypovolemia, an intervention that is different from acute normovolemic hemodilution, is hypothesized to decrease transfusion requirements. The objective of this work was to determine whether phlebotomy is protective of transfusion, after accounting for other known confounders. Consecutive patients who underwent liver resection at 1 institution (2010–2016) were examined. Factors predictive of perioperative blood transfusion, both on univariate analysis and previously published, were modelled using multivariate logistic regression. A total of 373 patients underwent liver resection (48% major). Phlebotomy was performed in 45 patients (12%) since 2013, for a median of 496 mL of removed blood (range 247–809). Phlebotomy patients were more likely to have a primary malignancy (31% v. 17%, p = 0.0278) and to have a major resection (84% v. 43%, p < 0.0001). A trend toward decreased blood loss was noted with phlebotomy (569 v. 748 mL, p = 0.0563). On multivariate logistic regression, only having a phlebotomy (OR 0.231, 95% CI 0.081–0.655, p = 0.0059), major liver resection (OR 2.858, 95% CI 1.622–5.036, p = 0.0003) and preoperative hemoglobin < 12.5 g/dL (OR 6.045, 95% CI 3.482–10.493, p < 0.0001) were significantly associated with perioperative red blood cell transfusion. Gender, body mass index, history of coronary disease, prior liver resection, having a primary malignancy, preoperative platelets, Pringle, and extrahepatic resection were not significantly associated with transfusion. Phlebotomy with controlled hypovolemia appears to be significantly protective of red blood cell transfusion, independently from other known risk factors. This intervention warrants further study.

Canadian Hernia Society (CHS)

01

Soft tissue integration of hernia mesh seeded with adipose-derived stem cells. ***D. Sisson*. From Queen's University, Kingston, Ont.**

Despite advances in technique, materials and approach, recurrence rate following herniorraphy remains high. Similarly, mesh infection remains a significant source of morbidity and early failure. Stem cells have been proposed as an adjunct to facilitate cell-based tissue repair, and adipose-derived stem cells are an abundant, autologous and nonimmunogenic potential source. Specifically, evidence suggests that adipose-derived stem cells (ASC) may be beneficial in stimulating early angiogenesis and wound healing, both in acute and chronic wounds. This study will examine the impact of using ASCs in the context of early integration of hernia mesh, using an animal model. We conducted a prospective placebo-controlled in vivo study comparing soft tissue integration of polypropylene hernia mesh seeded with ASCs versus unseeded mesh. The subjects were humanely sacrificed and samples were harvested. Histologic analysis was carried out by 2 independent, blinded pathologists. The primary end point was angiogenesis, measured by the number of vessels per high-powered field. Secondary end points were cellular infiltration and fibrosis. A modified Ehrlich–Hunt scale was used for evaluation of samples. Seeded and unseeded polypropylene hernia mesh was placed into subcutaneous pockets on the dorsal surface of 16 female Wistar rats. Four experimental time groups (72 hours, 1 week, 4 weeks and 8 weeks) were set. The primary and secondary end points were evaluated at each time point. The number of vessels per high-powered field was 6.7 versus 4.3 (72 h, seeded v. unseeded), 7.6 versus 7.4 (1 week, seeded v. unseeded), 6.3 versus 6.1 (4 weeks, seeded v. unseeded) and 5.6 versus 3.6 (8 weeks, seeded v. unseeded). Final analysis is still pending and will be completed for presentation at the Canadian Surgery Forum. Preliminary analysis suggests an increase in early angiogenesis with addition of ACSs to polypropylene hernia mesh. Further in vivo studies will be required to quantify the clinical benefit of this histologic finding.

02

Outcomes and costs of open incisional hernia repair with retromuscular ProGrip mesh placement, a retrospective case series. ***N. AlShahwan, S. Fraser*. From McGill University, Montreal, Que.**

This study examines the feasibility of using a self-fixating mesh (ProGrip) in retromuscular incisional hernia repair following a posterior component separation; the ProGrip mesh has been shown to be associated with less chronic pain than other types of mesh. This retrospective case series' primary outcome was early recurrence in patients undergoing retrorectus incisional herniorrhaphy with posterior component separation using ProGrip mesh between March 2013 and December 2015 at a tertiary care centre. Data collected included age, number/size of the hernia defect, body mass index (BMI), smoking status, American Society of Anesthesiologists (ASA) score, comorbidities, duration of the procedure and hospital length of stay, as well as process measures of administration of preoperative antibiotics and deep vein thrombosis (DVT) prophylaxis. The implant cost was also calculated. Follow-up included a clinical exam at 1–2 months and selective use of imaging to identify complications and early recurrences. Of the 33 patients with incisional hernias, 10 (30.3%) had had prior incisional hernia

repairs; 4 had more than a single fascial defect. Thirty-five percent were male, mean age was 61.2 years and 35% of the cohort were smokers. The mean BMI was 31.67 and the mean ASA score was 2.2. All patients received perioperative antibiotics and DVT prophylaxis. Mean implant cost was $253.12. A subanalysis was done on 10 patients to calculate the mean hospital cost, which was $3533.87. Postoperative complications occurred in 7 patients, with a median Clavien grade of 2. No patients had evidence of recurrence on clinic follow-up; the mean time from the procedure date to clinic follow-up visit was 5.52 months and the mean time from the procedure date to data review date was 28.74 months. Mean length of stay was 2.52 days. The use of the self-fixating mesh is feasible and safe in the treatment of incisional hernia with retromuscular placement of the mesh following a posterior component separation. There were no early recurrences, with few minor complications.

03

Outcomes after incisional hernia repair: Does mesh type matter? ***J. Koichopolos, R. Leeper, K. Vogt, N. Parry, K. Leslie*. From Western University, London, Ont.**

The rate of incisional hernia occurrence after laparotomy is as high as 30%, with many patients undergoing subsequent repairs. This study assesses hernia recurrence rates with synthetic mesh versus biologic mesh with or without component separation. All incisional hernia repairs at a single centre between 2007 and 2013 using synthetic mesh (Proceed, Johnson & Johnson) or biologic mesh were included. Data on patient risk factors and hernia characteristics that increase the risk of recurrence were collected. The primary outcome was recurrence rate and the secondary outcome was infection rate. A total of 183 patients were included in the retrospective review. Despite the differing patient complexity (patients with biologic mesh had significantly higher modified hernia grading scores, ostomy presence, American Society of Anesthesiologists [ASA] scores, bowel resections, and number of previous hernia repairs), the symptomatic recurrence rate was not significantly different with biologic mesh as compared with synthetic mesh (32.3% v. 22.2%, $p = 0.128$) nor was rate of reoperation for that recurrence (15.1% and 12.2%, $p = 0.577$). The time to recurrence was significantly earlier for biologic mesh as compared with synthetic mesh (20.5 v. 38.0 months, $p = 0.002$) and the rate of infection was significantly higher (37.7% v. 13.4%, $p = 0.000$). Component separation did not decrease the recurrence rate with biologic mesh (36.2% v. 23.5%, $p = 0.206$). A regression analysis did not identify any factors that significantly increase the risk of recurrence. There was no significant difference seen in hernia recurrence or repair rates between biologic or synthetic mesh. Biologic mesh had a higher rate of surgical site infection and a shorter time interval to recurrence. This is likely secondary to the increased surgical complexity that these patients consistently demonstrated. Component separation did not mitigate these factors. Future research should focus on ways to obtain primary fascial closure with synthetic mesh alone to avoid the added cost and increased morbidity when biologic mesh is used.

04

Pain and surgical outcomes reporting after laparoscopic ventral and incisional hernia repair in relation to mesh fixation techniques: a systematic review and meta-analysis of randomized clinical trials. ***M. Ahmed, Q. Tawfic, C. Schlachta, N. Alkhamesi*. From the London Health Sciences Centre, Western University, London, Ont.**

The aim of this review was to examine the level of postoperative pain following laparoscopic ventral and incisional hernia repair (LVIHR) and the effect of mesh fixation methods on its intensity and occurrence. Randomized clinical trials (RCTs) that compared different methods of mesh fixation in LVIHR and reported on pain outcome measures were analyzed using the statistical tool RevMan. Results were expressed as odds ratios (OR) for combined dichotomous data and mean differences (MD) for continuous data. Nine RCTs that were all published after 2005 with a total of 697 patients were eligible for inclusion. A meta-analysis of postoperative pain from 5 RCTs comparing tack (TMF) to suture mesh fixation (SMF) techniques gave statistically similar odds of chronic pain (OR 1.01; 95% CI 0.50–2.05; $p = 0.98$). No difference in postoperative pain intensity scores were found during the early postoperative period (MD –0.44; 95% CI –1.11 to 2.00; $z = 0.56$; $p = 0.05$), at 4–6 weeks (MD 0.18; 95% CI –0.48 to 0.85; $z = 0.45$; $p = 0.59$) and at 3–6 months postoperatively, which is defined as chronic pain (MD –0.11; 95% CI, –0.21 to –0.43; $z = 0.66$; $p = 0.51$). There were also no differences found in pooled analysis of seroma/hematoma formation ($p = 0.18$), recurrence (0.86) and hospital stay (0.40). Operative time was significantly lower with TMF ($p < 0.05$). Further analysis from 2 RCTs comparing nonabsorbable tacks (NAT) to absorbable tacks (AT) identified no difference in means for early postoperative pain (MD –0.03; 95% CI –0.30 to 0.24; $z = 0.22$; $p = 0.82$), chronic pain (MD –0.09; 95% CI –0.77 to 0.58; $z = 0.27$; $p = 0.78$), operative time ($p = 0.07$), hospital stay ($p = 0.98$), seroma/hematoma ($p = 0.46$), and recurrence rate ($p = 0.97$). Meta-analysis of RCTs comparing TMF with SMF fixation in LVIHR was comparable in terms of postoperative pain intensity, chronic pain incidence and hernia recurrence rate. These findings were also evident with NAT versus AT fixation techniques

Canadian Society of Colon and Rectal Surgeons (CSCRS)

01

The application of incisional negative pressure wound therapy for perineal wounds: a systematic review. ***C. Cahill, A. Fowler, L. Williams, H. Moloo, I. Raîche, R. Musselman*. From the University of Ottawa, Ottawa, Ont.**

Impaired perineal wound healing is a major source of morbidity after abdominoperineal resection. Incisional negative pressure wound therapy is the application of negative pressure wound therapy on closed incisions. It is a way to improve healing, prevent surgical site infections and decrease the frequency of dehiscence. Its use on perineal wounds is not well established. The primary objective of this systematic review was to summarize existing evidence on the use of incisional negative pressure wound therapy on perineal wounds after abdominoperineal resection. In January 2017, the electronic databases of Ovid Medline,

Embase, Cochrane Library and CINAHL were systematically searched. Studies describing use of incisional negative pressure wound therapy on primarily closed perineal wounds after abdominoperineal resection were included. The primary end point was presence or absence of literature on the subject of incisional negative pressure wound therapy for perineal wounds. Secondary outcome measures were the effect of incisional negative pressure wound therapy on postoperative perineal wound complication incidence. Of the 278 identified studies, 5 articles were retrieved for inclusion in the systematic review (n = 169 patients). There were 3 retrospective consecutive cohorts, 1 case series and 1 video case report. The cohort studies demonstrated a significant decrease in perineal wound complications when using incisional negative pressure wound therapy, with surgical site infection rates as low as 9% (v. 41% in control groups). The case series and video case report were supportive of the use of incisional negative pressure wound therapy. This review suggests that incisional negative pressure wound therapy decreases perineal wound complications after abdominoperineal resection when placed on the wound prophylactically for 5 days postoperatively. Limitations include the small number of retrieved studies with small patient populations, high heterogeneity and methodological issues. Further prospective trials with larger patient populations would be needed to confirm this association and delineate which patients might benefit most from the intervention.

02

On-table colonic lavage for left-sided obstruction carcinoma. ***D. Abramowitz*** **(University of Toronto, Toronto, Ont.),** ***A. Feinberg*** **(University of Toronto, Toronto, Ont.),** ***S. Feinberg*** **(University of Toronto, North York General Hospital, Toronto, Ont.).**

The management of left-sided malignant obstruction is a problem faced by the general surgeon that requires a combination of technical skill and judgment. Decisions on management are guided by patient factors, disease factors and technical factors. Options include diversion alone, segmental resection with or without anastomosis, subtotal colectomy with or without anastomosis and colonic stenting. When performing a segmental resection with a colorectal anastomosis, some considerations need to be made regarding an upstream fecal-loaded and distended colon. On-table colonic lavage is one strategy to manage the upstream bowel, and when compared with subtotal colectomy with ileal-rectal anastomosis in the SCOTIA trial, it had similar morbidity with better functional results. In this video, we will describe our technique of an on-table colonic lavage to deal with the upstream colon before anastomosis.

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Major abdominal surgery for benign colorectal disease improves patient-reported quality of life. ***R. Maniar G. Liu, J. Sutherland, C. Brown, M. Raval, T. Phang, A. Karimuddin.*** **From the University of British Columbia, Vancouver, B.C.**

Patient-reported outcomes (PROs) on health status and quality of life (QoL) can be used to assess surgical interventions. Limited data are available on PROs for patients with benign colorectal disease undergoing elective major abdominal surgery. Patients with benign colorectal disease, including ulcerative colitis (UC), Crohn's disease and diverticulitis were surveyed on PROs between 2012 and 2016. Included patients underwent an elective abdominal operation, in the form of a bowel resection or pelvic pouch procedure. Outcomes were assessed after placement on the surgical wait list and 6 months after surgery. Survey instruments included a general health outcome questionnaire (EQ-5D, max score 1.0), an overall health status visual analogue scale (VAS, max score 100) and assessment tools for pain (PEG, max score 10) and depression (PHQ-9, max score 27). Pre- and postoperative scores were compared using paired-samples t tests. Fifty-seven patients completed both pre- and postoperative surveys. Postoperative scores were significantly improved from preoperative scores on the EQ-5D (mean score ± standard deviation; 0.85 ± 0.17 v. 0.78 ± 0.19, p = 0.004), VAS (76.20 ± 18.02 v. 66.93 ± 19.69, p = 0.001), PEG (2.00 ± 2.35 v. 2.85 ± 3.05, p = 0.020) and PHQ-9 (3.86 ± 4.42 v. 5.25 ± 5.43, p = 0.016). Patients with Crohn's disease (n = 16) experienced the greatest preoperative reductions in QoL and highest pain and depression scores. Average health status and pain scores improved significantly following surgery for the Crohn's and diverticulitis (n = 30) patients but not the UC patients (n = 11). Depression scores also improved significantly following surgery for the Crohn's patients. Surgical intervention for benign colorectal disease improves patient-reported health status and QoL. Improvements are most pronounced for patients with Crohn's disease and diverticulitis, possibly owing to symptom burden before operative intervention. Surgery for ulcerative colitis may not result in significant improvements in health status outcomes as measured by the included tools.

47

The impact of intestinal resection for benign colorectal polyps on patient-reported health status. ***R. Maniar G. Liu, J. Sutherland, C. Brown, M. Raval, T. Phang, A. Karimuddin.*** **From the University of British Columbia, Vancouver, B.C.**

Response to surgical interventions can be assessed with patient-reported outcomes (PROs) on health status and quality of life. To our knowledge, no existing studies assess PROs following intestinal resection for benign colorectal polyps not amenable to endoscopic therapy or local excision. This study assessed the impact of bowel resection for benign polyps on patient-reported health status. Patients with benign polyps undergoing a colon or rectal resection completed pre- and postoperative surveys on health status between 2012 and 2016. Patients completed the survey tools following placement on the surgical wait list and again 6 months after surgery. The survey tools included a general health questionnaire (EQ-5D, max score 1.0), which incorporates an overall health status visual analogue scale (VAS, max score 100), a pain scale (PEG, max score 10) and a depression questionnaire (PHQ-9, max score 27). Survey tool scores before and after surgery were compared using paired-samples t tests. Forty-one patients submitted pre- and postoperative surveys. All patients underwent a bowel resection, including right hemicolectomy (n = 17), left hemicolectomy (n = 2), anterior resection (n = 13), abdoperineal resection or proctocolectomy (n = 7) or total colectomy (n = 2). Twenty-four procedures were completed laparoscopically. Patients generally had good preoperative health status scores and minimal symptoms. There were no significant differences in scores before and after surgery for the EQ-5D (mean

score ± standard deviation; 0.85 ± 0.12 v. 0.87 ± 0.15, $p = 0.15$), VAS (75.05 ± 16.32 v. 77.75 ± 12.13, $p = 0.08$), PEG (1.94 ± 2.10 v. 1.50 ± 1.92, $p = 0.24$), and PHQ-9 (3.54 ± 3.68 v. 3.02 ± 2.38, $p = 0.30$). Surgical intervention for benign polyps does not significantly impact patient-reported health status 6 months after surgery, as measured by the EQ-5D, PEG and PHQ-9. Patients undergoing bowel resection can be counselled that their quality of life is likely to remain stable following surgery.

03

Outcomes of transanal endoscopic microsurgery (TEM) for the surgical management of T2 and T3 rectal cancer. ***R. Maniar*, *M. Raval*, *T. Phang*, *A. Karimuddin*, *C. Brown*. From the University of British Columbia, Vancouver, B.C.**

Transanal endoscopic microsurgery (TEM) is an emerging surgical therapy for early-stage rectal cancer, but evidence has been discouraging for more advanced lesions. Although patients with more advanced lesions are recommended for radical resection, some patients with prohibitive comorbidity or those who refuse conventional treatment may receive TEM. This study assessed the outcomes of TEM as the sole surgical treatment for T2 and T3 rectal cancers at St. Paul's Hospital (SPH). At SPH, demographic, operative, pathologic and follow-up data have been collected and maintained for all patients treated by TEM. Included patients had T2 or T3 adenocarcinoma confirmed on final pathology. Patients who subsequently underwent radical resection were excluded. Subgroup analysis was performed by final tumour stage (T2 v. T3) and reason for TEM resection (patient comorbidity v. patient refusal). Complications, pathologic features, margin status, disease-free survival (DFS) and overall survival (OS) were assessed. Forty-five patients were treated by TEM for T2 ($n = 33$) or T3 ($n = 12$) rectal cancer between 2007 and 2016 due to significant comorbidity ($n = 27$) or patient refusal ($n = 18$). Postoperative morbidity occurred in 26.7%, although most complications were minor (83.3% Clavien–Dindo classification ≤ 2). On final pathology, 35.6% specimens had a positive margin and one-third had high-risk features, which were significantly more common for T3 lesions. Median follow-up was 23 months. Overall mortality was 42.2%, and 17.8% had disease recurrence. Five-year survival rates were 73.7% for DFS and 49.0% for OS. OS was significantly better for T2 tumours and patients who refused radical resection. Patients who received neoadjuvant and adjuvant therapy had trends toward improved survival. Oncologic outcomes are suboptimal following TEM for T2 and T3 rectal cancer. Prolonged survival may be seen in some patients who refuse more radical treatment. More studies are needed to determine the role of adjuvant therapy to TEM for T2 and T3 cancers.

04

The effect of a simultaneous versus staged resection of metastatic colorectal cancer on time to adjuvant chemotherapy. ***E. Le Souder* (University of Toronto, Toronto, Ont.), *A. Elnahas* (University Health Network, Toronto, Ont.), *A. Azin* (University Health Network, Toronto, Ont.), *D. Hirpara* (University of Toronto, Toronto, Ont.), *S. Cleary* (University Health Network, Toronto, Ont.), *A. Wei* (University Health Network, Toronto, Ont.), *R. Walker* (University Health Network, Toronto, Ont.), *A. Parsyan* (University Health Network, Toronto, Ont.), *S. Chadi* (University Health Network, Toronto, Ont.), *F. Quereshy* (University Health Network, Toronto, Ont.).**

Select patients presenting with colorectal cancer with synchronous liver metastases (SLM) may undergo a staged or simultaneous resection of the primary tumour and SLM with curative intent. Adjuvant chemotherapy is commonly given to reduce the risk of recurrence. This study aimed to determine if the time to adjuvant chemotherapy was delayed in patients undergoing a simultaneous resection when compared with a staged approach. A retrospective chart review of patients receiving surgical treatment for colorectal cancer with SLM at our institution from January 2005 to July 2016 was performed. The primary outcome was time to adjuvant chemotherapy. Secondary outcomes included rates of 30-day morbidity, overall survival (OS) and disease-free survival (DFS). A multivariate analysis was conducted to evaluate predictors associated with time to adjuvant chemotherapy. OS and DFS were calculated using the Kaplan–Meier product-limit method. A total of 155 patients underwent surgery for synchronous metastatic colon cancer for curative intent. There were 127 patients who received a staged resection and 28 who received a simultaneous resection. Patient factors, such as age, sex and American Society of Anesthesiologists (ASA) class, as well as tumour factors, such as TNM stage, location, and number and size of metastases, were similar between the 2 groups. Median time to adjuvant chemotherapy was 64 days for the staged group and 66 days for the simultaneous group ($p = 0.27$). There were no differences in hospital length of stay, 30-day morbidity, recurrence, OS and DFS between the 2 groups ($p > 0.05$). Our study demonstrated that a simultaneous resection of colorectal cancer with SLM does not result in a significant delay to adjuvant chemotherapy when compared with a staged approach. Both strategies were also comparable with respect to short- and long-term clinical outcomes, including 2- and 5-year OS and DFS. Further studies are needed to validate these findings.

05

Comparison of conflict of interests between robotic and nonrobotic surgery studies in colorectal surgery: a case-control study. ***B. Elsolh* (University of Toronto, Toronto, Ont.), *D. Yu* (Queen's University, Kingston, Ont.), *S. Patel* (Queen's University, Kingston, Ont.).**

Industry funding of research articles may be associated with more favourable results. As such, authors must declare any conflicts of interest that may bias the results. With the Physician Payments Sunshine Act, it is now possible to validate these declaration statements. The objective of this study is to assess differences in declaration of conflict of interest between robotic (cases) and nonrobotic (controls) colorectal studies. All colorectal studies assessing robotic surgery published in 2015 were identified and reviewed. Nonrobotic control articles were selected from the same journal as the case article and matched based on study design. Using the Open Payments database, actual funding was determined for each American author for 2013 and 2014. We then determined if there was a discrepancy between the author's declared conflict of interest and the actual funding they received. Articles were then compared for differences in declared conflict

of interest, undeclared conflict of interest and the value of payments. Seventy-two studies were included (36 cases, 36 controls) and included 320 American authors (157 in the cases and 163 in the controls). Declaration statements were present in 53 studies (71.6%), with no difference between cases and controls (72.2% v. 75.0%, $p = 0.79$). Funding, as determined by the Open Payments database, was common across both cases and controls (82%), with case articles less likely to receive funding (69.4% v. 94.4%, $p = 0.006$). Undeclared funding was common in both groups (72% v. 82%) and did not differ between cases and controls ($p = 0.35$). The average funding was $85 340 per study, with no difference between those who declared and those who did not declare their funding ($p = 0.21$). We found that undeclared funding is common in both cases and control articles, with no significant differences between groups. Interpretation of results from studies with undeclared funding and conflict of interest should be done with caution.

06

Perioperative blood transfusion for resected colon cancer: practice patterns and outcomes in a population-based study. ***S. Patel*, *K. Brennan*, *S. Nanji*, *S. Merchant*, *S. Karim*, *C. Booth*. From Queen's University, Kingston, Ont.**

Literature suggests that perioperative blood transfusion among patients with resected colon cancer may be associated with inferior long-term survival. Our objective was to determine the association between long-term outcomes and perioperative blood transfusion for patients with surgically resected colon cancer in Ontario, Canada. The exposure was perioperative red blood cell (RBC) transfusion. The main outcome measures were cancer-specific (CSS) and overall survival (OS). Cases were identified using the population-based Ontario Cancer Registry (2002–2008). Linked records of treatment identified surgery and RBC transfusion during hospital admission. Pathology reports were obtained for a 25% random sample of all cases and constituted the study population. Log binomial regression was used to identify factors associated with transfusion. A Cox proportional hazards model explored the association between transfusion and CSS and OS. The study population included 7198 patients with resected colon cancer: 18% stage I, 36% stage II, 40% stage III and 6% stage IV. Twenty-eight percent of patients were transfused; rates decreased over the study period from 31% in 2002 to 24% in 2008 ($p < 0.001$). Factors that were independently associated with transfusion include advanced age ($p < 0.001$), female sex ($p < 0.001$), greater comorbidity ($p < 0.001$), more advanced disease ($p < 0.001$) and open surgical resection ($p < 0.001$). Surgeon volume was not associated with transfusion rate. Transfusion was associated with inferior CSS (HR 1.51, 95% CI 1.38–1.65) and OS (HR 1.52, 95% CI 1.41–1.63). Results were consistent in a propensity score analysis and when patients who died within 90 days of surgery were removed from the analysis. Limitations of this study were the lack of details about transfusion and those that apply to large administrative databases, such as inherent errors in data capture and miscoding. Perioperative transfusion rates among patients with colon cancer have decreased over time. Transfusion is associated with inferior long-term CSS and OS.

07

Systematic review of outcomes after salvage abdominoperineal resection for persistent or recurrent anal squamous cell cancer. ***G. Ko*, *A. Sarkaria*, *S. Merchant*, *S. Patel*. From Queen's University, Kingston, Ont.**

Standard definitive treatment for patients with a new diagnosis of squamous cell carcinoma of the anus (SCCA) is chemoradiation. Up to 30% of these patients will require a salvage abdominoperineal resection (APR) for either persistent or recurrent disease. Studies looking at outcomes after APR for SCCA have been limited to single centres with small numbers of patients. The objective of this systematic review was to assess cancer-related outcomes in patients with either (1) persistent or (2) recurrent SCCA. Articles were included if they assessed short- or long-term outcomes in patients undergoing salvage APR for persistent or recurrent SCCA. Embase and Medline were searched. The primary outcomes of this review were overall survival (OS), disease-free survival (DFS) and locoregional recurrence or metastatic disease. Secondary outcomes included wound and other perioperative complications. A total of 200 studies were identified, with 20 studies meeting our inclusion criteria. The median time to salvage APR was 2.8 months (IQR 2.6–2.8 months, 4 studies) for persistent disease and 25.6 months (IQR 15–32.7 months, 4 studies) for recurrent disease. The median 5-year OS was 47% (IQR 33%–59.7%, 9 studies) for persistent disease and 43.5% (IQR 17.5%–68.6%, 10 studies) for recurrent disease. The median 5-year DFS was 33.6% (range 31.1%–36%, 2 studies) for persistent disease and 53.1% (range 48.2%–58%, 2 studies) for recurrent disease. A median of 47% of patients (IQR 39.7%–58.5%, 15 studies) developed locoregional recurrence or metastatic disease. The median wound complication rate was 38.9% (IQR 18.6%–56.4%, 17 studies) and the median perioperative mortality rate was 0% (IQR 0%–1.9%, 17 studies). This current review included 20 studies assessing outcomes following salvage APR for SCCA. Limitations of this review include small sample sizes from single institutional studies, as well as heterogeneity in disease definitions and outcomes.

08

Proctology patients on surgical waitlists show high pain and depression scores on patient-reported outcomes. ***S. Manoharan* (University of British Columbia, Vancouver, B.C.), *A. Karimuddin* (University of British Columbia, Vancouver, B.C.), *C. Brown* (University of British Columbia, Vancouver, B.C.), *T. Phang* (University of British Columbia, Vancouver, B.C.), *M. Raval* (University of British Columbia, Vancouver, B.C.), *R. Maniar* (University of British Columbia, Vancouver, B.C.), *G. Liu* (University of British Columbia, Vancouver, B.C.), *T. Crump* (University of Calgary, Calgary, Alta.), *J. Sutherland* (University of British Columbia, Vancouver, B.C.).**

Prolonged waits for elective surgery are commonplace in many health systems. There is a dearth of information regarding patients' health status as a result of prolonged wait times for proctology procedures. The burden on patients' health is not understood in this population of patients. Our objective was to determine the effect of wait time on patient-reported health status outcomes for patients awaiting proctology surgery as compared with general surgery patients and patients awaiting surgery for hemorrhoid conditions. This study is a prospective longitudinal cohort study of patients waiting for proctology and general

surgery procedures. Once assigned to a surgical wait list, patients self-reported their own health in domains of pain and depression. Comparisons were made between patients awaiting benign proctologic procedures and benign general surgical procedures. Patient-reported outcomes (PROs) were measured using the PEG-3 scale for pain and PHQ-9 questionnaire for depression. There were 269 proctology patients and 841 general surgery patients included in the study. There were 67 patients awaiting surgery for hemorrhoids. The most common proctology diagnoses for the remaining patients were anal fissure, anal fistula and rectal prolapse. They had an average PHQ-9 score of 4.3, which was higher than those in the hemorrhoid and general surgery groups, who had scores of 3.4 and 3.8, respectively. Similarly, the PEG-3 scores revealed a higher score of 3.1 in the nonhemorrhoid patients compared with 2.6 and 2.8 in the hemorrhoid and general surgery groups, respectively. Proctology patients waiting for surgery with diagnoses other than hemorrhoids trended toward higher pain and depression scores than other general surgery patients. The results of our study may help prioritization among patients on the surgical waitlist for benign anorectal disease due to differences in burden of symptoms. Utilization of PROs is a useful approach to developing prioritization systems or allocating resources.

09

Bowel preparation and perioperative complications in transanal endoscopic microsurgery: a systematic review. ***A. Warraich*** **(The Ottawa Hospital, Ottawa, Ont.),** ***J. Greenberg*** **(University of Ottawa, Ottawa, Ont.),** ***H. Moloo*** **(University of Ottawa, Ottawa, Ont.),** ***R. Musselman*** **(University of Ottawa, Ottawa, Ont.),** ***I. Raîche*** **(University of Ottawa, Ottawa, Ont.),** ***L. Williams*** **(University of Ottawa, Ottawa, Ont.).**

The objective of this systematic review is to gather data from the literature to compare preoperative mechanical bowel preparation (MBP) and fleet enema in terms of their impact on postoperative complication rates and quality of bowel preparation in transanal endoscopic microsurgery (TEM). The electronic databases of Embase, Cochrane Library and Ovid Medline were searched for TEM-related studies. Only full-length, English language articles with $n \geq 100$ were included. Each study was then assessed for author description of type of bowel preparation as well as documentation of postoperative outcomes. The primary end point was overall complication rates. Secondary end points were subgroup postoperative complication rates and surgeon satisfaction with bowel preparation. Of the initially identified 752 studies, 21 were included in our analysis. A total of 3567 patients from 16 studies were in the MBP group, and 819 patients from 5 studies were in the enema group. The overall postoperative complication rates were comparable between both groups (MBP 3.9% v. fleet enema 16.8%, $p = 0.47$). The most common postoperative complication was urinary retention, which was comparable between groups (MBP 4.2% v. fleet enema 6.1%, $p = 0.59$). Rates of infectious complications were also comparable (MPB 2.0% v. fleet enema 2.6%, $p = 0.45$), as were bleeding complications (MBP 3.2% v. fleet enema 2.12%, $p = 0.42$). There were no data on the quality of bowel preparation or surgeon satisfaction with preparation available. Our review suggests that clinical equipoise exists with regards to preoperative bowel preparation in the TEM population, but further studies are required. We plan to design a multicentre randomized controlled trial to compare enema and MBP to assess for quality of preparation and postoperative complications with the hypothesis that fleet enema is noninferior to MBP in the context of TEM.

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A comparison of provincial clinical practice guidelines for rectal cancer. ***Z. Mir, D. Yu, S. Merchant, C. Booth, S. Patel.*** **From Queen's University, Kingston, Ont.**

The management of rectal cancer requires a multidisciplinary approach, and clinical practice guidelines provide an important framework in delivering consistent evidence-based care. Our objective was to compare provincial clinical practice guidelines to identify areas of inconsistency. We obtained clinical practice guidelines for 7 of 10 Canadian provinces from the provincial bodies responsible for cancer care recommendations. Information from these guidelines was abstracted in duplicate. We compared recommendations related to initial staging investigations, treatment (by stage), and post-treatment surveillance between guidelines. Within staging investigations, we identified discrepancies in the recommended modalities for locoregional staging; 2 guidelines preferred MRI over endorectal ultrasound, 2 recommended either modality, and 3 specified scenarios for using one over the other. We also noted inconsistencies in recommendations for the use of chest CT versus chest x-ray to assess for pulmonary metastases, as well as specific indications for transanal excision in early-stage rectal cancer. Uniformly, all 7 guidelines did not recommend routine neoadjuvant or adjuvant therapy for stage I disease. However, recommendations for neoadjuvant therapy in stage II/III disease differed; 3 guidelines recommended chemoradiation over (short-course) radiation therapy, while 3 others preferred short-course radiation in specific clinical scenarios (e.g., stage II, nonfixed, or upper rectal lesions). One guideline did not commit to either protocol but stated chemoradiation was used by the majority of clinicians. Adjuvant chemotherapy for stage II/III disease was generally recommended (with variable protocols), but it is controversial in the literature. For surveillance, 1 guideline recommended only surveillance colonoscopy for stage I disease, but the majority did not differentiate surveillance protocols by disease stage. Lastly, duration of chest surveillance was also inconsistently applied. Our study shows a number of areas of discrepancy between provincial clinical practice guidelines for rectal cancer. As new evidence emerges, there may be value in consistent and uniform guidelines across provinces.

10

Surgical site infection in elective colon resections: effect of oral antibiotics. ***A. Ghuman, N. Kasteel, C. Brown, A. Karimuddin, M. Raval, P. Phang.*** **From the University of British Columbia, Vancouver, B.C.**

Surgical site infection (SSI) is a significant complication of colon surgery. Here, we assess the effect of oral antibiotics on SSI. Our study had a retrospective design: we analyzed consecutive elective colon resections at a single academic centre before ($n = 347$) and after ($n = 115$) addition of oral antibiotics, from January 2013 to October 2016. All patients had mechanical bowel preparation (MBP), oral carbohydrate loading, warming blankets, IV antibiotics, subcutaneous heparin, hair clipping and chlorhexidine skin preparation. SSIs were assessed using Centers for Disease Control and Prevention criteria. SSIs were compared before and after

addition of oral antibiotics. Adjusted odds ratios (OR, 95% CI) are reported for potential SSI risk factors. SSI rates were as follows, before versus after the intervention: overall 19.6% versus 2.6%, $p < 0.0001$; superficial 12.1% versus 2.1%, $p = 0.002$; organ space 7.2% versus 0%, $p = 0.002$. Univariate analysis yielded significant effects for age (0.98, 0.96–0.99), minimally invasive surgery (MIS) converted to open (2.74, 1.31–5.72), body mass index (BMI) (1.07, 1.02–1.12), wound class IV (2.77, 1.15–6.70), smoking (1.96, 1.03–3.74), surgery date (0.96, 0.94–0.98) and oral antibiotics (0.11, 0.03–0.36), but not for sex (0.79, 0.47–1.31), lesion location (0.64, 0.38–1.09), surgery duration (1.00, 0.99–1.004), American Society of Anesthesiologists (ASA) score (1.36, 0.90–2.05), diabetes (1.64, 0.87–3.10), steroid use (2.20, 0.76–6.38), surgeon (0.99, 0.78–1.26), wound protectors (WP) (0.74, 0.44–1.24) or negative pressure wound dressings (NPWD) (0.55, 0.16–1.86). With multivariate analysis, significant factors were age ($p = 0.04$), MIS converted to open ($p = 0.008$), BMI ($p = 0.007$), wound class IV ($p = 0.01$), smoking ($p = 0.02$) and oral antibiotics ($p = 0.0002$). Significant reduction in superficial and organ space SSI was found after adding oral antibiotics to MBP. Age, MIS converted to open, BMI, wound class IV and smoking also had a significant effect on SSI. The small postintervention number limits assessment of WP and NPWD. Further investigation is needed to understand isolated effects of oral antibiotics.

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Urinary retention in early Foley catheter removal after colorectal surgery. ***A. Ghuman, N. Kasteel, C. Brown, A. Karimuddin, M. Raval, P. Phang.* From the University of British Columbia, Vancouver, B.C.**

Prolonged catheterization causes increased urinary tract infections (UTIs), but early removal after surgery is linked to increased urinary retention. In our Enhanced Recovery After Surgery (ERAS) protocol for colorectal surgery we began removal of the Foley catheter on postoperative day 2. The aim of this study is to determine the incidence of urinary retention and infection and potentially contributing factors in male patients. This was a single academic centre retrospective cohort study with male patients 50 years of age and older undergoing elective colorectal surgery from January 2015 to October 2016. Females, prior prostate surgery, tumour extension to bladder or prostate and/or intraoperative urethral or bladder injury were excluded. As of 2016, prophylactic tamsulosin 0.4 mg daily was given 3 days before surgery and continued until discharge. A multivariate regression analysis was performed to determine potential risk factors for urinary retention, including age, neoadjuvant chemoradiation, history of voiding difficulty, minimally invasive surgery (MIS) versus open, lesion location, operative time, American Society of Anesthesiologists (ASA) score, intraoperative fluid balance, epidural, patient-controlled analgesia (PCA), postoperative complications, including anastamotic leak and ileus, and prophylactic tamsulosin use. Ninety-four patients were included in the analysis, 61 without and 33 with prophylactic tamsulosin. Urinary retention rate was 12.77% and urinary tract infection (UTI) rate was 5.32%. Operative duration and ileus were found to be independent risk factors for urinary retention with adjusted odds ratios of 1.02 (95% CI 1.01–1.04, $p = 0.004$) and 6.76 (95% CI 1.37–33.41, $p = 0.02$), respectively. There was no significant association with age, neoadjuvant chemoradiation, history of voiding difficulty, MIS versus open, lesion location, ASA score, intraoperative fluid balance, epidural, PCA, complications or prophylactic tamsulosin. The incidence of urinary retention and UTIs at our institution is high. Urinary retention was associated with operative duration and ileus, which could potentially be explained by more difficult cases. Urinary retention was not associated with rectal lesions location or prophylactic tamsulosin. However, sample size is small and further investigation is required.

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Right-sided colectomies for diverticulitis have worse outcomes compared with left-sided colectomies for diverticulitis: an ACS NSQIP analysis of predictors and outcomes. ***N. Wong-Chong, N. Morin, G. Ghitulescu, C. Vasilevsky, P. Gordon, J. Faria, M. Boutros.* From the Jewish General Hospital and McGill University, Montreal, Que.**

Right- and left-sided diverticulitis have similar clinical presentations. However, there are limited and conflicting data on the surgical outcomes following resection for right-sided compared with left-sided diverticulitis. The aim of this study was to compare these outcomes. All cases of right-sided colectomy (RC) and left-sided colectomy (LC) for diverticulitis were identified from the American College of Surgeons' National Surgical Quality Improvement Program database from 2005 to 2015. Demographics, comorbidities and postoperative outcomes were compared. Predictors of the predefined outcomes were analyzed by multivariate regression. Of 50 588 patients identified, 710 underwent RC for diverticulitis and 49 878 underwent LC. RC was associated with younger mean age (55.98 ± 14.68 v. 58.50 ± 13.00, $p < 0.01$) and Asian origin (3.66% v. 0.84%, $p < 0.01$). RC was more likely to be performed emergently (23.66% v. 15.80%, $p < 0.01$) and less likely to have a stoma (3.38% v. 24.91%, $p < 0.01$). Furthermore, RC was associated with higher rates of anastomotic leak (6.36% v. 3.16%, $p < 0.01$), reoperation (7.18% v. 4.80%, $p < 0.01$) and increased length of stay (median [IQR] 6 [4–10] v. 5 [4–8] days, $p < 0.01$), without any differences in overall 30-day major morbidity (19.44 v. 16.77, $p = 0.06$) or mortality (1.83% v. 1.30%, $p = 0.24$). On multivariate analysis, RC was a predictor of anastomotic leak (OR 2.04, 95% CI 1.13–3.68), major morbidity (OR 1.31, 95% CI 1.06–1.63) and increased length of stay (0.19 d, 95% CI 0.15–0.24). Emergency surgery was also a predictor for major morbidity (OR 1.42, 95% CI 1.53–2.66) for both RC and LC, while increased age, American Society of Anesthesiologists (ASA) score of 4 or 5, congestive heart failure, immunosuppression, contaminated/dirty wounds, and preoperative sepsis were predictors of mortality. Type of colectomy (right v. left-sided) was not a predictor of mortality. RC was more likely to be performed emergently compared with LC for diverticulitis, and it was associated with significantly greater rates of major morbidity, anastomotic leak and reoperation.

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Is the pathologic response of T3 rectal cancer to neoadjuvant high-dose-rate endorectal brachytherapy comparable to external beam radiotherapy? ***R. Garfinkle, S. Lachance, A. Mikhail, S. Vincent, V. Pelsser, N. Morin, T. Vuong, C. Vasilevsky, M. Boutros.* From the Jewish General Hospital and McGill University, Montreal, Que.**

Endorectal brachytherapy is an attractive neoadjuvant option for locally advanced rectal cancer (RC). This study compared

pathologic outcomes of patients with clinical T3 RC who underwent high-dose-rate endorectal brachytherapy (HDREBT) versus conventional external beam radiotherapy (EBRT). After institutional review board approval, all patients with clinical T3 RC based on MRI staging who underwent neoadjuvant therapy and total mesorectal excision from 2007 to 2016 were identified from a prospective database. Pretreatment MRIs were prospectively reviewed by a blinded gastrointestinal radiologist. Tumour response, defined as pathologic downstaging in T and/or N stage, was compared between patients who underwent neoadjuvant HDREBT versus EBRT. Baseline risk score for tumour response was modelled using variables a priori established with this outcome, including pretreatment nodal status, tumour distance from the anal verge, pretreatment carcinoembryonic antigen (CEA) levels and time from treatment to surgery. Effect of radiation technique was assessed in a multivariate regression model. Ninety-nine patients had T3 RC [median age: 67 years (Q1–Q3 59–75); there were 59 males (59.6%)]. Thirty-one (31.3%) were clinically node negative; 46 (46.5%) had c-N1 and 22 (22.2%) had c-N2 disease. Sixty-four (64.6%) underwent HDREBT and 35 (35.4%) underwent EBRT. The HDREBT group had lower median mesorectal depth of invasion (4 mm [Q1–Q3 2–7] v. 5 mm (Q1–Q3 4–13]; $p = 0.01$); all other preoperative tumour characteristics were similar. Eighteen patients (18.2%) achieved pathologic complete response (HDREBT: 12; EBRT: 6 [18.8% v. 17.1%; p = NS]). Sixty-eight (68.7%) patients were pathologically downstaged (HDREBT: 48; EBRT: 20 [75.0% v. 57.1%; p = NS]). On regression analysis, after accounting for mesorectal depth of invasion and baseline risk scores, radiation technique did not significantly impact differences in tumour response ($p = 0.15$). HDREBT was superior to EBRT for T (59.4% v. 28.6%; $p = 0.003$) but not N downstaging (35.9% v. 51.4%; $p = 0.14$). HDREBT neoadjuvant treatment of T3 RC appears to achieve equivalent overall pathologic downstaging and superior T downstaging compared with EBRT.

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Right-sided diverticulitis in a Canadian tertiary-care centre: a 15-year experience. ***J. Zuckerman, R. Garfinkle N. Morin, C. Vasilevsky, G. Ghitulescu, J. Faria, P. Gordon, M. Boutros.*** **From the Jewish General Hospital and McGill University, Montreal, Que.**

Although right-sided colonic diverticulitis is more common among Asians, it represents less than 5% of all diverticulitis cases in North America. This study aimed to describe the presentation, management and long-term outcomes of patients with a first episode of right-sided diverticulitis in North America. Patients who presented to a tertiary centre in North America with right-sided diverticulitis from January 2000 to August 2015 were identified. Patient demographics, disease characteristics and management data were collected by retrospective chart review. Long-term outcome was obtained by telephone follow-up. Sixty-three patients (median age: 52.1 [23.4–93.1] years) presented with a first episode of right-sided diverticulitis with median follow-up of 1683.5 (1–6084) days. Three (4.7%) patients were excluded due to subsequent right-sided colon cancer diagnosis. Twenty-five (41.7%) patients were male and 10 (16.7%) were Asian. Fifty-eight (96.7%) patients were admitted. Most patients had uncomplicated disease (88.3%); 7 (11.7%) had complicated diverticulitis (abscess 3; free perforation 4). Most were diagnosed by CT (75.0%), while a minority were diagnosed intraoperatively (20.0%) or by postoperative pathology (5.0%). All 45 patients diagnosed by CT were managed conservatively (antibiotic therapy) with median hospitalization of 5 (1–14) days; of these, 2 had persistent disease requiring readmission/antibiotics and 2 others had recurrence treated conservatively (time to recurrence 210 and 1430 days). Ten of 15 (66.7%) were managed operatively for suspected appendicitis, 2 for suspected colon mass, 2 for acute abdomen and 1 for failed percutaneous abscess drainage. Most underwent right hemicolectomy (53.3%) or ileocecectomy (40.0%). Median hospitalization was 9 (5–16) days for patients who underwent ileocecectomy and 13 (6–36) days for those who underwent right hemicolectomy. One patient developed postoperative enterocutaneous fistula following right hemicolectomy. When diagnosed by CT, right-sided diverticulitis can be successfully managed conservatively in most cases. Long-term expectant management appears successful, with low recurrence and complication rates. In a North American population, it is prudent to consider underlying colon cancer.

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Distal stump leak following Hartmann's procedure: ACS NSQIP study of risks and outcomes. ***A. Dan, C. Vasilevsky, N. Morin, G. Ghitulescu, J. Faria, P. Gordon, M. Boutros.*** **From the Jewish General Hospital and McGill University, Montreal, Que.**

Hartmann's procedure is often used when constructing a colorectal anastomosis that is unsafe. Nonetheless, the closed distal segment may be prone to leakage. Patients who underwent Hartmann's procedure were identified from the American College of Surgeons' National Surgical Quality Improvement Program (ACS NSQIP) databases from 2012 to 2015 based on CPT codes 44143 (open) and 44206 (laparoscopic). Pre- and perioperative variables were assessed using univariate analyses. Binomial models identified independent predictors of distal stump leaks. Secondary postoperative outcomes were analyzed using the same methods. Ninety-six of 2349 patients (4.1%) had distal stump leak (mean age 66 ± 15 years; 50.3% males). The most common indications were acute diverticulitis (15.5%), colon cancer with (18.1%) and without obstruction (14.4%) and diverticular disease (10%). Multivariate analysis demonstrated that longer operative time (OR 1.003; 95% CI 1.001–1.006) and contaminated wounds (OR 1.67; 95% CI 1.01–2.74) were predictive of distal stump leaks; medically treated hypertension was protective (OR 0.557; 95% CI 0.326–0.941). On univariate analyses, distal stump leaks significantly increased rates of ileus (46% v. 21%, $p < 0.001$), reoperation (37% v. 6%, $p < 0.0001$), readmission (32% v. 9%, $p < 0.0001$), failure to wean off ventilator (19% v. 5% $p < 0.0001$), systemic sepsis (30% v. 4%, $p < 0.0001$) and death (26% v. 8%, $p < 0.0001$). Multivariate analyses showed distal stump leak as a significant predictor of death within 30 days (OR 3.61; 95% CI 1.52–8.59), reoperation (OR 7.32; 95% CI 4.15–12.91), readmission (OR 5.76; 95% CI 3.42–9.72) and postoperative ileus (OR 2.12; 95% CI 1.27–3.53). This multicentre database showed a 4% distal stump leak rate following Hartmann's procedure. Increased operative time and contaminated wounds were independent predictors of distal stump leaks.

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Should we be quick to dismiss non-sphincter-sparing surgery for fistula-in-ano? An analysis of long-term outcomes. ***C. De Marco, M. Abou Khalil, N. Morin, C. Vasilevsky, J. Faria, P. Gordon, G. Ghitulescu, M. Boutros*. From the Jewish General Hospital and McGill University, Montreal, Que.**

Fistulotomy has been the mainstay for fistula-in-ano (FIA). Possible resulting fecal incontinence (FI) prompted sphincter-sparing (S-S) techniques that may result in higher recurrence. This study compared long-term risks of FI and recurrence following S-S and non-sphincter-sparing (N-SS) procedures for FIA. Patients with FIA and without inflammatory bowel disease, pelvic radiation and nondefinitive procedures who were managed operatively between 2000 and 2012 were included. Medical records were reviewed and telephone contact documented FI (Cleveland Clinic Florida-Fecal Incontinence Score [CCF-FIS]; Fecal Incontinence Quality of Life [FIQoL] scale). Fistulas were characterized by type, location, branching, number of internal openings, classification of high/low and primary/recurrent. Procedures were classified as S-S (≥ 1: fibrin glue, anal plug, anorectal flap, ligation of intersphincteric fistula tract [LIFT]), or N-SS (fistulotomy, cutting seton). In total 156 of 338 patients were available for long-term follow-up: 119 (76.3%) and 37 (23.7%) had N-SS and S-S procedures, respectively (median follow-up 9.1 [6.5, 12.6] years). The proportion of females was similar ($p = 0.223$). The S-S group had fewer referred recurrent (5.4% v. 29.4%; $p = 0.003$) and posterior (27.0% v. 52.1%; $p = 0.008$) but more high (73.0% v. 15.1%; $p < 0.001$) fistulas. No patients with S-S versus 21 (17.6%) with N-SS procedures had FI (CCF-FIS range 0–15, median 0); 2 (1.7%) in the N-SS group had moderate to severe symptoms (CCF-FIS score ≥ 10). Median FIQoL scores (range 1–4; 4 = not affected) were lifestyle 4.0 (2.0–4.0), coping 4.0 (1.33–4.0), depression 4.0 (1.30–4.0) and embarrassment 4.0 (1.33–4.0). Recurrence was significantly greater in S-S procedures (59.5% v. 19.3%; $p < 0.001$). After adjusting for follow-up, high fistula and posterior location on multivariate analysis, S-S procedures were associated with higher odds of recurrence (OR 5.72; 95% CI 2.02–16.17). Nonprimary fistula was predictive for recurrence after repair in both groups (OR 2.73; 95% CI 1.08–6.90). S-S procedures had significantly higher recurrence rates. Long-term rates of significant FI after N-SS procedures were low and did not impact quality of life, indicating these procedures are safe with appropriate patient selection.

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Long-term outcomes of acute diverticulitis in solid organ transplant patients. ***P. Youssef, A. Al-Khamis, J. Abou Khalil, N. Morin, J. Barkun, C. Vasilevsky, M. Boutros*. From the Jewish General Hospital and McGill University, Montreal, QC.**

Optimal management of acute diverticulitis in solid organ transplant recipients (SOTR) is increasingly debated. This study aimed to determine outcomes of acute diverticulitis in SOTR. Patients with kidney, liver, pancreas, heart and combined transplants presenting with acute diverticulitis between 1985 and 2014 were identified from a prospective database. Patient demographics, Charlson Comorbidity Index (CCI) score, details of index diverticulitis episode and outcomes were collected. Descriptive statistics were performed. Twenty-nine of 2998 SOTR had more than 1 episode of acute diverticulitis requiring admission with median follow-up of 65 (1–187) months (mean age 47 ± 14 years; 76% [$n = 22$] male; mean CCI 3.8 ± 0.75). All patients were taking immunosuppressants and/or steroids at the time of the index and subsequent diverticulitis episodes. Eleven of 29 (38%) patients had uncomplicated diverticulitis successfully treated with antibiotics and expectant management with no plans for elective resection. Seven of 11 (64%) had more than 1 recurrence; 6 were successfully treated conservatively; 1 had 3 recurrences and underwent uncomplicated elective resection. Eighteen of 29 (62%) patients initially presented with complicated diverticulitis. For the index episode, 10 patients with Hinchey I–II disease were successfully managed with initial nonoperative treatment; 8 with Hinchey II–IV underwent emergent surgery (7 Hartmann's procedure, 1 washout and drainage). Six of 10 patients with nonoperative management had successful expectant management (1 uncomplicated elective resection; 3 Hartmann's procedure for complicated recurrence). Four of 10 surgical patients suffered major perioperative complications (2 drained pelvic abscess, 1 acute renal failure, 1 intraoperative cardiac arrest). Five (50%) patients ultimately underwent colostomy reversal; 1 suffered anastomotic leak. No patients experienced graft failure as a complication of diverticulitis. After successful nonoperative management of the index episode of uncomplicated diverticulitis in SOTR, expectant nonoperative management appears safe. Patients with initial presentation of Hinchey III–IV disease require emergent surgery, with significant morbidity. Hinchey I–II disease patients with successful initial nonoperative management have significant risk of emergent surgery with morbidity for recurrence and may benefit from interval elective resection.

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Outcomes of ileocolic resection versus ileocolic resection with a concomitant procedure in patients with Crohn's disease: How much is the added risk? **D. *Hamad, M. Abou Khalil, A. Petrucci, G. Ghitulescu, C. Vasilevsky, N. Morin, J. Faria, M. Boutros*. From the Jewish General Hospital and McGill University, Montreal, Que.**

A majority of Crohn's disease patients require surgical management during their lifetime. This study compares outcomes of ileocolic resections and ileocolic resections with a concomitant procedure among Crohn's disease patients. After institutional review board approval, we performed a cohort study using the American College of Surgeons National Surgical Quality Improvement Program database for patients with Crohn's disease who underwent ileocolic resections or ileocolic resections with a concomitant procedure (any interventions on bowel related to Crohn's disease) between 2005 and 2015. Preoperative characteristics, comorbidities, laboratory results, procedure characteristics, postoperative outcomes and infectious complications (including postoperative leak and sepsis, 30-day morbidity and mortality) were compared using univariate and multivariate analyses. Of 6204 patients, 5692 (91.75%) and 512 (8.25%) underwent ileocolic resections and ileocolic resections with a concomitant procedure, respectively. Patients most commonly underwent concomitant resection and anastomosis of small intestine (48.0%), stricturoplasty (24.0%), partial colonic resection (20.3%) and closure of intestinal-cutaneous fistula (10.9%). The mean age was 40.2 years (± 15.3 years), 45.9% were male and 49.9% were immunosuppressed. On univariate analysis, ileocolic resections with a concomitant

procedure yielded a higher rate of surgical site infections (18.2% v. 12.3%, $p = 0.0003$), organ space infections (10.7% v. 5.8%, $p < 0.001$), infectious complications (20.7% v. 16.2%, $p = 0.011$) and sepsis/septic shock (9.0% v. 6.1%, $p = 0.014$). On multivariate analysis, ileocolic resections with a concomitant procedure significantly predicted organ space infection (OR 1.7; 95% CI 1.22, 2.40) and reoperation (OR 3.5; 95% CI 1.15, 11.0) and increased hospitalization duration by 10% (IRR 1.11; 95% CI 1.04–1.18). Both groups had comparable risks of anastomotic leak, sepsis, infectious complications, major morbidity and mortality. Low preoperative albumin, dirty wound classification, immunosuppression and smoking were found to be predictors of infectious complications, morbidity and mortality in both groups. A concomitant procedure significantly increases the likelihood of organ space surgical site infection, reoperation and prolonged hospitalization.

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Completeness of surveillance after resection for stage II/III colorectal cancer: a retrospective review. *S. Ollek, E. McFadden, D. Gill*. From the University of Saskatchewan, Saskatoon, Sask.

Colorectal cancer (CRC) is the third most common cancer in North America. Five-year overall survival (OS) rates for stage II and III cancer are 70% and 55%, respectively. Following resection, patients remain at risk for recurrence. Guidelines exist for the recommended surveillance of patients following surgical resection, with the aim of detecting recurrences earlier, thereby reducing mortality. More intense surveillance may reduce mortality. However, it has also been shown that adherence to the recommended surveillance is low. We aim to determine the proportion of patients at our centre with resected stage II and III CRC who undergo complete surveillance at 18 months. This study is a retrospective review of patients who underwent resection for stage II and III CRC between Jan. 1, 2014, and Dec. 31, 2014, at a single academic tertiary hospital. Following resection, patients who had at least 1 carcinoembryonic antigen (CEA) test, 1 colonoscopy and 1 CT scan of the chest, abdomen and pelvis within 18 months were considered to have complete surveillance. We identified 75 eligible stage II and III CRC patients who were included in our study. At 18 months, surveillance rates with CEA, CT scan and colonoscopy were 55%, 81% and 35%, respectively. Overall, 18% of patients received the complete recommended surveillance at 18 months. In patients with stage II and III CRC, the recommended surveillance includes CEA testing, colonoscopy and CT scans. We have demonstrated that at a single centre, adherence to the recommended surveillance is low. Given that more intense surveillance may reduce mortality, the rates of complete surveillance at our centre must be improved. Other studies have shown that introducing measures aimed at increasing adherence to surveillance, such as a patient navigator, is effective. Our study provides evidence that the introduction of such measures should be considered at our centre.

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Colonoscopy competency among senior residents in a Canadian general surgery training program. *R. Stewart, P. Johnson*. From Dalhousie University, Halifax, N.S.

Colonoscopy is a core component of general surgery practice, and ensuring that residents receive adequate endoscopy training is essential. Colorectal surgeons play an important role in teaching endoscopy skills. Colonoscopy competency is generally defined as achieving a cecal intubation rate (CIR) of 85%–90% in patients with intact colons (i.e., no prior colonic resections). The purpose of this research was to determine the proportion of resident colonoscopy procedures that were performed on patients with intact colons and to compare the CIR between patients with intact colons and those who had a prior segmental colectomy. This was a retrospective study using prospectively collected data. Colonoscopy performance data including number of scopes performed, CIR and patient surgical history were collected for all residents who completed a 3-month rotation on a colorectal surgery service from April 2016 to March 2017. The CIR was compared between scopes performed on patients with intact colons and those performed on patients who had had prior surgery. During the study period 13 residents (PGY5 = 10, PGY 3/4 = 3) performed 575 colonoscopy procedures (median 46/resident, range 18–70). The median CIR for all scopes was 85% (range 77%–91%). Overall, 81% of patients had an intact colon; however, this ranged from 68% to 100% per resident rotation. The CIR for colonoscopies performed on patients with an intact colon was significantly lower than for those performed on patients who had had a prior segmental colectomy, median 82.8% (range 73%–90%) versus 94.5% (range 80%–100%), respectively ($p < 0.01$). The volume of colonoscopy procedures performed by senior general surgery residents was quite variable as was exposure to patients with an intact colon. While cecal intubation rates were acceptable for most residents, it is unclear if this represents an adequate assessment of competency given the low number of procedures performed by many of the trainees.

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The uptake of laparoscopic colon cancer surgery in Canada: 2004–2014. *C. Hoogerboord, M. Hu, G. Flowerdew, A. Levy, R. Liu, G. Porter*. From Dalhousie University, Halifax, N.S.

Laparoscopic colectomy for cancer (LAC) has the same oncologic outcome as open colectomy, but postoperative recovery is enhanced. This study describes the pan-Canadian and provincial uptake of LAC from 2004 to 2014 and investigates factors associated with the use of LAC, as opposed to open surgery. All patients who underwent elective colectomies for colon cancer from 2004 to 2014 were identified from a national administrative database. In addition to temporal trends in the proportion of colectomies performed laparoscopically, multiple logistic regression was used to examine the association between LAC use and various patient and system characteristics. Among 63 504 patients undergoing colon cancer resection, LAC was used in 19 691 (31%) while an open approach was used in 43 813 (69%). Across 9 provinces, the overall proportion of patients undergoing LAC increased from 9% in 2004 to 52% in 2014 in a relatively uniform manner. There were marked differences in rates of LAC by province ($p < 0.001$). On multivariate analysis, year of surgery (OR 9.31; 95% CI 8.60–10.09 for 2014 compared with 2004), urban residence (OR 1.24; 95% CI 1.18–1.30), high hospital volume (OR 2.04; 95% CI 1.96–2.13) and high surgeon volume (OR 1.29; 95% CI 1.24–1.35) were associated with increased use of LAC, whereas male sex (OR 0.94; 95% CI 0.90–0.98), presence of comorbidity (OR 0.79; 95% CI 0.63–0.98), left-sided resection (OR 0.91; 95%

CI 0.87–0.95 for left hemicolectomy; OR 0.58; 95% CI 0.55–0.62 for anterior resection compared with right hemicolectomy) and low provincial total number of colectomies (OR 0.14; 95% CI 0.12–0.16) were associated with decreased use. Although there has been considerable uptake of LAC in Canada over the past decade, wide interprovincial variation remains. The use of laparoscopy at the individual patient level is related to patient factors, urban versus rural residence, and the local practice pattern as measured by average colectomy volume at the surgeon and hospital level.

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Laparoscopic rectal cancer surgery: a pan-Canadian analysis. *A. Drohan, G. Flowerdew, M. Hoogerboord, P. Johnson, G. Porter*. From Dalhousie University, Halifax, N.S.

Over the past decade, randomized controlled trials have demonstrated noninferior oncologic outcomes and decreased morbidity in rectal cancer patients who undergo laparoscopic surgery (LS) when compared with those patients who undergo open surgery (OS); some concern remains regarding inferior specific pathological end points among patients undergoing LS. Given the lack of related Canadian data, the objective of this study was to describe the use of LS in rectal cancer surgery at a pan-Canadian and provincial level and to identify factors associated with its use. Using the Discharge Abstract Database held by the Canadian Institute for Health Information, we identified all adult patients undergoing surgery for rectal cancer from 2004 to 2014 in all Canadian provinces, excluding Quebec. Exclusion criteria included emergency surgery, pregnancy, lack of a Canadian postal code, or complex multivisceral resection. Baseline demographic characteristics were compared between patients who underwent LS and OS. Provincial and national uptake of LS in rectal cancer was determined by calculating the proportion of LS cases, analyzed over time. Among the study cohort of 26 441 patients, 22 538 (85.2%) underwent OS and 3903 (14.76%) underwent LS. Nationally, the uptake of LS increased from 1.4% in 2004 to 34.7% in 2014 (time trend $p < 0.0001$). The use of LS increased over the study period in all provinces except Newfoundland, with the greatest proportional increase seen in Ontario, British Columbia and Prince Edward Island. In addition to province and year of surgery, other factors associated with the use of LS included female gender (OR 1.33; 95% CI 1.24–1.44) and younger age (65 years and under) (OR 1.15; 95% CI 1.07–1.24). The use of LS in rectal cancer in Canada has increased markedly over the past decade but remains lower than for colon cancer surgery. Significant interprovincial variation exists in the uptake of LS for rectal cancer.

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Postoperative ileus in an Enhanced Recovery After Surgery program. *T. Wallace*. From the University of British Columbia, Vancouver, B.C.

Postoperative ileus (POI) refers to obstipation and intolerance of oral intake due to factors that disrupt the normal GI activity following surgery. POI can increase discomfort and contribute to prolonged hospitalization. An effective strategy to prevent POI minimizes risk factors that may precipitate and exacerbate the condition. Measures for preventing prolonged POI after abdominal surgery are key components of an established Enhanced Recovery After Surgery (ERAS) program. At a community hospital all patients undergoing elective colon resection were on an ERAS pathway. Data for these patients were collected through the National Surgical Quality Improvement Program (NSQIP) Procedure Targeted Module and Enhanced Recovery in NSQIP (ERIN). POI was defined as nothing by mouth on postoperative day (POD) 4 or reinsertion of a nasogastric tube for gastric decompression on POD 4 or later. Between July 2014 and December 2016, 246 consecutive patients underwent colectomy or proctectomy. Of these, 37 (15%) developed an ileus. Patients in the ileus group were compared with those who did not develop an ileus. Variables analyzed include compliance with ERAS elements, postoperative outcomes and comorbid disease. Patients who developed an ileus were more likely to have other complications and to require readmission to hospital (32% v. 6%, $p < 0.05$). Patients in the ileus group were less likely to be compliant with multiple ERAS elements, including gum chewing, early Foley removal and early mobilization. Patients who developed ileus were more likely to be older (70.5 years v. 67.2 years) and to have more comorbid disease. POI remains a significant problem, even within an established ERAS program that has good process compliance. POI is often associated with other complications such as organ space infection. Patients at increased risk for POI may be identified preoperatively. Increasing compliance with ERAS measures decreases the incidence of POI.

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Supporting patients at home after colorectal surgery through a mobile app: a feasibility study. *C. Keng, S. Schmocker, S. Rashid, A. Goriwala, A. Easson E. Kennedy*. From the University of Toronto, Toronto, Ont.

We assessed the feasibility of a mobile application (app) for the remote support and monitoring of patients after discharge from colorectal surgery. In this single-centre feasibility study, patients who underwent colorectal surgery were offered a mobile app for use during the first 14 days after discharge from hospital. Patients were asked to submit a daily symptom survey and wound photos as needed. In response, patients received tailored feedback and education through the app. Physician assistants (PA) under surgeons' supervision reviewed app entries daily, with concerning entries prompting calls to patients to further assess and advise. Feasibility outcomes included app usage by patients, patient satisfaction with the app and time spent by PAs monitoring the app. Exploratory outcomes included number of calls to patients, emergency department (ED) visits, ED visits avoided and readmissions. Between November 2016 and March 2017, 92 patients were enrolled. Of these, 77 patients (83.7%) ultimately logged in to and used the app. The mean number of app entries per participant was 6.3, with highest usage between days 3 and 9 after discharge. Satisfaction surveys were completed by 25.3% of patients. All respondents reported their overall experience with the app as good or excellent, and all reported the app helped them feel more confident in self-management at home. PAs spent on average 1.8 hours per week monitoring the app. Within 30 days of discharge, 13 participants (16.9%) visited the ED and 7 participants (9.1%) were readmitted. Visits to the ED were avoided in 3 patients (3.9%). This study demonstrated that a mobile app to support patients at home after colorectal surgery is a feasible

discharge intervention, viewed positively by patients. These findings will inform future larger scale randomized studies to assess the effect of the mobile app on ED visits and readmissions among colorectal surgery patients.

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Diagnostic utility of staging abdominal CT and repeat endoscopy in detecting localization errors at initial endoscopy in colorectal cancer. ***A. Azin, T. Wood, D. Hirpara, E. Le Souder, A. Chadi, T. Jackson, A. Okrainec, F. Quereshy*. From the University of Toronto, Toronto, Ont.**

Colonoscopy has a reported localization error rate as high as 21% for colorectal cancer (CRC). Preoperative repeat endoscopy has been shown to be protective against localization errors. There is a paucity of literature assessing the utility of staging CT and repeat endoscopy as diagnostic tools for detecting localization errors following initial endoscopy. The objective of this study is to compare the diagnostic characteristics of staging CT and repeat endoscopy in correcting localization errors at initial endoscopy. A retrospective cohort study was conducted at a tertiary academic hospital between January 2006 and August 2014. All patients undergoing surgical resection for CRC were identified. Group comparisons were conducted between (1) patients who underwent only staging CT (staging CT group) and (2) patients who underwent staging CT and repeat endoscopy (repeat endoscopy group). The primary outcome was localization error correction rate for errors at initial endoscopy. A total of 594 patients were identified, 196 (33.0%) in the repeat endoscopy group and 398 (77.0%) in the staging CT group. Error rates for each modality were as follows: initial endoscopy 8.8% (95% CI 6.5–11.0), staging CT 9.3% (95% CI 6.5–11.0) and repeat endoscopy 2.6% (95% CI 0.3–4.7) ($p < 0.01$). Repeat endoscopy was superior to staging CT in correcting localization errors for left-sided/rectal lesions (81.2% v. 33.3%; $p < 0.01$), right-sided lesions (80.0% v. 54.5%; $p = 0.21$) and overall lesions (80.8% v. 42.3%; $p < 0.01$). Repeat endoscopy compared with staging CT demonstrated a relative risk reduction of 66.7% (95% CI 22%–86%), absolute risk reduction of 38.5% (95% CI 14.2%–62.8%) and odds ratio of 0.18 (95% CI 0.05–0.61) for correcting errors at initial endoscopy. Repeat endoscopy in colorectal cancer is superior to staging CT as a diagnostic tool for correcting localization errors at initial endoscopy. Further research exploring factors associated with localization error is needed to establish and implement guidelines for the appropriate use of repeat endoscopy.

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Implementation of a single-surgeon taTME program in Northern Ontario and establishment of learning curve. ***A. Caycedo, G. Ma, H. Jiang, E. Kohtakangas*. From the Northern Ontario School of Medicine, Sudbury, Ont.**

The transanal total mesorectal excision (taTME) proctectomy has been demonstrated to be a safe advancement in rectal surgery. The majority of the literature to date has focused on procedures done with teams of 2 surgeons working simultaneously. A substantial learning curve has been described, including case observation, cadaveric training, proctoring and ongoing mentorship. We present evidence of the safe implementation of a taTME program with only a single surgical team. After pertinent training and planning, implementation of the single surgical team taTME program occurred in June 2015. Retrospective review of a prospectively collected database was used to extract data. The initial 27-patient cohort was reviewed to ensure adequate surgical technique (completeness of TME, lymph node harvest, margin positivity) and safety (30-day morbidity and mortality). We demonstrate the learning for a single surgical team taTME over the first 54 cases. We also compared both surgical adequacy and safety comparing the first 27 cases with the next 27 cases to ensure ongoing quality. For the first 27 cases, average body mass index was 27. Ninety-two percent of these patients had adenocarcinoma, and 66% received neoadjuvant chemoradiation. There was 1 positive circumferential radial margin (CRM) case, with a distal margin positive rate of 0%, and all specimens were judged as complete or near-complete TME based on the Quirk method. Average lymph node yield was 26. Average length of stay was 4 days. There was no 30-day mortality. Major and minor morbidity rates were 14% and 11.1%, respectively. Having evidenced the safety of the technique we reviewed the next 27 cases, demonstrating a decrease in complications and operative time compared with the first 27 cases. The quality of the specimen was constant. Over time the learning curve stabilized, suggesting a target number to achieve proficiency as 1 team. Single surgical team taTME is safe and feasible, with high-quality oncological outcomes. Patient selection, tailoring of the technique and collaboration with the international registry are instrumental to the success of our program.

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Botox-A injection for treatment of low anterior resection syndrome after rectal cancer surgery. ***M. Gagnon-Konamna, C. Richard*. From the Université de Montréal, Montreal, Que.**

After sphincter-sparing procedures (SSP) for rectal cancer treatment, up to 50% of patients may experience low anterior resection syndrome (LARS). LARS can significantly impact quality of life. The pathophysiology is multifactorial and treatment options are limited. Injection of Botox-A (BTX-A) has been an effective treatment in spastic diseases, such as interstitial cystitis, which may share similarities with LARS. The purpose of this study was to evaluate injection of BTX-A for treatment of rectal cancer with LARS. This was a prospective multi-institutional phase II study evaluating the role of BTX-A injection treatment for patients with LARS following rectal cancer surgery. A new approval for BTX-A was obtained from Health Canada and our hospital's ethics review board. Inclusion criteria were patients who had SSP for rectal cancer and persistent LARS 12 months after ileostomy closure. Twenty-four patients were enrolled in the study between 2007 and 2013. Treatment was endoscopy-directed wall injection of BTX-A. Subjective sphincter function (Wexner score) and quality of life (EORTC score) were assessed at 0, 1, 3 and 6 months after treatment. Manometric studies were performed. Toxicity profiles were assessed. At the assessment 1 month after treatment, 59% ($n = 13$) experienced an improvement of symptoms, and 68% ($n = 15$) experienced an improvement at 3 months. Average pretreatment Wexner score was 11 with a standard deviation (SD) of 3. At 1, 3 and 6 months after treatment, the average scores dropped to 8 (SD 3), 9 (SD 4) and 9 (SD 4), respectively. Frequency of defecating (EORTC) score was 4 (SD 1) before treatment and 3 (SD 1) after treatment. Evaluation of difficulty with defecation score was 3 (SD 1) before

treatment and 2 (SD 1) after treatment. No patient experienced toxicity to BTX-A. Based on our phase II study assessing the role of BTX-A treatment for LARS, BTX-A injections significantly improve symptoms without toxicity. A larger study is warranted with assessment of repeated injections.

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Composite pathologic outcomes in patients with rectal cancer treated with a transanal total mesorectal excison. ***S. Zerhouni, P. Karanicolas, S. Ashamalla*. From the University of Toronto, Toronto, Ont.**

Pathologic outcomes after total mesorectal excision (TME) for rectal cancer are directly correlated with local recurrence. The ACOSOG-Z6051 trial introduced a composite pathologic outcome to study patients with rectal cancer who had a laparoscopic versus open TME. Our objective was to compare the composite pathologic score for patients treated with a transanal TME (taTME) to the 2 standards (open and laparoscopic TME). A retrospective review between 2015 and 2017 was conducted of consecutive patients with T3 or less rectal cancer treated with a TATME at a single institution. A successful composite score was defined as follows: (1) complete/near complete TME, (2) > 1 mm radial margin and (3) > 1 mm distal margin. Pathologic and perioperative outcomes were compared with the laparoscopic and open cohorts from the ACOSOG trial. A χ^2 test was used to compare the groups. Fifty patients met the inclusion criteria. Thirty-six (72%) were male and the mean age and body mass index were 58.6 years and 27.9, respectively. Low, mid and high rectal lesions were encountered in 30, 18 and 2 patients, respectively. Clinical stages 1, 2, 3 and 4 were seen in 10 (20%), 16 (32%), 21 (42%) and 3 (6%) patients, respectively. Neoadjuvant treatment was administered to 38 patients (76%). Operations involved low anterior resection in 45 (90%) and low Hartmann's procedure in 5 (10%) patients. Complete pathologic response was encountered in 6 patients (16%). Successful composite pathologic outcome was achieved in 96% of patients compared with 81.7% in the laparoscopic ($p = 0.01$) and 86.9% in the open ($p = 0.07$) ACOSOG cohorts. Grade III complication was encountered in 1 patient. The median length of stay was 3 days and 7 patients (14%) were readmitted within 30 days. TATME is safe and yields pathologic outcomes that are comparable or superior to the open and laparoscopic approaches. Randomized controlled trials are warranted to confirm these findings.

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Ready to go home? Patients' experiences of the discharge process following care in an Enhanced Recovery After Surgery (ERAS) program for colorectal surgery. ***D. Jones, R. Musselman, E. Pearsall, M. McKenzie, H. Huang, R. McLeod*. From the University of Toronto, Toronto, Ont.**

Due to ERAS programs promoting shorter lengths of hospital stay, there is a greater need for patients to plan and be educated for their recovery at home. Thus, patients who were managed in an ERAS pathway were surveyed to understand their needs before discharge. Between 2012 and 2014, an ERAS pathway was implemented for patients having elective colorectal surgery at a large, urban teaching hospital. Demographic and outcome data, including 30-day follow-up data, were collected prospectively. Following discharge, a survey containing multiple-choice questions, preference ranking, and open-ended questions was sent to patients to ascertain patient educational and follow-up needs before discharge. Free-text responses were analyzed through a grounded theory approach. Of 554 patients who were part of the ERAS program, 496 patients were mailed surveys, of whom 219 (44.2%) responded. Most patients (88%) stated they received information before discharge. While 93% of respondents stated they were satisfied with the information, they indicated they wanted additional information on how to manage wound problems (59%), fever (38.4%), nausea/vomiting (56.6%), abdominal pain (43.4%), bowel function (49%) and ostomy problems (35.6%). Patients also wanted more information on what to expect and whom to contact should there be problems. Patients reported that they were advised to go to the emergency department (68.4%), call their surgeon (53.4%) or call the surgical nurse (30%) if there were problems. The latter was valued and 1 patient said "a telephone number for follow-up concerns would have been helpful for me." Despite 54.3% having the telephone number of the surgical nurse, only half of them contacted her. Improved postoperative education for surgical patients before discharge within an ERAS program is required to facilitate patient-centred discharge planning. Such interventions may help to decrease unplanned hospital visits during the immediate postdischarge period.

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Retaining smokers in a smoking cessation program: implementation of a novel evidence-based smoking cessation program in an outpatient colorectal surgery clinic. ***J. Sadek* (University of Ottawa, Ottawa, Ont.), *P. Belanger* (University of Ottawa Heart Institute, Ottawa, Ont.), *K. Nadeau* (University of Ottawa, Ottawa, Ont.), *K. Mullen* (University of Ottawa Heart Institute, Ottawa, Ont.), *D. Aitken* (University of Ottawa Heart Institute, Ottawa, Ont.), *K. Foss* (University of Ottawa, Ottawa, Ont.), *D. McIsaac* (University of Ottawa, Ottawa, Ont.), *L. Williams* (University of Ottawa, Ottawa, Ont.), *I. Raîche* (University of Ottawa, Ottawa, Ont.), *R. Musselman* (University of Ottawa, Ottawa, Ont.), *H. Moloo* (University of Ottawa, Ottawa, Ont.).**

Smoking cessation programs initiated as late as 4 weeks before surgery reduce perioperative morbidity and mortality, yet outpatient smoking cessation interventions are rarely provided. Our aim was to develop a functional, evidence-based, outpatient smoking cessation program, including a novel "opt out" consultation. The main objectives were testing the feasibility of implementing our approach and maximizing smoker retention within the program. A needs assessment was done in our outpatient colorectal surgery clinic to assess the prevalence of smoking, how often smoking cessation was addressed and what, if any, methods of intervention were used. A multidisciplinary team developed a novel smoking cessation protocol, focusing on efficiency and ease of use. Customized consultation forms and prescriptions were made to facilitate the process and relevant staff received training. A novel opt-out approach was used. Our needs assessment found that 70 of 369 (19%) surgical patients were current smokers. Less than 10% of patients were asked about smoking, and none of the

smokers were offered any intervention. The opt-out approach resulted in 78% of smokers joining the program. After 2 months of implementation, 29 patients (average age 48.8, 58.6% male, average smoking 16 cigarettes/day) received smoking cessation interventions, 23 agreed to receive automated follow-up support and 19 received quit cards providing free nicotine replacement therapy. Our team has developed a fast, easy-to-use smoking cessation protocol for outpatient surgical clinics, with a successful early implementation in our colorectal surgery clinics. Importantly, the novel opt-out approach has doubled the usual retention rate of smokers agreeing to join the program: 78% versus 35%. This protocol has already been adopted in our department of medicine outpatient clinics, and we hope to spread this to other outpatient surgical clinics. Six-month smoking cessation outcomes are being collected and efficacy will be reported at a later date.

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Needs assessment for the management of fecal incontinence. *I. Raîche*, *H. Moloo*, *L. Williams*, *R. Helewa*, *K. Foss*, *W. Baksh-Thomas*. From the University of Ottawa, Ottawa, Ont.

A large proportion of Canadians suffer with fecal incontinence (FI), with limited treatment options to help them. In this context, our institution decided to implement a new program to help patients with FI in our community. As part of our program implementation, a qualitative needs assessment was undertaken to better define successful outcomes and to identify barriers for program sustainability. This was a cross-sectional, qualitative study involving standardized, semistructured interviews. The participants in this study included patients suffering from FI as well as nurses, physical therapists and physicians who treat FI. The goal was to get the perspective of multiple stakeholders in the treatment of FI. Interview questions revolved around success definitions, barriers and promoters of FI care. Transcripts were analyzed using content analysis methodology to develop themes surrounding FI care. Twelve interviews were undertaken, raising a total of 17 different themes. Barriers to FI care included education for both the care provider and patients. Access issues for FI treatments were also highlighted. Promoters of FI care were reflected by the impact that FI has on quality of life (QoL), personal hygiene, psychological burden, and activity and productivity. The definition of FI success was focused on improvements in QoL, rather than a numerical reduction of incontinence episodes. In general, success was defined by patients as restoration of their self-confidence. This study was limited in the small number of interviews conducted. Also, we were unable to identify patients who did not seek out care for FI. In conclusion, education for both patients and care providers surrounding FI is lacking. Furthermore, access to effective FI treatments is a real barrier for Canadians suffering with FI. Programs to treat FI should focus on improvement of overall QoL rather than a reduction of FI episodes.

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Loop ileostomy and colonic lavage for fulminant *Clostridium difficile* colitis: survey of current practice. M. *Abou Khalil* (Jewish General Hospital and McGill University, Montreal, Que.), *T. Phang* (University of British Columbia, Vancouver, B.C.), *P. Gordon* (University of British Columbia, Vancouver, B.C.), *J. Faria* (Jewish General Hospital and McGill University, Montreal, Que.), *N. Morin* (Jewish General Hospital and McGill University, Montreal, Que.), *C. Vasilevsky* (Jewish General Hospital and McGill University, Montreal, Que.), *G. Ghitulescu* (Jewish General Hospital and McGill University, Montreal, Que.), *M. Spencer* (Abbott Northwestern Hospital, Minneapolis, Minn.), *S. Wexner* (Cleveland Clinic Florida, Weston, Fla.), *M. Boutros* (Jewish General Hospital and McGill University, Montreal, Que.).

The gold-standard treatment for fulminant *Clostridium difficile* colitis is total abdominal colectomy (TAC), which is associated with high morbidity and mortality. Diverting loop ileostomy and colonic lavage is an attractive option, but with limited data. We sought to assess surgeons' experience with this procedure. After institutional review board approval, a multiple-choice questionnaire went to members of the Canadian Association of General Surgeons, the Quebec Association of General Surgeons, the International Society of University Colon and Rectal Surgeons and the Society of American Gastrointestinal and Endoscopic Surgeons research committee from September 2015 to September 2016. Of 101 surveys returned, 13.9% were from trainees; surgeons with less than 5, 5–15, and more than 15 years experience accounted for 20.7%, 40.2% and 39.1% of respondents, respectively; 75.8% of respondents were Canadian (64.7% from Quebec; 11.1% from Ontario) and 7.1% were American. Practice settings were academic (60.4%), community (41.6%) or private (5.9%). Fifty percent had treated at least 1 patient with fulminant *C. difficile* colitis during the last year; 18% had performed at least 1 loop ileostomy with colonic lavage. Colonic lavage was performed in the operating room, intensive care unit and/or ward in 87.5%, 25.0% and 12.5% of cases, respectively. Although there was no consensus regarding the regimen for colonic lavage or postoperative management, vancomycin flushes were given for 10–14 days by 61.2% of respondents and administered by a nurse in 93.0% of cases. Loop ilesotomy failure requiring conversion to TAC was reported by 13.3% of respondents. After resolution of fulminant colitis, 33.3% closed the loop ileostomy and 25.0% reported recurrence of *C. difficile* infection after ileostomy closure. Most participants (78.7%) supported this procedure for fulminant disease. Most surgeons (59.3%) voiced the need for more evidence and expressed interest in performing this procedure within the confines of a study. The exact indications, technique and postoperative management of loop ileostomy and colonic lavage for fulminant *C. difficile* colitis remain unclear and would be best determined by prospective multicentre trials.

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Outcomes of ERAS patients with diabetes undergoing elective colorectal surgery: a retrospective case control study. *M. Li*, *X. Shi*, *R. Brisebois*, *P. Senior*, *H. Wang*. From the University of Alberta, Edmonton, Alta.

Outcome studies examining the Enhanced Recovery After Surgery (ERAS) pathway have demonstrated a decreased length of hospital stay and decreased rate of postoperative complications. Although hyperglycemia related to diabetes has been independently linked to significant increases in postoperative complications and mortality, existing ERAS outcome studies have not included patients with diabetes. A retrospective single-centre

review was performed using the provincial ERAS database. All patients with diabetes (type 1 and 2) who underwent the ERAS pathway for elective colorectal surgery between July 2014 and October 2016 were identified. This group was matched 1:1 with patients without diabetes for variables such as age, gender, body mass index, preoperative carbohydrate loading, oral bowel prep, surgery performed and surgical approach. Primary outcomes included postoperative complications, and secondary outcomes included length of stay, 30-day readmission rate and 30-day mortality. Student's *t* test and Fisher's exact test were used for statistical analyses. A total of 126 patients were included (63 with diabetes [DM] and 63 controls [ND]). Postoperative complications were as follows: wound infection (4.84% in ND v. 12.7% in DM, $p = 0.21$), anastomotic leaks (3.17% in ND v. 1.59% in DM, $p = 1$), respiratory events (0% in ND v. 6.35% in DM, $p = 0.12$) and myocardial infarction (MI) (3.17% in ND v. 0% in DM, $p = 0.496$). Secondary outcomes, such as mean length of stay (7.6 d, 95% CI 6.1–9.0 in ND; 10.6 days, 95% CI 7.8–13.3 in DM; $p = 0.0559$), readmission rate (9.52% in ND v. 12.7% in DM; $p = 0.778$) and death (0% in ND v. 1.59% in DM; $p = 1$) were observed. Patients with diabetes undergoing the colorectal ERAS pathway appear to have a higher wound infection rate, more respiratory events, a longer length of stay, more readmissions and higher mortality compared with patients without diabetes. Although these trends were not statistically significant, a further study with a larger sample size is planned.

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Derivation and validation of an administrative data set algorithm for patients with rectal cancer. ***R. Musselman, R. Auer, R. Boushey, M. Husein, T. Gomes, R. Deanna, C. van Walraven.*** **From the University of Ottawa, Ottawa, Ont.**

The purpose of this study was to measure the accuracy of coding algorithms used to identify patients with rectal cancer within administrative data sets. We derived a cohort of patients with a surgical resection for rectal cancer at a single institution between Apr. 1, 2002, and Dec. 31, 2010, through administrative data sets within the Institute for Clinical Evaluative Sciences (ICES) using a previously described coding algorithm. This patient cohort was measured against a gold-standard, validated patient cohort of all known rectal cancer resections performed at the same institution over the course of the study period. Accuracy statistics for the coding algorithm were calculated using this gold-standard cohort as a reference standard. A total of 821 known rectal cancer resections were identified from the reference standard cohort, and 664 075 hospital admissions over the course of the study period were identified through ICES. The pre-test probability for rectal cancer surgery was therefore 0.124%. Using the previously described coding algorithm, 1131 potential rectal cancer resections were identified within ICES. When compared with the reference standard, the coding algorithm was 89.5% sensitive and 99.9% specific and had a positive predictive value (PPV) of 64.9%. Previously published methods used to derive rectal cancer resections within ICES have high sensitivity and specificity but a PPV of only 64.9%. This is due to the very low pre-test probability inherent when using administrative data. This study highlights the importance of validating coding algorithms used in administrative data research.

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Incidence rates and predictors of colectomy for ulcerative colitis in the era of biologics: results from the provincial database in Quebec. ***M. Abou Khalil, M. Boutros, H. Nedjar, P. Gordon, G. Ghitulescu, C. Vasilevsky, N. Morin, E. Rahme.*** **From the Jewish Hospital and McGill University, Montreal, Que.**

Biologics are at the forefront for treating ulcerative colitis (UC). Debate centres on their ability to reduce long-term risk of colectomy and immunosuppressive effects on postoperative outcomes. We aimed to evaluate long-term rates of colectomy in patients with UC in the prebiologics and biologics eras and identify risk factors for colectomy. The secondary objective was to assess postoperative risk of death. Using the Régie de l'assurance maladie du Québec, 2 cohorts were defined: the prebiologics era (1998–2004) and the biologics era (2005–2011). Patients who had inflammatory bowel disease or colectomy the year before the initial diagnosis of UC during the study period were excluded. A multivariate logistic regression model was fit to compare patient baseline characteristics between the 2 cohorts. Kaplan–Meier curves were constructed to display unadjusted time to event in the 2 study periods and survival analyses were performed using Cox proportional hazards models. A total of 335/2829 patients in the prebiologics era versus 314/3313 in the biologics era underwent colectomy. Median follow-up (first and third quartiles) was similar: 3.38 (1.56, 5.21) and 3.29 (1.68,5.14) years for the prebiologics and biologics eras ($p = 0.206$). Incidence rates of colectomy were 36.08/1000 and 29.99/1000 patient years in the prebiologics and biologics eras. The unadjusted rate of colectomy was higher in the prebiologics versus the biologics era (log-rank; $p = 0.004$), which remained significant after adjusting for potential confounders (hazard ratio [HR] 0.81; 95% CI 0.70–0.95). Predictors of colectomy included anemia (1.66; 1.38–2.01), past GI hospitalizations (1.24; 1.04–1.47), congestive heart failure (CHF) (2.08; 1.27–3.40) and male gender (1.47; 1.26–1.72). Postoperative mortality was 8.06% and 3.18% in the prebiologics and biologics eras (log rank; $p = 0.007$). After adjusting for potential confounders, age at index date (1.08; 1.05–1.12) and emergency surgery (5.65; 2.19–14.54) were predictive of increased death hazard. Decreased incidence of colectomy was noted after the introduction of biologics in Quebec. GI hospitalizations, anemia, male gender and CHF were risk factors for colectomy. Emergency surgery and age were predictors of postoperative mortality. The biologics era was not predictive of postoperative mortality.

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Outcomes of ileal pouch excision: an American College of Surgeons National Surgical Quality Improvement Program Analysis. ***S. Lachance, M. Abou Khalil, N. Morin, C. Vasilevsky, G. Ghitulescu, J. Faria, P. Gordon, M. Boutros.*** **From the Jewish Hospital and McGill University, Montreal, Que.**

This study aimed to assess outcomes of ileal pouch excision (IPE) and determine predictors of 30-day morbidity in a large multicentre validated database. After institutional review board approval, a retrospective analysis of prospectively collected data from the American College of Surgeons' National Surgical Quality Improvement Program (NSQIP) was conducted. Adult

patients who underwent IPE between 2005 and 2015 were identified using CPT codes. We aimed to describe rates of specific 30-day morbidity and mortality following IPE. Risk factors pertaining to these outcomes were assessed with logistic regression models. A total of 381 patients underwent IPE from 2005 to 2015 (mean age 47.7 ± 15.3 years; 51.7% females). Mean body mass index was 24.6 ± 5.7 kg/m^2; 55.4% of patients were American Society of Anesthesiologists (ASA) class 1–2 and 18.4% were immunosuppressed. Mean operative time was 252 ± 112.7 minutes; 98.0% of surgeries were elective and 2.0% were emergent. Mean median length of stay was 7 (5–11) days. All patients suffered at least 1 postoperative 30-day morbidity, most notably surgical site infection (SSI) (21.5% overall, 9.2% superficial, 3.7% deep, 10.3% organ space), sepsis (9.5%), urinary tract infection (UTI) (5.8%) and pneumonia (2.4%). Reoperation was required in 5.5% of cases. Postoperative mortality was 0.8%, with none of the emergent cases accounting for it. On multivariate logistic regression, smoking (OR 3.20; 95% CI 1.66–6.20) and operative time (OR 1.002; 95% CI 1.0002–1.0048) were associated with increased odds of all SSI. Specific 30-day morbidities were most significant for septic complications, encompassing SSI, UTI, pneumonia and sepsis. Smokers had longer operative times and had an increased risk of infectious complications. These factors are important when counselling and preparing patients for IPE.

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Outcomes of synchronous segmental versus total colectomies for colon cancer: an American College of Surgeons National Surgical Quality Improvement Program analysis. ***S. Lachance, N. Morin, C. Vasilevsky, G. Ghitulescu, J. Faria, P. Gordon, M. Boutros*****. From the Jewish Hospital and McGill University, Montreal, Que.**

This study aimed to assess 30-day major morbidity and mortality of patients with colon cancer who underwent total colectomy (TC) or synchronous segmental colectomy (SSC). After institutional review board approval, a retrospective analysis of data from the American College of Surgeons' National Surgical Quality Improvement Program (ACS NSQIP) was conducted. Adult patients with colon cancer who underwent elective TC or SSC between 2005 and 2015 were identified using ICD9 and CPT codes. Primary outcomes were 30-day major morbidity and mortality. Secondary outcomes were length of stay and readmission rates. Multivariate logistic and binomial regressions were used. A total of 640 and 2467 patients with colon cancer underwent SSC and TC, respectively. SSC patients were older (68 v. 58 years; $p < 0.0001$), had more American Society of Anesthesiologists (ASA) 3 scores (57.3% v. 47.4%; $p < 0.0001$), had decreased smoking rates (16.7% v. 23.3%; $p = 0.0001$) and had increased diabetes rates (23.1% v. 15.5%; $p < 0.0001$), preoperative weight loss (7.8% v. 5.3%; $p = 0137$) and hypertension (62.7% v. 44.6%; $p < 0.0001$). SSC patients had a decreased unadjusted rate of 30-day major morbidity (16.9% v. 20.7%; $p = 0.0303$), length of stay (7.83 v. 8.99 days; $p = 0.0002$) and operative time (184 v. 233 minutes; $p < 0.0001$). No statistically significant differences were found for unadjusted rates of superficial (5.9% v. 6.6%) and organ space (5.0% v. 5.6%) surgical site infections (SSI), readmission rates (10.9% v. 13.6%; $p = 0.0181$) and 30-day mortality (1.9% v. 1.6%). On multivariate logistic regression, SSC did not significantly differ compared with TC for readmission rates (OR 0.748; 95% CI 0.206–2.713) and 30-day mortality (OR 0.846; 95% CI 0.405–1.768). Differences in 30-day major morbidity (OR 0.750; 95% CI 0.587–0.958) and length of stay (OR –0.17; 95% CI –0.22 to –0.11) remained statistically different when adjusted for confounders. Patients who underwent SSC had significantly decreased risk-adjusted 30-day major morbidity compared with patients who underwent TC. These findings can be one of several factors taken into consideration when deciding between SSC and TC for colon cancer.

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A nomogram for prediction of mortality in patients who undergo surgery for fulminant *Clostridium difficile* colitis: results from the ACS NSQIP database. ***M. Khalil, A. Khalil S. Rai Bhatnagar, N. Morin, C. Vasilevsky, L. Feldman, Y. Longtin, G. Ghitulescu, J. Faria, M. Boutros*****. From the Jewish Hospita and McGill University, Montreal, Que.**

This study aimed to develop a clinically applicable nomogram to quantify the risk of 30-day mortality for patients who undergo surgery for fulminant *Clostridium difficile* colitis (FCDC). After institutional review board approval, the American College of Surgeons' National Surgical Quality Improvement Program (ACS NSQIP) database (2005–2015) was used to include adult patients who underwent emergency surgery (American Society of Anesthesiologists [ASA] score ≥ 3) for FCDC. CPT codes were limited to total abdominal colectomies (TAC) and diverting loop ileostomies with or without lavage (DLI). A priori preoperative predictors of mortality were selected from the literature: age, immunosuppression, sepsis, acute renal failure, dialysis, intubation and laboratory values. Logistic regression models using stepwise regression were fitted and the predictive accuracy of different models was measured by calculating the area under the receiver operating characteristic (ROC) curve. Of 583 patients with FCDC, 557 (96%) and 26 (4%) underwent TAC and DLI. Overall mortality was 44% and similar in both groups. The best model included 5 preoperative categorical predictors (reported as OR [95% CI]): shock (systemic inflammatory response syndrome [SIRS] 0.86 [0.29–2.48]); sepsis (1.26 [0.53–3.02]); septic shock (2.49 [1.11–5.60]), immunosuppression (1.84 [1.11–3.04]), creatinine (Cr 1.13–2.26 mg/dL 0.52 [0.3–1.00], Cr > 2.26 mg/dL 0.80 [0.33–1.28]), low platelets (2.52 [1.67–3.81]) and age > 65 years (4.39 [2.02–9.52]). The 5 independent covariates were then used to create adjusted estimates, each on a weighted scale of 0–100. The total score on a 331-point scale is used to directly obtain the probability of death. A clinically applicable nomogram using preoperative variables can be used to predict postoperative mortality for patients with FCDC and help guide preoperative decision-making.

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The feasibility of a laparoscopic approach to reoperative ileoanal J-pouch surgery. ***A. Petrucci*** **(Cleveland Clinic Florida, Weston, Fla.),** ***S. Chadi*** **(University of Toronto, Toronto, Ont.),** ***I. Mizrahi*** **(Cleveland Clinic Florida, Weston, Fla.),** ***S. Wexner*** **(Cleveland Clinic Florida, Weston, Fla.).**

Restorative proctocolectomy and ileal J-pouch anal anastomosis is the current standard of care for reconstructive surgery in

most patients with ulcerative colitis (UC) and familial adenomatous polyposis (FAP). The currently available literature has described successful outcomes for reoperative surgery with both abdominal and perineal approaches. However, no previous series have demonstrated the feasibility of a laparoscopic assisted approach to management of various pouch-related complications. The objective was to establish the feasibility of a laparoscopic-assisted approach in patients with various pouch-related complications necessitating reoperation (repair, revision or excision). Patient demographics and outcomes were retrospectively collected from a prospective database and chart review approved by an institutional review board. All procedures were performed by a single surgeon with extensive expertise in laparoscopy and pouch-related complications. Between 2013 and 2016, 14 laparoscopic reoperative pouch procedures were performed on 11 patients (1 FAP, 10 UC) with a mean age of 41.1 years and body mass index of 23.6 (18–32). Nine of 11 patients had their initial pouch surgery performed laparoscopically; 1 of these 9 patients had a subsequent open pouch revision followed by an eventual laparoscopic pouch excision for recurrent pouch-vaginal fistula. The median time from the prior procedure was 1007 days (2–12 562 days). Procedures included laparoscopic-assisted pouch revision or repair (7/14) and laparoscopic pouch excision (7/14). Mean operative time was 273 minutes (107–430 minutes). Two pre-emptive conversions were made in this series; 1 for extensive pelvic fibrosis precluding safe dissection; 1 for dense intra-abdominal adhesions. Two patients developed postoperative pelvic fluid collections; 1 patient developed an intra-abdominal collection. All collections were successfully drained through percutaneous imaging techniques. Median length of stay was 9.5 days (3–24 days). Despite longer operative times, our series demonstrates the feasibility of a laparoscopic assisted approach for reoperative pouch surgery in centres that practise high-volume minimally invasive and pouch-related surgery.

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Surgical site infection rates are higher among colorectal surgery patients receiving non-penicillin-based antibiotic prophylaxis: a retrospective chart review. ***A. Fernandes, M. Valencia, F. Farrokhyar, C. Eskicioglu, W. Ciccotelli, S. Forbes.*** **From McMaster University, Hamilton, Ont.**

The administration of antibiotic prophylaxis in elective colorectal surgery reduces surgical site infection (SSI) rate and decreases postoperative length of stay (LOS). The gold-standard antibiotic prophylaxis is penicillin-based (PBAP). The SSI risk and LOS for patients receiving alternative antibiotic prophylaxis regimens (AAP) in cases of reported penicillin allergy may differ from those for patients receiving PBAP. Adult elective colorectal surgery patients with a clean-contaminated wound classification who received preoperative antibiotic prophylaxis were included in this retrospective review. Factors including age, comorbidities, diagnosis, surgical procedure and approach, and postoperative complications within 30 days of surgery were recorded. SSI rates and LOS were compared between the PBAP and AAP groups. Dichotomous variables were compared using χ^2 tests, and continuous variables were compared using the Mann–Whitney U test. Statistical significance was set at $p < 0.05$. A total of 1011 eligible procedures occurring between 2009 and 2015 were included in this review. Of these, 876 (86.6%) patients received PBAP and 135 (13.4%) patients received AAP. There was a statistically significant difference in SSIs between the groups, with patients receiving AAP presenting with significantly more SSIs than those receiving PBAP (OR 2.16, 95% CI 1.41–3.31, $p = 0.0004$). Readmissions for management of SSI were more frequent among patients receiving AAP (OR 3.05, 95%[.70–5.48, $p = 0.0002$). There was no significant difference in LOS between groups (median 7 days AAP and 6 days PBAP, $p = 0.18$). We conclude that the administration of AAP in elective colorectal surgery patients is associated with significantly higher SSI risk than PBAP. This study is the first to challenge the notion of equivalent efficacy of PBAP and AAP regimens in patients undergoing elective colorectal surgery. These findings inform the need for more accurate penicillin allergy testing and reporting, and for administration of PBAP prophylaxis to all eligible patients with a view toward decreasing SSI rates.

32

Surgical interval after neoadjuvant therapy in rectal cancer, current practice patterns in Canada. ***A. Caycedo, G. Ma.*** **From the Northern Ontario School of Medicine, Sudbury, Ont.**

The management of locally advanced rectal cancer usually requires neoadjuvant therapy; as of today, there is no consensus on the perfect interval for surgery. Different strategies have been used, and current literature supports the implementation of either short or long intervals. As part of this study a literature review and a nationwide survey among colorectal surgeons in Canada was conducted. We had 50% (54) respondents. Fifty percent of the surgeons have been practising for fewer than 10 years, 72.7% practise at academic centres and 13% at both academic and community hospitals; 52.9% of surgeons perform over 20 total mesorectal excisions (TME) per year and 29.5% between 10 and 20. The vast majority of surgeons (81%) rely on MRI for regional staging and the remainder use MRI plus endorectal ultrasonography. Among the respondents, 56.8% operate on their patients between 8 and 10 weeks after completion of neoadjuvant therapy, 18.2% after 10 weeks, 22.7% between 6 and 8 weeks and 2.3% earlier than 6 weeks; 41% of the surgeons always wait the same interval regardless of any other factor and 25.6% modify their interval based on the size of the original tumour. Interestingly 59% of the respondents customarily use laparoscopic surgery for the management of rectal cancer, 29.5% do it open, 9.1% is use transanal TME (taTME) and 2.3% do it robotically. Fifty percent of surgeons will always present their cases at Multidisciplinary Cancer Conference rounds, 20% will do so most of the time, 20% only half the time only and 10% rarely. Regarding the watch-and-wait strategy, only 4.5% will apply this strategy regularly, 40.9% never do so, 43.2% do so on selected occasions and 11% do so very often. Interestingly, only 50% of the respondents could be considered high-volume surgeons but a significant majority prefer minimally invasive methods. Most Canadian surgeons remain cautious about the watch-and-wait strategy. Learning our current patterns of practice in Canada could help us to focus our research and educational strategies.

33

Development of a novel formative assessment tool to assess intraoperative decision-making in colorectal surgery. ***I. Raîche*** **(University of Ottawa, Ottawa, Ont.),** ***E. Dionne*** **(University of Ottawa, Ottawa, Ont.),** ***B. Charlin*** **(Université de Montréal, Montreal, Que.),** ***L. Williams*** **(University of Ottawa, Ottawa, Ont.),** ***R. Musselman*** **(University of Ottawa, Ottawa, Ont.),** ***J. Mamazza*** **(University of Ottawa, Ottawa, Ont.),** ***H. Moloo*** **(University of Ottawa, Ottawa, Ont.).**

Intraoperative decision-making has been identified as a key component of surgical expertise by many authors. However, it remains difficult to teach and assess in the current clinical context. Multiple conflicting priorities limit the amount of teaching possible during surgical procedures. Furthermore, it can be challenging for expert surgeons to explain their decision-making process. Our aim was to develop a formative assessment modality using operative video clips to assess and improve intraoperative decision-making skills during laparoscopic right hemicolectomy. A formative assessment tool was developed using Downing's test development model. Interviews with expert surgeons and a literature review were conducted to identify content. Items were then developed following the principle of script concordance and formative evaluation. Items included a short video clip from a real surgical procedure, a multiple-choice questionnaire related to decision-making, and experts' answers and explanation of their choice. Fifteen experts provided answers to the questions. Experts' answers were presented as a frequency graph. Explanations were obtained from 3 expert surgeons and included in the final formative assessment tool. A total of 2 surgeons and 6 trainees from PGY2 to PGY7 were asked to use the formative assessment tool and to give feedback through an electronic survey on its potential use and logistics considerations. Overall, the feedback was very positive, with participants suggesting that this assessment tool provided a unique learning opportunity that could enhance learning in the operating room. Participants also indicated that a tool like this would have to be easily accessible on mobile devices to be used in a sustainable fashion by trainees. This project presents a proof of concept of the use of operative video clips to teach surgical decision-making. As a next step, the impact of this formative assessment tool on surgical decision-making should be formally investigated.

34

Neoadjuvant treatment for locally advanced rectal cancer: patient and system factors contribute to underutilization. ***R. Rochon, E. Martin, A. MacLean, R. Yee-Ling, P. Tang, J. Heine, W. Buie*****. From the University of Calgary, Calgary, Alta.**

Neoadjuvant chemoradiation (nCRT) and radiation (nRT) are used in the treatment of stage II and III rectal cancer to improve resectability and local regional control. The aim of this study was to determine the utilization of nCRT and nRT and to determine why some eligible patients do not receive appropriate treatment. All patients diagnosed with stage II or stage III rectal cancer in 2015 were identified retrospectively from the provincial cancer registry. Provincial e-charts were examined to extract demographics, staging, details of nCRT/nRT and surgical management. Eligible patients who did not receive neoadjuvant treatment were reviewed and an attempt was made to determine potential reasons. A total of 325 patients underwent radical resection for rectal cancer, with complete data available for 321. Pelvic MRI was obtained in 246 (76.6%) patients, with 170 classified as having clinical stage II (45) or III (125) disease. In total, 135 (79.4%) patients received nCRT (114) or nRT (21). An additional 20 (8.1%) patients were understaged by MRI based on final pathology and may have benefitted from neoadjuvant treatment. Thirty-five MRI-staged eligible patients did not receive neoadjuvant treatment because of patient factors (19), system factors (3) and unknown factors (13). Of 75 patients without pelvic MRI, 15 had tumours above the peritoneal reflection (ineligible for neoadjuvant treatment) while 8 (13.3%) of the remaining 60 patients received neoadjuvant treatment based on CT. In contrast, 26 (43.3%) of these patients were stage II or III on final pathology and could have been considered for neoadjuvant treatment. Approximately 80% of eligible clinical stage II and III patients received neoadjuvant treatment. Pathology identified an additional 46 (14.3%) patients who were understaged or incompletely staged. All patients with rectal cancer should have a complete radiologic work-up and review at a multidisciplinary cancer conference to ensure appropriate use of neoadjuvant treatment.

35

Peritoneal perforation during transanal endoscopic microsurgery is not associated with significant short-term complications. ***J. Ramkumar, A. Karimuddin, T. Phang, M. Raval, C. Brown*****. From the University of British Columbia, Vancouver, B.C.**

In patients treated by transanal endoscopic microsurgery (TEM), breach of the peritoneal cavity is a feared intraoperative challenge. Our aim is to analyze predictors and outcomes of patients with peritoneal perforation (TEM-P) when compared with similar patients with no peritoneal compromise (TEM-N). Demographic, surgical, pathologic and follow-up data for all patients treated by TEM are maintained in a prospectively populated database. Two groups were established for comparison: TEM-P and TEM-N. Statistical analysis was performed using Student's t test or χ^2 test, where appropriate. Of 619 patients treated by TEM between 2007 and 2016, 39 (6%) patients were in the TEM-P group and 580 (94%) in the TEM-N group. There were no differences between the groups in patient age, gender, histology or tumour size. Patients who had peritoneal perforations had more proximal lesions (11 v. 7 cm, $p < 0.0001$), anterior lesions (56% v. 43%, $p < 0.05$) and longer operations (80 v. 51 minutes, $p < 0.005$). While most defects were closed endoluminally, 2 patients with perforation were converted to transabdominal surgery. There was a difference in overall hospital stay, with TEM-P patients staying on average 2 days in hospital with fewer patients managed as day surgery (31% v. 73%, $p < 0.0001$). There were no deaths or significant 30-day complications in the TEM-P group and only 1 patient required readmission. Our single-centre TEM experience suggests that proximal, anterior lesions are at highest risk of peritoneal perforation. Select TEM patients with peritoneal perforation can be transluminally managed and treated as day surgery. Finally, patients with peritoneal breach during TEM can be safely managed with no significant short-term complications.

Canadian Society for Surgical Oncology (CSSO)

01

The last 30 days of life: trends in aggressive end-of-life care in gastrointestinal malignancies. ***S. Merchant*** **(Queen's University, Kingston, Ont.),** ***K. Lajkosz*** **(Institute for Clinical Evaluative Sciences, Queen's University, Kingston, Ont.),** ***C. Booth*** **(Queen's University, Kingston, Ont.),** ***S. Brogly*** **(Queen's University, Kingston, Ont.),** ***S. Patel*** **(Queen's University, Kingston, Ont.),** ***S. Nanji*** **(Queen's University, Kingston, Ont.),** ***N. Baxter*** **(St. Michael's Hospital, University of Toronto, Institute for Clinical Evaluative Sciences, Toronto, Ont.).**

Studies have reported overly aggressive end-of-life care (EOLC) in a variety of malignancies. We investigate trends in and factors associated with aggressive EOLC in patients with gastrointestinal (GI) malignancies in Ontario, Canada. The Ontario Cancer Registry identified patients with primary cause of death from esophageal, gastric, colon and anorectal malignancies from January 2003 to December 2013. Information was collected from linked administrative health and cancer registry data. Outcomes representing aggressive EOLC were assessed: administration of chemotherapy, any emergency department (ED) visits, hospital admissions or intensive care unit (ICU) admissions (within 30 days of death), death in hospital and in ICU. Temporal trends were analyzed using the Cochran–Armitage test. Modified Poisson regression determined factors associated with aggressive EOLC. There were 34 630 patients in the cohort; 43% had colon cancer, 26% anorectal cancer, 19% gastric cancer and 12% esophageal cancer. Any outcome representing aggressive EOLC was delivered to 65% with a decreasing trend over the study period ($z = -3.36$, $p = 0.001$). Utilization of specific elements of aggressive EOLC included 8% chemotherapy, 46% ED visits, 49% hospital admissions, 6% ICU admissions, 45% death in hospital and 5% death in ICU. Temporal trends showed that ED visits ($p = 0.0001$) and death in ICU ($p = 0.04$) increased; hospital admissions ($p = 0.02$) and death in hospital ($p < 0.0001$) decreased. Factors associated with aggressive EOLC included male sex (RR 1.09, 95% CI 1.07–1.11) and greater comorbidity (RR 1.04, 95% CI 1.03–1.05). Factors associated with reduced use of aggressive EOLC included advanced age (RR 0.77, 95% CI 0.75–0.79) and care in a teaching hospital (RR 0.90, 95% CI 0.89–0.92). Two-thirds of patients with GI cancer had aggressive EOLC in the last 30 days of life. Although use decreased over the study period, targeted interventions are warranted to reduce the use of futile aggressive measures while optimizing quality of EOLC in terminally ill patients.

02

Can molecular subtypes be used as predictors for non-sentinel lymph node involvement in node-positive breast cancer patients? Results from a multi-institutional cohort study. ***D. LeBlanc*** **(University of Toronto, Toronto, Ont.),** ***A. Hosein*** **(University of Toronto, Toronto, Ont.),** ***E. Cordeiro*** **(University of Ottawa, Ottawa, Ont.),** ***A. Roberts*** **(University of Ottawa, Ottawa, Ont.),** ***S. Nofech-Mozes*** **(University of Toronto, Toronto, Ont.),** ***B. Youngson*** **(University of Toronto, Toronto, Ont.),** ***D. McCready*** **(University of Toronto, Toronto, Ont.),** ***M. Elmi*** **(University of Toronto, Toronto, Ont.),** ***M. Al-Assi*** **(University of Toronto, Toronto, Ont.),** ***S. Ramkumar*** **(University of Toronto, Toronto, Ont.),** ***T. Cil*** **(University of Toronto, Toronto, Ont.).**

Management of the axilla in early breast cancer is becoming increasingly conservative. Axillary lymph node dissection (ALND) can now be omitted in node-negative patients and in selected patients with a limited number of positive sentinel lymph nodes (SLN). Research continues to try to identify predictors of residual axillary disease. Conflicting data exist regarding whether molecular subtypes constructed on biological markers such as estrogen (ER), progesterone (PR) and Her 2-neu receptors can predict non–sentinel lymph node (NSLN) involvement. The aim of this study was to determine if molecular subtype is associated with NSLN involvement. A multi-institutional cohort study was conducted. It included women with invasive ductal carcinoma (IDC) with at least 1 positive SLN, treated between 1997 and 2009, with a primary breast procedure and a sentinel lymph node biopsy (SLNB) followed by an ALND. Univariate and multivariate logistic regression analyses were performed comparing molecular subtypes by group. The primary outcome was NSLN involvement (i.e., at least 1 positive node in the ALND specimen). A total of 272 patients were included. Overall, 35.7% of ALNDs had NSLN involvement. Independent predictors of NSLN involvement included the presence of extranodal extension (ENE) (OR 2.58, $p = 0.003$), lymphovascular invasion (LVI) within the primary tumour (OR 2.05, $p = 0.049$) and the absolute number of SLNs involved (OR 1.96, $p = 0.003$). The number of SLNs removed was inversely related to NSLN involvement (OR 0.72, $p = 0.004$). Molecular subtypes were not found to be an independent predictor. Based on our results, the presence of LVI, the presence of ENE and the number of SLNs involved are useful predictors for increased NSLN involvement, but molecular subtype is not an independent predictor. Overall, changes to axillary management following a positive SLN biopsy appear to be generalizable to all molecular subtypes of breast cancer.

03

An assessment of the effect of a randomized controlled trial: preoperative biliary decompression in patients with periampullary malignancy. ***D. Kagedan*** **(University of Toronto, Toronto, Ont.),** ***J. Mosko*** **(University of Toronto, Toronto, Ont.),** ***M. Dixon*** **(University of Toronto, Toronto, Ont.),** ***P. Karanicolas*** **(University of Toronto, Toronto, Ont.),** ***A. Wei*** **(University of Toronto, Toronto, Ont.),** ***N. Goyert*** **(University of Toronto, Toronto, Ont.),** ***Q. Li*** **(Institute for Clinical Evaluative Sciences, Toronto, Ont.),** ***N. Mittmann*** **(University of Toronto, Toronto, Ont.),** ***N. Coburn*** **(University of Toronto, Toronto, Ont.).**

In 2010, a multicentre randomized controlled trial reported increased postoperative complications among pancreaticoduodenectomy (PD) patients undergoing preoperative biliary decompression (PBD). We sought to evaluate rates of PBD at the

population level before and after publication. A retrospective population-based observational cohort study was performed. Patients undergoing PD for malignancy between 2005 and 2013 were identified and linked to administrative health care databases covering medical services provided to a population of 13.5 million. Patients undergoing PBD within 6 weeks before surgery were identified using physician billing codes and divided into those undergoing PD before and after publication (6-month washout period). PBD rates were compared using χ^2 tests. Surgeon and/or gastroenterologist consultations before PD were identified using billing codes, and the time interval between initial consultation and PD was calculated. Of 2053 PD patients identified, 974 underwent surgery before article publication and 951 after (128 in the washout period). Before publication, the rate of PBD was 47.4%, versus 40.8% after (p = 0.003). The annual rate of PBD decreased from 52.5% (2005) to 40.4% (2013) (p = 0.025). Among patients seen preoperatively by both a gastroenterologist and a surgeon, the median interval from initial consultation to surgery was 47 days (surgeon first) and 48 days (gastroenterologist first). Patients seen preoperatively only by a surgeon had a median interval of 30 days. Rates of PBD have significantly decreased following publication of a randomized trial. While preoperative consultation with multiple specialists increases the time interval to surgery, the order in which they are seen does not.

04

Considering the economic impact of a simultaneous versus staged approach to resection of colorectal cancer with synchronous liver metastases in a publicly funded health care model. ***E. Le Souder*** **(University of Toronto, Toronto, Ont.),** ***A. Azin*** **(University of Toronto, Toronto, Ont.),** ***D. Hirpara*** **(University of Toronto, Toronto, Ont.),** ***R. Walker*** **(University Health Network, Toronto, Ont.),** ***S. Cleary*** **(University Health Network, Toronto, Ont.),** ***F. Quereshy*** **(University Health Network, Toronto, Ont.).**

Simultaneous resection for colorectal cancer with synchronous liver metastases (SLM) is an established alternative to a staged approach in select patients. There is a paucity of literature comparing the cost of these 2 surgical approaches. The aim of this study was to compare the simultaneous and staged approach with regard to economic parameters and short-term clinical outcomes in a publicly funded health care model. A retrospective chart review was conducted at a tertiary academic hospital between February 2005 and February 2016. The primary exposure was surgical approach: (1) simultaneous resection and (2) staged resection. The primary outcome was cost per episode of care including total cost and cost breakdown by operating room, post-anesthesia care unit (PACU), ward, laboratory, imaging and pharmacy costs. Secondary outcomes included postoperative complications as well as 30-day morbidity, mortality and readmission rate. Fifty-four cases were identified. Twenty-eight patients underwent a staged resection of their disease, while 26 patients underwent a simultaneous resection. Patient demographics, including age (p = 0.49), sex (p = 0.20), body mass index (p = 0.74) and American Society of Anesthesiologists (ASA) class (p = 0.44), were comparable between groups. Tumour characteristics including pathologic T (0.66) and N (0.23) stage, and number (0.12) and size (0.50) of metastasis were also comparable. Total cost ($20 297 v. $27 522), OR ($6830 v. $10 376), PACU ($675 v. $1182), ward ($7586 v. $11 603) and pharmacy costs ($728 v. $1075) were significantly less for the simultaneous group ($p < 0.05$). Total LOS was shorter in the simultaneous group (mean 12 days [SD 8.3] v. mean 22 days [SD 6.9], $p < 0.01$). The 2 groups were comparable with regard to Clavien–Dindo scores (p = 0.96), as well as 30-day readmissions (p = 0.44), morbidity (p = 0.22) and mortality (p = 1.00). Our study confirms equivalent short-term outcomes between a simultaneous and staged surgical approach. The simultaneous approach was associated with significantly lower total cost and a significantly shorter hospital stay. More studies are needed to validate these findings.

05

Diagnostic laparoscopy is effective in identifying suitable candidates for cytoreduction and heated intraperitoneal chemotherapy. ***D. Bischof*** **(Mount Sinai Hospital, Toronto, Ont.),** ***E. Taylor*** **(Mount Sinai Hospital, Toronto, Ont.),** ***A. Govindarajan*** **(Mount Sinai Hospital, Toronto, Ont.),** ***J. McCart*** **(Mount Sinai Hospital, University of Toronto, Toronto, Ont.).**

Cytoreduction and heated intraperitoneal chemotherapy (CRS/HIPEC) improves survival in selected patients with peritoneal carcinomatosis. Cross-sectional imaging has limited sensitivity for detecting peritoneal carcinomatosis. The objective of this study was to determine the efficacy of diagnostic laparoscopy (DL) in identifying suitable candidates for CRS/HIPEC. Patients who underwent DL for evaluation before CRS/HIPEC for peritoneal carcinomatosis secondary to colorectal cancer (CRC), appendiceal adenocarcinoma (low-grade mucinous tumours excluded) or small intestine adenocarcinoma between January 2011 and June 2016 were identified from a prospective institutional database. Standard demographic, clinicopathologic and operative data were obtained using retrospective chart review. DL was performed on 115 patients during the study period to evaluate suitability for CRS/HIPEC. Pathology of the primary tumour included 76 CRC (66%), 16 appendiceal adenocarcinoma (14%), 21 adenocarcinoma ex-goblet cell carcinoid (18%) and 2 small bowel adenocarcinoma (2%). Based on DL, 31 patients were excluded from CRS/HIPEC due to extent of disease. Peritoneal carcinomatosis index (PCI) at DL for patients who were not candidates for CRS/HIPEC was significantly higher than PCI for patients who were candidates for CRS/HIPEC (median PCI 26 v. 7.5, $p < 0.001$). Of the 76 patients who proceeded with laparotomy and planned CRS/HIPEC, CRS/HIPEC was completed in 49 patients. Median PCI at time of CRS/HIPEC was 13. Median PCI at CRS/HIPEC was 6 points (IQR 2.5–10) higher than that at DL. The positive predictive value of DL was 64.5%. Intraoperative complications of DL included small bowel enterotomy (n = 1) and serosal tear (n = 1). There were no major postoperative complications. DL is a safe and effective tool in identifying suitable candidates for CRS/HIPEC and may avoid the need for laparotomy in a subset of patients. PCI at the time of CRS/HIPEC was higher than at DL; this difference and the quality of visualization at DL should be considered when determining suitability for CRS/HIPEC.

06

Is it time to reconsider lobectomy in low-risk pediatric thyroid cancer? ***P. Bongers*** **(University Health Network, Toronto, Ont.),** ***R. Verzijl*** **(University Health Network,**

Toronto, Ont.), *D. van der Kaay* (Hospital for Sick Children, Toronto, Ont.), *M. Vriens* (University Medical Centre, Utrecht, the Netherlands), *E. Propst* (Hospital for Sick Children, University of Toronto, Toronto, Ont.), *J. Wasserman* (Hospital for Sick Children, Toronto, Ont.), *J. Pasternak* (University Health Network, Toronto, Ont.).

Current guidelines recommend total thyroidectomy (TT) for nearly all children with well-differentiated thyroid cancer (WDTC). We speculate that there is a subpopulation of children who may be adequately treated with a lobectomy. A retrospective analysis of 73 children in a single-centre institution with WDTC treated between 2004 and 2015 was conducted. We applied 2 different risk-stratification criteria to this population. We determined the number of patients meeting American Thyroid Association (ATA) low-risk criteria and defined a set of very-low-risk histopathological criteria. Twenty-seven (37%) males and 46 (63%) females (mean age 13.4 years) were included in this study. Ipsilateral and contralateral multifocality were identified in 27 (37.0%) and 19 (26.0%) of specimens respectively. Thirty-seven (51%) patients had lymph node metastasis (N1a = 18/N1b = 19). Preoperative ultrasound identified all cases with clinically significant nodal disease. Of the 73 patients, 39 (53·4%) met ATA low-risk criteria and 16 (21·9%) met our very-low-risk criteria. All very-low-risk patients demonstrated excellent response to initial therapy without persistence/recurrence after a mean follow-up of 36.4 months. Ultrasound and histopathology identify a significant population that may be candidates for lobectomy, avoiding the risks and potential medical and psychosocial morbidity associated with total thyroidectomy and long-term thyroid replacement. We propose a clinical framework to stimulate discussion of lobectomy as an option for low-risk pediatric thyroid cancer patients.

07

Papillary thyroid cancers with focal tall cell and hobnail changes are clinically similar to tall cell and hobnail variants. ***P. Bongers* (University Health Network, Toronto, Ont.), *R. Verzijl* (University Health Network, Toronto, Ont.), *W. Kluijfhout* (University Medical Centre, Utrecht, the Netherlands), *O. Mete* (University Health Network, Toronto, Ont.), *S. Asa* (University Health Network, Toronto, Ont.), *J. Pasternak* (University Health Network, Toronto, Ont.).**

Hobnail and tall cell variants of papillary thyroid carcinoma (PTC) are aggressive histological variants. The clinical relevance of focal hobnail and tall cell changes within PTC remains unclear. Patients treated for PTC between 2010 and 2016 were reviewed. Focal hobnail and tall cell were defined as occupying less than 30% of the specimen; true variants were defined as occupying at least 30%. The control group consisted of classical type PTC patients. A total of 357 patients were included (80 classical PTC, 56 with focal hobnail, 131 with focal tall cell, 52 with focal hobnail and tall cell, 7 hobnail variant and 31 tall cell variant). Compared with true variants, focal changes had a similar lymph node metastasis rate ($p = 0.543$). Recurrence was present in 33 (18.4%) with focal changes and 5 (18.5%) with a true variant compared with 7 (9.2%) with classical PTC ($p = 0.096$, mean follow-up 42 months). Distant metastasis was not present in classical PTC patients compared with 17 (7.1%) with focal changes and 7 (18.9%) with true variants ($p = 0.001$). Patients with focal hobnail or tall cell changes, defined as less than 30% of the tumour, resemble those with at least 30% change. Both have comparable rates of recurrence and lymph node and distant metastasis and are seen to be more aggressive than classical PTC. Consideration should be given to classifying selected patients with focal changes as intermediate risk with associated therapy.

08

Virtual multidisciplinary case conferences: a systematic review. ***A. Warraich* (The Ottawa Hospital, Ottawa, Ont.), *H. Moloo* (University of Ottawa, Ottawa, Ont.), *R. Musselman* (University of Ottawa, Ottawa, Ont.), *I. Raîche* (University of Ottawa, Ottawa, Ont.), *L. Williams* (University of Ottawa, Ottawa, Ont.).**

The primary objective of this systematic review is to summarize the available literature on the existence, feasibility and effectiveness of virtual multidisciplinary case conferences (vMCC) in the context of cancer patient management. In July 2016, the electronic databases of Embase, Ovid Medline, Cochrane Library and CINAHL were searched. Studies describing the use of a web-based platform to conduct MCCs, either in a synchronous or asynchronous fashion, were included. The primary end point was defined as the presence or absence of literature on the subject of vMCC with secondary end points including specific process and outcome measures to assess the feasibility and effectiveness of existing models. Of the 462 studies identified, 3 articles (in abstract form only) met the criteria for an asynchronous vMCC and were included in the review. An additional 4 articles met the criteria for a synchronous vMCC and were also included. Only 1 synchronous rectal cancer-specific vMCC was identified. The included studies demonstrated the feasibility of obtaining clinical consensus within a timely fashion, improved adherence to clinical practice guidelines, a change in management plan in up to 53% of patients, and improved participation in clinical trials. Participant satisfaction with the process was variable. Identified barriers to implementation included time constraints for synchronous platforms, technical support issues and concerns regarding lack of participant remuneration. There is a paucity of literature on the feasibility and effectiveness of a vMCC model for cancer patient management. Based on the limited available evidence, there is potential for vMCC frameworks to improve the quality of cancer care but further study is warranted. We plan on designing and implementing an asynchronous, rectal cancer-specific vMCC at our institution to assess the feasibility and effectiveness of this novel approach.

09

Baseline neutrophil-lymphocyte and platelet-lymphocyte ratios are associated with survival in cutaneous malignant melanoma. ***R. Wade*, *A. Robinson*, *C. Keeble*, *H. Peach*, *M. Marples*, *D. Dewar*. From the University of Leeds, Leeds, U.K.**

Systemic inflammation in response to malignancy can be quantified using the peripheral blood neutrophil-lymphocyte ratio (NLR), platelet-lymphocyte ratio (PLR) and lymphocyte-monocyte ratio (LMR). These biomarkers are strongly associated

with adverse outcomes in advanced melanoma and other disseminated cancers, but the evidence is limited in relation to early-stage melanoma. This study sought to investigate the association between these biomarkers and survival in stage I–III cutaneous melanoma. This retrospective cohort study describes a consecutive series of patients who underwent wide excision and sentinel lymph node biopsy (SLNB) for cutaneous melanoma at a single institution over 10 years. We generated adjusted hazard ratios (HR) for overall survival and melanoma-specific survival, with 95% confidence intervals (CI), for baseline NLR, PLR and LMR. A total of 569 patients were included. The median follow-up was 2.86 years (IQR, 1.67–4.72; minimum 8 months, maximum 10.7 years). During surveillance, 67 (11.8%) participants died; 57 (10%) of these deaths were attributable to melanoma. Increased NLR was associated with increasing age and regression of the primary tumour. Improved overall survival was associated with a baseline NLR less than 2.5 (HR 3.49; 95% CI 1.36, 8.93, $p = 0.009$) and PLR less than 100 (HR 2.78; 95% CI 1.23–6.32, $p = 0.014$), whereas LMR was unrelated. A combined high NLR/PLR ratio was strongly predictive of overall survival ($p = 0.001$). Peripheral blood biomarkers were not associated with melanoma-specific survival. A decreased baseline NLR and PLR was associated with worse overall survival, which is dissimilar to previous studies and strengthens the hypothesis that the host immune response limits spread. Further studies are warranted to validate these findings.

10

Baseline neutrophil-lymphocyte, platelet-lymphocyte and lymphocyte-monocyte ratios are associated with microscopic metastases of cutaneous melanoma to the sentinel lymph node. ***R. Wade*, *C. Keeble*, *A. Robinson*, *H. Peach*, *M. Marples*, *D. Dewar*. From the University of Leeds, Leeds, U.K.**

Baseline peripheral blood biomarkers including neutrophil-lymphocyte (NLR), platelet-lymphocyte (PLR) and lymphocyte-monocyte ratios (LMR) are associated with nodal status in a number of malignancies, but evidence is limited in cutaneous melanoma. This study investigated the association between baseline biomarkers and sentinel lymph node status in cutaneous melanoma. This retrospective cohort study describes a consecutive series of patients who underwent wide excision and sentinel lymph node biopsy (SLNB) at a single institution over 10 years. Binary logistic regression was used to generate adjusted odds ratios (OR) and 95% confidence intervals (CI) for sentinel node involvement for each biomarker. A total of 569 patients who underwent SLNB had available preoperative blood results and were included. Factors associated with sentinel node positivity were increasing Breslow thickness, mitotic rate and tumour diameter, the presence of ulceration, microsatellites and vascular invasion and the absence of tumour infiltrating lymphocytes ($p < 0.05$). An adjusted baseline NLR greater than 1.9, PLR greater than 180 and LMR less than 4.3 were associated with sentinel lymph node metastasis (OR 1.82; 95% CI 1.05, 3.17, $p = 0.034$; OR 1.79; 95% CI 1.02, 3.15, $p = 0{\cdot}044$; and OR 1.79; 95% CI 1.06, 2.99, $p = 0.028$, respectively). Baseline peripheral blood biomarkers appear to be associated with metastasis of melanoma to the sentinel node. Further investigation is required to validate this association.

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Does Canada have an epidemic of thyroid cancer, or increasing overdiagnosis? A national cancer registry analysis. ***D. Topstad*, *J. Dickinson*. From the University of Calgary, Calgary, Alta.**

Thyroid cancer incidence rates are increasing in many developed countries while mortality remains stable. International evidence shows that this is mostly caused by overdiagnosis of small papillary cancers. We sought to describe how thyroid cancer incidence has changed and how it varies between provinces in Canada. Data were obtained from the National Cancer Incidence Reporting System (NCIRS), causes of death tables and Canadian Cancer Registry using 1991 census population. We report thyroid cancer incidence by gender, age and province and mortality by gender from 1970 to 2012. Since 1970, age-standardized thyroid cancer incidence rates have increased in females from 3.9 to 23.4 per 100 000 and in males from 1.5 to 7.2 per 100 000 while mortality has remained stable at around 0.5 per 100 000 for both genders. In 2012, both females and males had the highest incidence rates in Ontario at 31.8 and 9.4 per 100 000, respectively, while the lowest rates were in British Columbia at 14.9 and 4.5 per 100 000. Age-specific incidence rates were the highest in Ontarian females aged 50–54 years old at 65.2 per 100 000. The rapid increase in thyroid cancer incidence especially since 1990, variation between provinces and peak in middle-aged women does not correspond to any known cause or risk factor for disease, while unchanged mortality suggests that serious cancer has not increased. The likely cause is an epidemic of overdiagnosis for clinically unimportant lesions detected by modern diagnostic imaging. Hence, to reduce harms of overtreatment, reducing overdiagnosis is necessary, by more judicious use of diagnostic imaging and promoting research to identify the aggressive thyroid cancer that needs treatment.

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Ten-year survival outcomes following resection of locally recurrent rectal cancer. ***D. Cyr* (University of Toronto, Toronto, Ont.), *F. Zih* (University of Toronto, Toronto, Ont.), *J. Swett-Cosentino* (University of Toronto, Toronto, Ont.), *S. Luu* (University of Toronto, Toronto, Ont.), *B. Wells* (Nanaimo Regional General Hospital, Nanaimo, B.C.), *R. Burkes* (Mount Sinai Hospital and Princess Margaret Cancer Centre, Toronto, Ont.), *B. Cummings* (Princess Margaret Cancer Centre, Toronto, Ont.), *F. Esmail* (University of Toronto, Toronto, Ont.), *A. Smith* (University of Toronto, Toronto, Ont.), *C. Swallow* (University of Toronto, Toronto, Ont.).**

The international "Beyond TME" Collaborative identified locally recurrent rectal cancer (LRRC) as a complex problem requiring multidisciplinary consultation and specialized surgical care. Aggressive en bloc resection has been associated with 5-year survival rates of 25%–50%. However, skepticism persists that LRRC can be "cured," given the lack of published longer term survival data. We investigated the oncologic outcomes at 10 years following resection of LRRC and sought relevant clinicopathologic prognostic factors. The study cohort

consists of 52 consecutive patients (21 female) who underwent LRRC resection at our centre between September 1997 and August 2005. Patients were followed with CT-chest-abdomen-pelvis every 4 months for 2 years, every 6 months for 3 years, then annually, following LRRC resection. Survival curves were constructed by the Kaplan–Meier method and compared by log-rank. At last follow-up, 32 patients had died of rectal cancer, 1 had died of other causes, 4 were alive with rectal cancer and 15 (29%) were alive cancer-free. For the entire cohort of 52 patients, median follow-up time was 44 months (4–162), and overall survival (OS) was 42% at 5 years and 37% at 10 years, with a median OS of 43 months. Prognostic variables for OS in univariate analysis included resection margin status, receipt of chemoradiation before resection of LRRC and presence of distant metastasis at the time of LRRC. All patients who had M1 disease at the time of LRRC resection died of recurrent cancer at a median of 21 months (4–46). In multivariable analysis, R0 margin status (n = 41) and receipt of preoperative concurrent chemoradiation before resection of LRRC (n = 20) were prognostic of superior OS (p = 0.000 and p = 0.04, respectively). In patients who had R0 resection, OS was 51% at 5 years and 45% at 10 years, median 72 months. Complete resection of LRRC was associated with durable survival in approximately 40% of patients, with plateauing of survival curves after 5 years. Preoperative multimodality therapy before resection of LRRC may improve survival.

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Saving the axilla: Can we reduce up-front axillary lymph node dissection in T1–T2 breast cancers? ***D. Percy, A. Roberts, J. Pao, E. McKevitt, C. Dingee, U. Kuusk, R. Cheifetz, R. Warburton*. From the University of British Columbia, Vancouver, B.C.**

Axillary lymph node dissection (ALND) for breast cancer carries a higher morbidity than sentinel lymph node biopsy. The American College of Surgeons Oncology Group (ACOSOG) Z0011 trial demonstrated that many patients with T1–T2 breast cancer and 2 or fewer positive lymph nodes can be spared ALND, with favourable long-term results. Despite this, patients with cT1–T2 disease and positive axillary lymph nodes (LNs) detected on preoperative ultrasound and fine-needle aspirate (US/FNA) often undergo up-front ALND. The purpose of this study was to examine the proportion of patients with cT1–T2N1 invasive breast cancer who could potentially be spared ALND. Patients with cT1–T2N1 primary invasive breast cancer treated with ALND were identified from an institutional database. Patients who received neoadjuvant treatment were excluded. For patients with nonpalpable LNs, preoperative axillary imaging with a positive LN biopsy confirmed N1 status. Patients with 2 or fewer positive LNs on final pathology were compared for both the palpable and nonpalpable groups. A total of 283 patients underwent ALND for primary T1–T2 invasive breast cancer from 2012 to 2016. Ninety-one patients met the inclusion criteria; 52 (57%) patients had clinically palpable axillary lymphadenopathy, and 39 (43%) had a positive US/FNA. In the group with palpable lymphadenopathy, 26/52 (50%) had 2 or fewer positive LNs on final pathology. In the US/FNA group 17/39 (44%) had 2 or fewer positive LNs on final pathology. There was no significant difference between the 2. The positive predictive value for having a positive US/FNA and more than 2 LNs on final pathology was 0.56. Of patients with cT1–T2 tumours who underwent ALND, almost one-half (47%) could have potentially been spared an ALND based on ACOSOG Z0011 criteria for nodal burden. These results suggest that up-front ALND in node-positive cT1–T2 breast cancer may lead to overtreatment in some patients. Further study is required to determine possible candidacy for avoiding up-front ALND in the setting of preoperative positive axillary LNs.

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Radioactive seed localization versus wire localization for breast-conserving surgery: Which is more costly? ***Y. Zhang, E. Cordeiro, J. Seely, J. Hefler, K. Thavorn, M. Mahajan, S. Domina, J. Aro, A. Ibrahim, A. Arnaout, D. Gravel, C. Nessim*. From the University of Ottawa, Ottawa, Ont.**

The purpose of this study is to compare the cost outcomes and resource utilization between the first-year implementation of radioactive seed localization (RSL) with wire-guided localization (WGL) from the previous year, for breast-conserving surgery (BCS) for patients with nonpalpable breast cancer at a large Canadian tertiary centre. This is a retrospective cohort study. Data for BCS cases with RSL were collected from Apr. 1, 2015, to Mar. 31, 2016; data for BCS cases with WGL were collected from Apr. 1, 2014, to Mar. 31, 2015. We compared 153 patients who underwent WGL with 194 patients who underwent RSL. There were no significant demographic differences observed. The average cost per patient for RSL was $208.44 versus $345.24 for WGL ($p < 0.001$). After implementation of the RSL program, there was an increase in dedicated allocated radiology appointments to RSL (9/day) and fewer radiologists were required for these procedures/day. Patients were transported to the OR more quickly for RSL procedures (142 minutes v. 254 minutes, $p < 0.001$). There were no significant differences observed for surgery time, specimen volume, intraoperative margin re-excision rates and positive margin rates. There were no significant differences for complication rates. RSL is a less costly procedure than WGL and allowed for more efficient use of radiology scheduling with shorter wait times for patients on the day of the surgery. Although there were no significant clinical differences in patient outcome, we suggest that RSL should be used in place of WGL given the cost, decreased need of human resources, and efficiency benefits.

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Immediate breast reconstruction and post-mastectomy radiation therapy: two safe and complementary entities. ***N. Shahvary, L. Meloche-Dumas, D. Mathieu, K. Boulva, N. Côté, M. Al Khaldi, I. Fortin, E. Patocskai*. From the Université de Montréal, Montreal, Que.**

Adjuvant radiotherapy after mastectomy has been proven to increase disease-free survival (DFS) and overall survival (OS) rates in women with locally advanced breast cancer. Also, immediate breast reconstruction (IBR) after mastectomy offers important psychosocial benefits and decreased morbidity as compared with delayed reconstructive surgery. There is currently controversy in the literature regarding the safety of post-mastectomy radiotherapy (PMRT) after IBR with regards to compromised

treatment plans and the possibility of increased radiation toxicity. Current practice in most centres prohibits PMRT after IBR. This study aims to demonstrate that, with advances in radiotherapy technologies, adequate and safe PMRT can be offered to patients after IBR. This retrospective study includes patients with breast cancer who underwent IBR after mastectomy with adjuvant radiotherapy. Whole-breast irradiation at 50 Gy in 25 fractions was used, with lymph node coverage when indicated. Treatments were delivered by tangential irradiation, tomotherapy or deep inspiration breath-hold (DIBH). Toxicities were graded according to the Common Terminology Criteria for Adverse Effects v 4.0. Disease control and survivals were calculated by Kaplan–Meier curves. Seventy-one patients treated with PMRT after IBR between August 2006 and April 2015 were included. Median follow-up was 43 months. An adequate radiotherapy dose was administered without treatment delay to 66 (93%) patients. Fifty-seven patients received lymph node coverage. Tangential irradiation was used in 59 patients, whereas 10 patients were treated with tomotherapy and 2 in DIBH to reduce cardiac doses induced by treatment of left breast lesions or coverage of internal mammary chains. Grade ≤ 2 skin toxicities were observed in 56 patients. At 3 years, local control, DFS and OS were 98%, 87% and 94%, respectively. With newly developed radiotherapy technologies, the vast majority of IBR post-mastectomy patients can obtain adequate adjuvant radiotherapy without treatment delay. In our experience, only low-grade skin toxicities were reported, with excellent tumour control.

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Adoption and outcomes of radio-guided seed localization for nonpalpable invasive and in situ breast cancer at 3 academic hospitals. ***E. Parvez*** **(McMaster University, Hamilton, Ont.),** ***S. Cornacchi*** **(McMaster University, St. Joseph's Healthcare, Hamilton, Ont.),** ***E. Fu*** **(McMaster University, Hamilton, Ont.),** ***F. Farrokhyar*** **(McMaster University, Hamilton, Ont.),** ***N. Hodgson*** **(McMaster University, Juravinski Hospital and Cancer Centre, Hamilton, Ont.),** ***S. Reid*** **(McMaster University, Juravinski Hospital and Cancer Centre, Hamilton, Ont.),** ***P. Lovrics*** **(McMaster University, St. Joseph's Healthcare, Hamilton, Ont.).**

Radio-guided seed localization (RSL) and wire localization (WL) are at least equivalent with respect to specimen volume, positive margin rate and local recurrence, with RSL having the added benefit of improved perceived ease of use and scheduling flexibility. The purpose of this study was to assess adoption and outcomes of RSL for breast cancer in our city. Data for consecutive invasive and in situ breast cancer cases localized with RSL or WL at 3 academic hospitals (Hospital1 [H1], Hospital2 [H2], Hospital3 [H3]) between Jan. 1, 2012, and Feb. 28, 2016, were abstracted from hospital charts. Patient and disease characteristics, and surgical variables and outcomes were collected. Data analysis was conducted using t tests, χ^2 tests and Tukey's honest significant difference post hoc tests, with significance set at $p < 0.05$. There were 803 consecutive cases. H1 exclusively used RSL after January 2012 (247 cases), whereas H2 adopted RSL after July 2014 (109 cases) but continued to use WL (347 cases). H3 exclusively used WL (100 cases). Four groups were generated for analysis: H1-RSL, H2-RSL, H2-WL and H3-WL. Patients were similar across groups in age, body mass index and menopausal status. There was a significantly higher proportion of T2 tumours (WL 21%) at H3 compared with the other sites (H1-RSL 13%, H2-RSL 17%, H2-WL 16%; $p < 0.05$). There was no difference between the groups in margin positivity rate (H1-RSL 11%, H2-RSL 6%, H2-WL 8%, H3-WL 11%), reoperation rate (H1-RSL 13%, H2-RSL 11%, H2-WL 12%, H3-WL 7%), or mean specimen volume (cubic centimetres) (H1-RSL 198.2 [SD 163.1], H2-RSL 199.6 [SD 143.8], H2-WL 182.6 [SD 123.5], H3-WL 167.3 [SD 113.2]). There has been variable adoption of RSL across academic hospitals in our city, with 1 site exclusively using RSL, 1 site exclusively using WL and 1 site using RSL and WL. Despite the variable adoption, relevant surgical outcomes have been similar across groups. The causes of variable adoption of this novel technique merit further investigation.

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Radioactive seed and targeted axillary dissection: a feasibility study. ***S. Rodriguez-Qizilbash*****,** ***L. Guilarte*****,** ***S. Lazizi*****,** ***K. Boulva*****,** ***A. Robidoux*****,** ***R. Younan*****,** ***E. Patocskai*****. From the Université de Montréal, Montreal, Que.**

Targeted axillary dissection (TAD) with a radioactive seed is a new and promising technique to evaluate the axillary status in post-neoadjuvant chemotherapy (NACT) node-positive breast cancer patients. This study aims to evaluate the feasibility of TAD with a radioactive seed in a Canadian setting. We conducted a retrospective observational study of a prospectively gathered database of patients having undergone TAD with a radioactive seed implanted in a proven metastatic axillary node, between 2015 and 2017. An iodine-125 radioactive seed was implanted under ultrasound guidance by trained radiologists. Patients then underwent standard sentinel lymph node biopsy (SLNB) using technicium-99 and blue dye, as well as selective removal of the node containing the radioactive seed. Data were gathered from electronic medical records and chart review. Nine patients with a median age of 54 years underwent TAD for unilateral breast cancer after NACT between 2015 and 2017, 3 of whom were "triple negative." A median of 3 lymph nodes were removed, including that which contained the radioactive seed. Postoperative pathological evaluation showed 4 patients with positive nodes and 5 pathologic complete responses in the axilla. In all patients, the seed had been accurately positioned in a positive node (no false negatives). The seed also located a positive retropectoral node that would otherwise have been missed using standard dual tracer SLNB. No complications due to the use of the radioactive seed were encountered. All implanted seeds were identified and retrieved within the pathology specimen. In our experience, TAD with a radioactive seed combined with dual tracer SNLB is an accurate and safe method of evaluating the axillary lymph node status in post-NACT node-positive breast cancer patients. Further studies with larger cohorts are warranted to ensure continued feasibility and reproducibility of our positive results.

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Selective use of diverting ostomies is safe in patients undergoing low anterior resection during CRS and HIPEC. ***A. Ayoub*** **(University of Ottawa, Ottawa, Ont.),** ***E. Taylor*** **(Mount Sinai Hospital, Toronto, Ont.),** ***D. Bischof***

(Mount Sinai Hospital, University of Toronto, Toronto, Ont.), *J. McCart* (Mount Sinai Hospital, University of Toronto, Toronto, Ont.), *A. Govindarajan* (Mount Sinai Hospital, University of Toronto, Toronto, Ont.).

Diverting ostomies are frequently created in patients undergoing low anterior resection (LAR) during cytoreductive surgery and hyperthermic intraperitoneal chemotherapy (CRS/HIPEC). Study objectives were to assess the use and outcomes of ostomies in these patients. We conducted a retrospective cohort study using a prospectively collected institutional database. All patients undergoing LAR during CRS/HIPEC from February 2011 to February 2016 were included. Patients were categorized based on receipt of ostomy. Perioperative 90-day complications were compared between groups and factors associated with ostomy creation were assessed. Ostomy closure rates and time to closure were determined. During the study period, a total of 148 patients underwent CRS/HIPEC. Of these, 45 patients (30.4%) underwent LAR and were included in the study, 6 of whom received a permanent ostomy and were excluded from analyses. No patients received neoadjuvant radiotherapy. Overall, 7/39 patients (17.9%) received a diverting ostomy. The majority of anastomoses were to the mid-rectum, with a higher incidence of low rectal anastomoses in the ostomy group (ostomy: 3/7 v. no ostomy: 0/32). No other patient factors were significantly associated with ostomy creation. The incidence of postoperative leak/abscess/fistula was 5.1% with no significant difference between groups (ostomy: 0/7, no ostomy: 2/32, p = 1.00). There was no significant difference between groups in dehydration, readmission or use of anti-diarrheal medications. At a median follow-up of 17 months, 4/7 patients had not undergone ostomy reversal. Reasons for not having reversal included patient preference, early recurrence and insufficient time from CRS/HIPEC. The overall risk of anastomotic failure after LAR during CRS/HIPEC is very low and a practice of highly selective use of diverting ostomies is safe. Patients should be counselled that a diverting ostomy may be permanent.

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Perioperative chemotherapy and surgery for colorectal liver metastases: a cost-effectiveness analysis. *V. Gupta, L. Bubis, P. Karanicolas, N. Coburn, K. Chan, N. Look Hong, G. Kulkarni*. From the University of Toronto, Toronto, Ont.

The role of perioperative chemotherapy for colorectal cancer liver metastases (CRCLM) is controversial. Clinical trials have not demonstrated a clear survival benefit, although there is evidence of improved disease-free survival with chemotherapy; this uncertainty has led to practice pattern variation in its use. A cost-effectiveness analysis of surgery with perioperative chemotherapy versus surgery alone would provide important information for practitioners and health care policy-makers. A cost-effectiveness analysis from the single-payer Ontario government perspective was performed on 2 strategies for management of patients planned for curative hepatectomy for CRCLM: (1) 3 months of pre- and post-operative chemotherapy with 5-fluorouracil, leucovorin and oxaliplatin (FOLFOX) and (2) surgery alone. A Markov model was developed to simulate clinical care over a lifetime horizon. Probabilities and costs were derived from a focused literature review. Effectiveness was measured in life-years (LY), costs were adjusted to 2016 Canadian dollars and both were discounted 5% and used to calculated the incremental cost-effectiveness ratio (ICER). We used a willingness-to-pay threshold of $50 000/LY to determine cost-effectiveness. Deterministic and probabilistic sensitivity analyses were performed. Base case analysis showed surgery plus chemotherapy was more effective than surgery alone (4.7 v. 4.2 LY) at a cost of $133 779 v. $125 170 (ICER: $17 218/LY). The model was sensitive to probabilities of recurrence in each strategy and cost of initial hepatectomy. Perioperative chemotherapy remained cost-effective if the probability of recurrence at 3 years was 3.3% lower compared with surgery alone (base case: 66.8%, 95% CI 49.5–66.0). Surgery plus chemotherapy was cost-effective when the cost of the initial hepatectomy remained under $66 624 (base case: $25 886). Probabilistic sensitivity analysis revealed that perioperative chemotherapy was cost-effective in 82.8% of simulations. This cost-effectiveness analysis suggests the addition of perioperative chemotherapy may be cost-effective versus surgery alone in the treatment of CRCLM. Uncertainty regarding the effectiveness of adjuvant chemotherapy significantly limits the strength of our findings; further randomized evidence regarding the effectiveness of this strategy is needed.

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Surgical outcomes of nipple-sparing mastectomy: a multi-institutional study. *K. Ho, S. Hofer, A. Koch, M. Brown, D. McCready, T. Cil*. From the University of Toronto, Toronto, Ont.

Mastectomy may be used for the treatment of breast cancer and as an option to reduce risk for women at high lifetime risk of developing breast cancer. Nipple-sparing mastectomy (NSM) is a technique that preserves the breast skin envelope, including the nipple and areola. This results in less scarring and more natural-looking breasts in conjunction with immediate reconstruction. To date, no Canadian study has examined the surgical outcomes of NSM. The aim of this study was to evaluate the surgical outcomes of patients who have undergone NSM at 2 Canadian centres. A retrospective chart review study was conducted on all women who underwent NSM at 2 academic tertiary care hospitals between Jan. 1, 2009, and June 30, 2016. A total of 135 patients underwent 237 NSMs; 102 patients (75.6%) had bilateral and 33 (24.4%) unilateral surgery. The mean follow-up time was 12.6 months (1–63 months). Of the 237 NSMs, 202 (85.2%) were for risk reduction and 35 (14.8%) were for cancer treatment (17 ductal carcinoma in situ, 17 invasive ductal, 1 invasive lobular carcinoma). The inframammary fold was the most common incision site (51.7%) followed by periareolar with lateral extension (32.8%). There were 2 cases of local recurrence, both in the therapeutic group, with no recurrences in the nipple-areolar complex (NAC). Surgical complications associated with NSM included NAC necrosis (9.7%), skin flap necrosis (3.4%), wound dehiscence (3.4%), infection (2.5%), hematoma (2.1%) and seroma (1.7%). Of the 23 patients with necrosis, 2 required surgical débridement and 1 had resection of the NAC. At our centres, NSM was performed predominantly for breast cancer risk reduction. Rates of local recurrence and surgical complications are comparable to those reported in the literature, adding support to the oncological and surgical safety of NSM.

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Long-term outcomes of resection for locoregionally recurrent colon cancer: a multicentred retrospective descriptive

cohort study. ***J. Metz, T. Chesney, C. Swallow*****. From the University of Toronto, Toronto, Ont.**

Local recurrence (LR) of colon cancer (CC) is less common than for rectal cancer, and the oncologic outcomes of resection of LRCC are not clear. In addition, the morbidity and mortality of resection are poorly documented in the limited literature available. We evaluate the short- and long-term outcomes of resection for LRCC across 3 academic institutions. All patients undergoing curative-intent resection for LRCC between 1993 and 2016 were identified from prospective databases. Follow-up included serial clinical visits, colonoscopy, carcinoembryonic antigen (CEA) level and cross-sectional imaging. Primary outcomes were overall survival (OS) and time to re-recurrence, estimated using the Kaplan–Meier method and cumulative incidence function. The effect of resection margin on OS was estimated using Cox proportional hazards model. Mean value imputation was used for missing data: 0% OS, 2.7% re-recurrence. Seventy-two patients met the inclusion criteria and make up the study cohort; median age was 63 years (IQR 55–72) and 29 (40%) were female. Half of the patients (n = 37) underwent multivisceral resection, and microscopically negative resection margins (R0) were achieved in 82% (59/72) of cases. There were no postoperative deaths, but complications occurred frequently (30/72, 42%). Median follow-up was 36.3 months (IQR 23–61). OS at 5 years was 64% (95% CI 49%–78%). R0 resection was associated with improved OS compared with margin-positive resection (74% v. 27%, HR 3.37, 95% CI 1.35–8.41). Re-recurrence of cancer following R0 resection of LRCC occurred in 56% of patients within 5 years. Use of chemotherapy and/or radiotherapy was limited. This series of consecutive patients selected for curative-intent management of LRCC is among the largest in the literature, with the best-documented follow-up. Perioperative morbidity and mortality were acceptable. R0 resection was achieved in the majority and 5-year OS was greater than 60% These results are relatively favourable but may be further improved by systematic application of multimodality therapy.

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Novel uses of radioactive seeds in complex cases. ***K. Boulva, S. Lazizi, L. Guilarte, S. Rodriguez-Qizilbash, E. Patocskai*****. From the Université de Montréal, Montreal, Que.**

Radioactive seeds are mainly used to localize occult breast lesions and have more recently been used for targeted axillary dissection. The objective of this study is to explore novel uses of radioactive seeds in complex cases. A retrospective review of complex surgical cases that required the adjunct of an iodine-125 radioactive seed to localize metastatic lymph nodes at our institution between 2015 and 2017 was performed. Data were collected from electronic medical records and chart review. From 2015 to 2017, we identified 5 patients who underwent surgery with the use of a radioactive seed to localize lymph nodes in challenging surgical contexts, other than breast lesion localization and targeted axillary dissection. Four of these patients had breast cancer with metastatic nodes deemed unresectable by standard surgery. Preoperative radiological evaluation excluded distant metastases in all patients. The decision to move forth with surgery for oncological resection was taken in multidisciplinary cancer conferences. The use of a radioactive seed allowed us to complete a level III axillary dissection by infraclavicular transpectoral approach, resect an ectopic metastatic lymph node in a patient with non-melanoma skin cancer and locate a clipped metastatic lymph node that was not identified by standard dual-tracer sentinel lymph node biopsy in a patient after neoadjuvant chemotherapy. In our experience, radioactive seeds have allowed the excision of metastatic lymph nodes otherwise deemed unresectable. This technical adjunct should be considered in complex cases for complete oncological resection of lymph nodes. Its full potential is yet to be explored.

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Duodenal gangliocytic paraganglioma with lymph node metastasis: a systematic case review of epidemiology, diagnosis, surgical management, surveillance, histopathology and outcomes. ***L. Hartford, K. Leslie, A. Sherazadishvili*****. From Western University, London, Ont.**

Gangliocytic paragangliomas (GP) are a rare tumour, most commonly located in the 2nd portion of the duodenum. Their origin is poorly understood and management is uncertain. Typically exhibiting benign behaviour, they infrequently metastasize to lymph nodes (LN) and distant sites. A systematic literature search for duodenal gangliocytic paragangliomas (DPGs) with LN metastases was performed. Epidemiologic, diagnostic, management, surveillance and outcome data were recorded. The histopathology and immunohistochemistry (IHC) of these tumours and possible predictors of LN metastases were revisited. A total of 30 cases of duodenal GP with LN metastases were included. The mean age of patients was 49 years (SD 15.9 years), with no predilection for sex. The 2nd portion of the duodenum was the most common location and presenting complaints included abdominal pain and GI bleeding/anemia. Obstructive jaundice was more common in patients with lymph node metastasis. Tumour size (maximum diameter) ranged from 1 to 9 cm, with a mean of 3.15 cm, and tumours with LN metastases were larger than DGPs without LN metastases (2.5 cm). Serum/urine tumour markers and hormones were inconsistent; however, there was evidence of neuroendocrine activity. Esophagogastroduodenoscopy (EGD) successfully identified the lesion in 21/21 reported cases but had no role in tissue diagnosis. CT and endoscopic ultrasound (EUS) had a diagnostic rate of 83% and 100% in reported cases and were successful in detecting LN involvement in 50% and 60% of cases. EUS biopsies had a poor diagnostic utility of 14%. Pancreaticoduodenectomy (PD) was the definitive treatment in 86% of the cases. The mortality rate for the initial hospital stay was 3.3%. One-year mortality was 4.5%; 5-year mortality was 20%. Possible predictors of LN metastasis included tumour extension and angiolymphatic invasion, as well as changes noted in IHC. Using the best data available, we suggest diagnostic aids, management and surveillance for DGPs with LN metastases. While there are no predictors of which tumours will metastasize, angiolymphatic invasion, local tumour extension and the role of IHC may be further investigated. Treating clinicians should be aware of the uncertain malignant potential and have an informed discussion with their patients as to surgical management and treatment adjuncts such as chemotherapy and radiation therapy, taking into consideration patient comorbidities, risks/benefits and patient preference. Surveillance has not been well established and should be focused on diagnostic imaging and close clinical follow-up.