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Abstracts

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ASSOCIATION CANADIENNE DES MÉDECINS ET CHIRURGIENS BARIATRIQUES

02

The usefulness and costs of routine contrast studies after laparoscopic sleeve gastrectomy for detecting staple line leaks. ***P. Leung, D. Terterov, C. Smith, D. Pace, L. Twells, R. Murphy, K. Lester, D. Gregory, D. Boone*. From Memorial University, St. John's, Nfld.**

Although laparoscopic sleeve gastrectomy (LSG) has been shown to be a safe and effective treatment for severe obesity (BMI ≥ 35 kg/m^2), staple line leaks remain a major complication and account for a substantial portion of the procedure's morbidity and mortality. Many centres performing LSG routinely obtain contrast studies on postoperative day 1 to screen for staple line leaks. Here, we examined the value of upper gastrointestinal (UGI) contrast studies as a screening test for staple line leaks on postoperative day 1 after LSG, as well as the associated costs. A retrospective review was conducted on a prospectively collected database that included 200 patients who underwent LSG for severe obesity from 2011 to 2014. The outcome measures were the incidence of staple line leaks, the results of UGI contrast studies with sodium diatrizoate and meglumine diatrizoate (Gastrografin) and diagnostic computed tomography (CT) scans. Imaging costs were obtained from appropriate hospital departments. LSG was performed in 200 patients, with UGI contrast studies obtained on postoperative day 1 for all patients. Three patients (1.5%) were found to have staple line leaks. One was diagnosed with a positive contrast study, whereas the other 2 had negative contrast studies and were diagnosed on subsequent CT scans. Overall, UGI contrast studies yielded 2 false negatives and 1 true positive result. There were no false positives. The sensitivity of UGI contrast study for detecting staple line leaks after LSG in this patient population was 33%. For 200 patients, the total direct cost of screening for staple line leaks was $37 214 (including $35 000 for contrast studies and $2214 for diagnostic CT scans). Staple line leaks are a rare but serious complication following LSG. The use of routine UGI contrast studies to screen for staple line leaks has low sensitivity and is costly.

03

The association of change in body mass index and health-related quality of life in severely obese patients. ***E. Lester, R. Padwal, F. Ye, D. Birch, S. Karmali, A.M. Sharma, S. Klarenbach*. From the University of Alberta, Edmonton, Alta.**

The obesity epidemic is responsible for substantial morbidity, mortality, reduced quality of life and health care costs. The association between reduction in BMI and utility-based health-related quality of life (HRQoL) is not well described, and the existing literature does not analyze this relationship in severely obese patients where significant weight reductions have occurred. The association between significant weight loss and HRQol is vital to determining effectiveness and cost-effectiveness of existing and emerging interventions. Therefore, the objective of this study was to describe the relationship between change in BMI and utility-based HRQoL over 2 years in wait-listed, medically, and surgically managed severely obese patients. A cohort of 500 adult patients, in a population-based prospective evaluation of the quality of life and economic outcomes of bariatric surgery, were followed for 24 months. Baseline characteristics, as well as change in BMI and HRQoL using the EQ-5D were ascertained. Univariable and multivariable regression analyses were conducted to describe the association between change in BMI and EQ-5D, resulting in a mean reduction in BMI of –0.6, –2.5 and –7.4 for wait listed (n = 150), medically treated (n = 200) and surgically treated (n = 150) patients, respectively. Mean change in EQ-5D for waited-listed, medical and surgical patients was 0.005, 0.073 and 0.054, respectively. In univariable analysis, a 1-unit decrease in BMI was associated with an increase of 0.005 ($p < 0.001$) in EQ-5D score. In partially and fully adjusted multivariable analysis (age, sex, obesity-related comorbidities) the association was unaltered (1 unit reduction in BMI associated with increase in EQ-5D of 0.0053 (95%CI 0.008–0.0026)). A 1-unit reduction in BMI is associated with a statistically important increase in HRQoL. These data may be used to estimate the health impact and cost-effectiveness of interventions that impact obesity.

04

Inpatient cost of bariatric surgery within a regionalized centre of excellence system. ***A.G. Doumouras, F. Saleh, J.-E. Tarride, D. Hong*. From McMaster University, Hamilton, Ont.**

In 2009, Ontario developed Canada's first regionalized bariatric care system based on a centre of excellence (COE) model. One of the most important aspects of the COE model is increased efficiency per patient and the objective of this study was to identify key drivers of inpatient healthcare costs for bariatric surgery. We performed a population-based, retrospective cohort study including all patients, (age > 18 yr) who received a bariatric surgical procedure in Ontario between April 2009 and March 2012. Patient demographics, comorbidities and procedures were derived from the Canadian Institute of Health Information's (CIHI) Discharge Abstract Database. The CIHI statistics of resource intensity weight and cost per weighted case were used to determine costs. A multivariate generalized linear regression model using an inverse Gaussian distribution was developed to determine the effects of covariates on total inpatient cost per patient. Over 3 years, 4996 patients were identified and unadjusted mean costs over the first 3 years decreased from $12243 to $8744 ($p < 0.001$). The results of the multivariate regression demonstrated that the sleeve gastrectomy procedure decreased costs by $1478 per patient over gastric bypass (95% CI $1353–$1604, $p < 0.001$) and the 2011 fiscal year was $501 more efficient than previous 2 years (95% CI $375–$628, $p < 0.001$). Conversely, patients having any complication raised costs by $1367 (95% CI

$1062–$1673, $p < 0.001$) and leaks and reoperations specifically increased costs by $6599 (95% CI $484–$12713, $p = 0.034$) and $12971 (95% CI $11227–$14717, $p < 0.001$). Additionally, chronic kidney disease and COPD predicted higher costs ($p < 0.05$). When compared with the most efficient COE, each of the 3 other COEs predicted increased resource utilization from $730 to $2038 ($p < 0.05$). Overall, bariatric surgical care in Ontario became more efficient from 2009 to 2011. Major drivers of resource increased utilization included complications, kidney disease and COPD. Moreover, one of the COEs demonstrated significantly decreased costs compared with the other 3. We feel this points to further potential cost efficiencies within the regionalized care system.

05

Regional variations in the public delivery of bariatric surgery: an evaluation of the centre of excellence model. ***A.G. Doumouras, F. Saleh, S. Gmora, M. Anvari, D. Hong.* From McMaster University, Hamilton, Ont.**

In 2009, Ontario implemented Canada's first regionalized bariatric surgical care system based on a centre of excellence (COE) model. Because of this, a small number of COEs service a large population and geographic area. We evaluated variation in regional access to bariatric surgery within the high volume, COE model of Ontario, Canada. This study identified all patients aged > 18 years who received gastric bypass or sleeve gastrectomy between April 2009 and March 2012 for the purposes of weight loss. Morbid obesity adjusted rates of surgery were calculated for each neighbourhood and a cluster analysis was performed to determine spatial aggregation of neighbourhoods with significantly higher (hot spots) or lower (cold spots) rates of surgery. Neighbourhood socioeconomic status was derived from the Ontario Marginalization Index. Ordinal logistic regression was used to identify independent predictors of neighbourhood access. The cluster analysis identified 49 cold spot neighbouhoods, representing 1.7 million people. Rates of laparoscopy varied from 2.7 to 14.1 procedures per 1000 morbidly obese patients ($p < 0.001$). In the multivariate analysis, for every 100 km from the nearest COE, neighbourhoods were 0.88 times as likely to be in a hot spot (95% CI 0.80–0.97, $p = 0.012$). Additionally, having a bariatric facility within the same administrative health region as the neighbourhood made it almost twice as likely to be a hot spot, OR 1.75 (95% CI 1.10–2.79, $p = 0.018$). Low neighbourhood socioeconomic status was not associated with decreased delivery of care. This study identified an unequal delivery of bariatric surgery within Ontario. Both longer distances and not having a bariatric facility within the same health region had significant negative effects. Further research into patient attitudes and referral patterns is required to better characterize these disparities.

06

The effect of distance on short-term outcomes after bariatric surgery. ***F. Saleh, A.G. Doumouras, D. Hong.* From McMaster University, Hamilton, Ont.**

Regionalization of care to high-volume centres of excellence (COE) can increase travel distance for patients. A difference in outcomes created by this unequal distribution could be problematic for policy-makers. This is the first study to investigate whether the COE model impacts complication and readmission rates for patients travelling great distances for bariatric surgery. This study identified all patients aged > 18 years who received bariatric surgery between April 2009 and March 2012. The exposure of interest was distance from patients' primary residence to their bariatric COE. Outcomes of interest were 30-day overall complication rates and readmission rates. Univariable and multivariable logistic regression were used to examine the impact of distance on patient outcomes. In total 5007 patients were identified for inclusion in this study. The mean distance from patient residence to the COE where bariatric surgery occurred was 117.2 ± 168.5 km and the majority of patients did not reside within a LHIN with a COE (3192 [63.8%]). Patients living within a LHIN without a COE had a lower complication (10.7% v. 13.4%, $p = 0.003$) and readmission (5.9% v. 6.5%, $p = 0.429$) rate compared with those who did. After multivariable adjustment for procedure type and important patient characteristics, the odds of a complication for each 10 km increase in distance from a COE was 1.00 (95% CI 0.99–1.01, $p = 0.986$) while the OR of complication for those outside a LHIN with a COE compared with those within was 0.77 (95% CI 0.63–0.93, $p = 0.003$). The likelihood of readmission for every 10 km increase in distance from a COE was 0.99 (95% CI 0.98–1.00, $p = 0.082$) while for those living outside a LHIN with a COE compared with those within was 1.00 (95% CI 0.77–1.30, $p = 0.982$). It appears that the COE model, where a few centres in high population areas service a large geographic region, is adequate in ensuring patients living further away receive appropriate short-term care.

07

The role of preoperative upper endoscopy in bariatric surgery: a systematic review. ***S. Bennett, M. Gostimir, F. Haggar, J.-D. Yelle, J. Mamazza, A. Neville.* From University of Ottawa, Ottawa, Ont.**

The necessity of routine preoperative endoscopy (EGD) before bariatric surgery is controversial. European and North American guidelines recommend a routine and a selective approach, respectively. The objective of this study was to perform a systematic review to determine the prevalence of clinical findings on preoperative EGD. A systematic search of Medline, Embase and Cochrane databases was conducted. Search strategy included MeSH terms "bariatric surgery," "endoscopy," and "preoperative." Inclusion criteria included case series, cohort study or controlled trial that described results of preoperative EGD for any bariatric surgery. Exclusion criteria were studies with fewer than 10 patients, patients under 18 years old, or patients undergoing revisional surgery. Pathologic findings, and their prevalence, at endoscopy were extracted. Initial search identified 532 abstracts, and 48 were included in the study, consisting only of patient series. Included studies were published between 1996 and 2014, comprising 12 261 patients with mean age of 40.5 ± 1.3 years and BMI of 46.3 ± 1.5. The majority of patients (77.1%) were female. Changes in medical and surgical treatment resulting from EGD were reported inconsistently and with varying definitions. Twenty-one studies found a change in medical management in 27.3% (range 7%–70%) of patients. Twenty-four studies found a change in surgical management in 7.5% (range 0%–86%) of patients. Changes in surgical management included changes in the main bariatric procedure, additional procedures, operative

delays or cancellation. Other important findings such as Barrett's esophagus and malignancy were rare. Studies reporting EGD findings before bariatric surgery were heterogeneous in definitions and reported outcomes. However, the proportion of findings that led to a significant change in surgical management was low. The majority of findings leading to changes in medical management pertained to *Helicobacter pylori*, and could be alternatively managed with noninvasive testing. The incidence of unexpected, serious findings such as cancer appears to be very low.

08

Outcomes of a dedicated bariatric revision surgery clinic. ***C. Fulton, C.E. Sheppard, D.W. Birch, S. Karmali, C.J. de Gara.* From the University of Alberta, Edmonton, Alta.**

Bariatric surgery is the only evidence-based sustainable weight loss option for the morbidly obese, and it is becoming increasingly popular every year. Weight recidivism and complications from primary surgery often need to be corrected with further operations. Our dedicated multidisciplinary clinic addresses these complex issues using a specific "red flag" system to exclude patients who would be unlikely to benefit from further surgery. The objective of this study is to characterize patients receiving revision surgery and compare outcomes to our primary clinic data. A retrospective chart review of 532 bariatric revision clinic patients was performed from 2009 to 2014. Data were compared with 4665 patients over the same time period from the primary clinic. Demographics were similar. Revision patients were 90% female (47.9 ± 10.1 yr) with an average BMI of 42.6 ± 11.0. The majority had either a vertical banded gastroplasty (VBG; 50%) or a laparoscopic adjustable gastric band (LAGB; 25%), and 12% had undergone prior revisional surgery. Most primary surgeries had been performed in Alberta (56%); however, over 40% were medical tourists (26% from other provinces and 15% from outside Canada). Patients came to the clinic either because of weight regain (64%), dysphagia (26%), surgical complications (12%), and/or malnutrition (3%). Only 18% of patients seen in the revision clinic ultimately received surgery compared with 26% in the primary clinic. Over 60% had an open Roux-en-Y gastric bypass. Twelve months after surgery patients had a significantly reduced BMI of 33.6 ± 8.3 ($p < 0.001$), which is comparable to our primary data 34.0 ± 9.2 ($p > 0.99$). Early revision complications were significantly higher ($p < 0.001$). The Bariatric Surgery Revision clinic manages a variety of complicated patients. Few patients were surgical candidates because of our highly selective process. While revisional procedures have an increased short-term complication rate compared with primary bariatric surgery, revisional surgery is integral for significantly decreasing weight regain.

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Quality of follow-up: a systematic review of the research in bariatric surgery. ***N.J. Switzer, S. Merani, D, Skubleny, J.-S. Pelletier, R.S. Gill, R. Kanji, X. Shi, D.W. Birch, C. de Gara, A.M. Sharma, S. Karmali.* From the University of Alberta, Edmonton, Alta.; McGill University, Montréal, Que.; University of Calgary, Calgary, Alta.; and Royal Alexandra Hospital, Edmonton, Alta.**

Loss to follow-up is a major concern in clinical research and can potentially bias the outcome and interpretation of a study. Bariatric surgery is a rapidly growing surgical area, however recent systematic reviews have criticized the field for its lack of overall follow-up. The quality of follow-up in the bariatric surgical literature appears highly variable. Our aim was to systematically review the bariatric surgery literature with regards to adequacy of patient follow-up. A complete search of PubMed was performed. Literature was restricted to a range of 5 years (2007–2012), English language, and publications listed in PubMed. Whether each study met McMaster Evidence-Based Criteria for High Quality Studies was used to assess the follow-up data and a logistic meta-regression was performed to identify factors associated with high quality follow-up studies. Ninety-nine published manuscripts were included. For follow-up at study end, only 40/99 (40.4%) of papers had adequate patient follow-up, 42/99 (42.4%) failed to meet the McMaster criteria and 17/99 (17.2%) failed to report any follow-up results. On average, 31% were lost to follow-up at the study's end. Only shorter study duration and whether the study was performed in the United States were associated with studies meeting the McMaster criteria for high quality follow-up. Only 40% of studies in the bariatric surgery literature meet criteria for adequate follow-up recommended by the McMaster group. On average, studies have 30% of patients lost to follow-up at the stated end-point. Identified study characteristics associated with high quality follow-up include shorter study duration and studies performed in the United States.

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Bariatric surgery improves weight loss and cardiovascular disease compared with medical management alone: an Alberta multi-institutional early outcomes study. ***N.J. Switzer, S.E. Jelinski, N. McGuire, R.S. Padwal, S. Crawford, R. Lewancuzk, A.M. Sharma, R.S. Gill.* From the University of Alberta, Edmonton, Alta.; University of Calgary, Calgary, Alta.; and Alberta Health Services, Alta.**

The prevalence of obesity in North America is growing at an alarming rate. Bariatric surgery has been shown to be an evidence-based approach to produce marked weight loss and improvement in obesity-related comorbidities. Hence, the Alberta Health Services (AHS) Provincial Obesity Initiative was launched to expand adult bariatric specialty care throughout Alberta. The objective of this population-based multi-institutional study was to determine the clinical outcomes of laparoscopic Roux-en-Y gastric bypass (LRYGB), laparoscopic sleeve gastrectomy (LSG), laparoscopic adjustable gastric band (LAGB) and medical management of severe obesity in Alberta. This is a retrospective multi-institutional cohort study conducted as a required part of the AHS Provincial Obesity Initiative. Patients were obtained from the 5 adult bariatric specialty care clinics in Alberta between the years 2010 and 2014. The outcome of interest was weight change (kg) at 12 months follow-up. Secondary outcomes included change in cardiovascular risk markers and hospital readmission with 180 days of surgery. A total of 1052 patients were enrolled in the study, consisting of 618 medically and 434 (LRYGB = 138, LSG = 241, LAGB = 55) surgically managed patients. At referral, the mean weight of all patients was 134 ± 28 kg and body mass index (BMI) of 48 ± 9. At 12-month follow-up, bariatric surgical patients had significantly greater weight-loss than medically managed patients ($p < 0.0001$). Weight change was greatest in the LRYGB (–38 ± 3 kg)

compared with LSG (–27 ± 3 kg), LAGB (–15 ± 3 kg) and medical therapy alone (–4 ± 3 kg). Cardiovascular disease markers, including total cholesterol:HDL ratio, HDL, triglycerides, fasting glucose and A1C levels, were all significantly improved in bariatric surgical group compared with patients treated with medical management alone ($p < 0.0001$, for each variable respectively). Bariatric surgery specialty care is effective in producing weight loss and improving cardiovascular health in severely obese patients in Alberta. Multidisciplinary medical management resulted in weight stabilization.

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Diabetic control after laparoscopic gastric bypass and sleeve gastrectomy: a short-term prospective study. ***S. Elkassem*. From Medicine Hat Regional Hospital, Medicine Hat, Alta.**

Bariatric surgery improves glycemic control in diabetic patients. Conflicting evidence still exists regarding the type of bariatric surgery that would be most effective in treating diabetes. The purpose of this study is to prospectively compare diabetic outcomes after laparoscopic gastric bypass (GRYB) and sleeve gastrectomy (SG). A total of 37 morbidly obese patients with diabetes were followed prospectively after GRYB and SG. Selection was based on patient preference and risk factors. Outcomes included weight loss, change in A1c levels, and reaching A1c targets. Patients were followed for 6–12 months. A total of 22 patients underwent a GRYB, while 15 patients had SG. The average BMI for the 2 groups was 47.8 and 49. 2, respectively. The average age was 48 and 48.7, respectively. Fifty percent of patients in the GRYB were insulin diabetic, versus 33.3 for SG. The average A1c was 7.5 and 7.7, respectively. GRYB patients had diabetes for 10 years compared with 5.4 years for SG. At 6 months, the average BMI for GRYB and SG was 35 and 42, respectively. The percent of total weight loss for GRYB and SG was 24.9% and 21.4%, respectively. The average A1c for GRYB and SG was 6.3 and 6, respectively ($p = 0.11$). A total of 57.8% of GRYB reached an A1c target of 6.5% or less compared with 83.3% for the SG group. A target A1c of 7% or less was achieved in 78.9% in GRYB and 91.6% in SG. Diabetic patients undergoing either GRYB or SG achieved comparable weight loss. No difference in A1c levels was seen between the groups postoperatively. More patients tended to reach target levels of A1c control in the SG group. This study shows that in the short-term, no major differences in gylcemic control between the 2 bariatric procedures. Since family physicians are at the front lines of obesity management, it is important to understand their opinions about bariatric surgery. The objectives of this study were to identify Ontario family physicians' knowledge and perceptions of bariatric surgery, and to determine factors associated with physician referral for surgery. The study population included all physicians practising family medicine in Ontario who were listed in the Canadian Medical Directory. A self-administered questionnaire consisting of 28 questions was developed and validated using a focus group of 7 primary care physicians. The questionnaire was distributed to 1328 physicians. In total, 165 surveys were completed — a 12.4% response rate. A total of 8.8% of physicians do not have any bariatric surgical patients, and 71.3% have no more than 5 in their practice; 70.2% have referred no more than 5% of their morbidly obese patients for surgery. Only 32.1% have the appropriate equipment and resources to manage obese patients. A total of 92.5% of physicians would like to receive more education about bariatric surgery. A comparative analysis revealed that physicians with no history of referral ($n = 21$) are earlier into their practices and have fewer morbidly obese patients than physicians who have made previous referrals ($n = 141$). They are also less likely to discuss bariatric surgery with their patients (30% v. 79.3%, $p < 0.001$) and less likely to feel comfortable explaining procedure options (5.6% v. 33.9%, $p = 0.013$) and providing postoperative care (26.7% v. 64.2%, $p = 0.005$). About 55.6% would refer a family member for surgery, compared with 85.4% of physicians who have made previous referrals ($p = 0.002$). Physicians are generally supportive of weight loss surgery. However, there appears to be a knowledge gap in understanding the role of bariatric surgery in the treatment of obesity. There is an opportunity to improve education and available resources for primary care physicians surrounding patient selection and follow-up care. This may improve access to treatment.

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Knowledge and perception of bariatric surgery among primary care physicians: a survey of family doctors in Ontario. ***M. Auspitz, M.C. Clegborn, A. Azin, S. Sockalingam, F.A. Queresby, A. Okrainec, T.D. Jackson*. From the University Health Network, University of Toronto, Toronto, Ont.**

Since family physicians are at the front lines of obesity management, it is important to understand their opinions about bariatric surgery. The objectives of this study were to identify Ontario family physicians' knowledge and perceptions of bariatric surgery and to determine factors associated with physician referral for surgery. The study population included all physicians practising family medicine in Ontario who were listed in the Canadian Medical Directory. A self-administered questionnaire consisting of 28 questions was developed and validated using a focus group of 7 primary care physicians. The questionnaire was distributed to 1328 physicians. A total of 165 surveys were completed, a 12.4% response rate. In total, 8.8% of physicians do not have any bariatric surgical patients, and 71.3% have no more than 5 of these patients in their practice. About 70.2% have referred no more than 5% of their morbidly obese patients for surgery. Only 32.1% have the appropriate equipment and resources to manage obese patients. About 92.5% of physicians would like to receive more education about bariatric surgery. A comparative analysis revealed that physicians with no history of referral ($n = 21$) are earlier into their practices and have fewer morbidly obese patients than physicians who have made previous referrals ($n = 141$). They are also less likely to discuss bariatric surgery with their patients (30% v. 79.3%, $p < 0.001$) and less likely to feel comfortable explaining procedure options (5.6% v. 33.9%, $p = 0.013$) and providing postoperative care (26.7% v. 64.2%, $p = 0.005$). In all, 55.6% would refer a family member for surgery, compared to 85.4% of physicians who have made previous referrals ($p = 0.002$). Physicians are generally supportive of weight loss surgery. However, there appears to be a knowledge gap in understanding the role of bariatric surgery in the treatment of obesity. There is an opportunity to improve education and available resources for primary care physicians surrounding patient selection and follow-up care. This may improve access to treatment.

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Is early discharge of patients post laparoscopic sleeve gastrectomy safe? ***K. Karol, C. Smith, L. Twells, D. Boone, D. Pace, R. Murphy.*** **From Memorial University, St. John's, Nfld.**

Morbid obesity has become a growing epidemic and has led to a rising prevalence in bariatric surgery. Advances in surgical and anesthetic techniques along with an increased emphasis on cost saving has led to improvements in perioperative care. Typically, patients undergoing laparoscopic sleeve gastrectomy (LSG) would be discharged on postoperative day (POD) 2 or 3. The purpose of this study is to determine if earlier discharge of these patients is safe. A retrospective review of a prospectively collected database was performed on the first 200 patients who had undergone LSG between 2011 and 2014 in our institution. Appropriateness for discharge was determined by tolerance of oral fluids, oral analgesia and independent ambulation. Patients who were discharged on POD 1 were compared with those who were discharged on POD 2 or 3. The primary outcome, complications within 30 days, was determined as a pooled variable. This comprised readmission, return to ED, cardiac complication, respiratory complication, surgical site infection, wound dehiscence, staple line leak, urinary tract infection, and dehydration. In total, 189 patients were included in the analysis, 27 were discharged on POD 1 and 162 were discharged on POD 2 or 3. The 2 groups were similar in terms of their baseline characteristics. Overall, there were 21 patients with perioperative complications (11.1%). The POD 1 discharge group had 2 patients with complications (7.4%), whereas, 19 patients (11.7%) suffered complications in the POD 2 or 3 group. There was no significant difference in complications between the 2 groups ($p = 0.51$). The discharge of patients undergoing LSG on POD 1 is not associated with an increased risk of perioperative complications. Early discharge (POD 1) from hospital post-LSG is safe, with the potential for increased patient satisfaction and cost savings.

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A comparison of outcomes between bariatric centres of excellence within Ontario. ***F. Saleh, A.G. Doumouras, D. Hong.*** **From McMaster University, Hamilton, Ont.**

The Ontario Bariatric Network (OBN) introduced the centre of excellence model for bariatric medicine in 2009, consisting of 7 hospitals within 4 bariatric centres. We have previously shown outcomes within the program are comparable to other programs reported in the literature. However, between-centre variation in outcomes has never been looked at within the OBN. The objective was to evaluate complications and major morbidity of bariatric surgery between the different centres. This was a population-based cohort study that included all patients (age > 18 yr) who received a Roux-en-Y gastric bypass (RYGB) or sleeve gastrectomy (SG) between March 2009 and April 2012 within Ontario for the purposes of weight loss. Data were derived from the Canadian Institute for Health Information Discharge Abstract Database and Hospital Morbidity Database. Hierarchical logistic regression was used to provide risk-adjusted outcomes. A median odds ratio (OR) was used to compare risk-adjusted complication rates. Over 3 years, 5007 procedures (91.7% RYGB, 8.3% SB) were performed with an overall complication rate of 11.7%. This varied among the 4 centres, ranging from 6.3% to 23.6% ($p < 0.001$). The leak rate varied from 0.1% to 1.3% ($p = 0.056$), the reoperation rate varied from 1.7% to 6.0% ($p < 0.001$), and the death rate from 0% to 0.3% ($p = 0.198$). The median OR for overall complications was 1.73, with 3 of the 4 centres varying significantly from the mean complication rate. While the complication rates within the OBN are comparable to other programs, there is a wide variation within the centres themselves. Further studies are needed to identify the factors responsible for these differences.

CANADIAN ASSOCIATION OF GENERAL SURGEONS

ASSOCIATION CANADIENNE DES CHIRURGIENS GÉNÉRAUX

02

Closure methods for laparotomy incisions: a cochrane review. ***S.V. Patel; for the Canadian Association of General Surgeons.*** **From Queen's University, Kingston, Ont.**

Surgeons who perform laparotomy have a number of choices for closure. The objectives of this Cochrane Review were to identify the best available suture techniques and suture materials for closure of the fascia following laparotomy incisions. Our primary outcome was incisional hernia. Secondary outcomes included wound infection, dehiscence, fistula and sinus formation. We included randomized controlled trials (RCTs) that compared suture materials or closure techniques, or both, for fascial closure of laparotomy incisions. Studies published between January 1950 and December 2014 were included. Title, abstract and full text review was done in duplicate by independent reviewers. Data and risk of bias were also completed in duplicate. Fifty RCTs with a total of 18 336 participants were included in the review. Included studies were heterogeneous in the type of sutures used, methods of closure and patient population. We did not find evidence that suture absorption (absorbable v. nonabsorbable), closure method (mass v. layered) or closure technique (continuous v. interrupted) resulted in a difference in the risk of incisional hernia. We did, however, find evidence that monofilament sutures reduced the risk of hernia (RR 0.76, 95% CI 0.59–1.00, I^2 = 34%). None of the techniques reduced the risk of wound infection. Monofilament sutures increased the risk of wound dehiscence (RR 1.55, 95% CI 1.14–2.10, I^2 = 0%), as did mass closure (RR 0.61, 95% CI 0.36–1.05, I^2 = 25%). Both absorbable sutures (RR 0.49, 95% CI 0.26–0.94, low-quality evidence) and mass closure (RR 0.33, 95% CI 0.16–0.69) reduced the risk of sinus or fistula formation. Based on the evidence from this review, surgeons should consider choosing monofilament sutures to reduce the risk of hernia. Study design and reporting limited the strength of this recommendation.

03

Closing the audit cycle: Are we consenting correctly now? ***M. Mak, R. Talboys, S. Garg.*** **From James Paget University Hospital, Great Yarmouth, Norfolk, UK**

Provision of consent before surgery is fundamental in ensuring the patient is fully informed of the benefits and potential risks of the proposed procedure. This process is documented on the Standard Consent Form. In 2013, we audited consent forms of patients undergoing several common orthopedic procedures. We now aim to close the audit loop and ascertain the quality of consent provision in 2 common orthopedic procedures. Forty-two cases from Nov. 1 to Dec. 30, 2014, were retrospectively identified using the operating room database. Consent forms were reviewed on electronic health records and audited against standards endorsed by the British Orthopaedic Association. There was improvement in provision of supplementary written information specific to the procedure (98% from 85%), and listing a named consultant (90% from 70%). Some postoperative complications were well recorded: bleeding (100%), infection (100%), venous thromboembolic events (96%) and neurovascular damage (95%). However, common risks, such as postoperative pain (36%), prosthesis wear/loosening (16%) and stiffness (40%), were still poorly documented. Some of the rare complications were also inconsistently recorded: poor wound healing (8%), joint dislocation (30%), fractures (50%). Limb-length discrepancy was documented even more poorly than the year before. There has been overall improvement in certain aspects, but several common risks are still poorly documented. Procedure-specific consent forms were suggested previously, but may be impractical to use. The development of stickers explaining specific complications is in the pipeline, and could be attached on the Standard Consent Form in the future.

05

Regional variation in the use of surgery in Ontario. ***A.E. Feinberg, J. Porter, R. Saskin, J. Rangrej, D.R. Urbach.*** **From University or Toronto, Toronto, Ont.**

Regional variation in the use of surgery implies that there is uncertainty regarding appropriate use. The objectives of this study were (1) to identify which procedures are most commonly performed in the studied province and (2) to measure the extent of variation in the use of procedures across counties. We used the Canadian Institute for Health Information Discharge Abstract Database, Same Day Surgery Database and National Ambulatory Care Reporting System to retrieve information on all inpatient and day surgery visits in the province. We identified the 85 most common procedures according to Canadian Classification of Interventions (CCI) codes, including all services that occurred during the time period Apr. 1, 2002, to Mar. 31, 2011. We calculated rates of use for each of the procedures throughout the 49 counties and then calculated measures of variation (quartile ratio, systematic component of variation) in use among the counties. Colonoscopy was the most commonly performed procedure in the studied province between 2002 and 2010 with an average adjusted rate of 2012 per 100 000. The procedure with the largest quartile ratio was iridectomy with a value of 6.7, followed by colposcopy and cervical biopsy. These procedures were less commonly performed. Common procedures such as colonoscopy, cataract extraction and vaginal delivery had lower quartile ratios. Results of area variation analysis were similar when using the systematic component of variation as the measure of variation. Colonoscopy was the most commonly performed procedure in the studied province. Procedures with the highest measures of variation between counties tended to be those that occurred less commonly in the province, and very common procedures were associated with less area variation.

06

Quitting general surgery residency: attitudes and factors in Canada. ***D.N. Ginther, P. Hayes.*** **From the University of Saskatchewan, Saskatoon, Sask.**

General surgery training has a high attrition rate, greater than other surgical disciplines. Attrition rates and influencing factors in Canadian training programs have not been assessed. Understanding the relevant factors could contribute to successful training completion. We sought to determine the prevalence with which Canadian general surgery residents consider leaving their training and the contributing factors. An anonymous survey was distributed to all general surgery residents in Canada. Responses from residents who considered leaving their training were assessed for importance of contributing factors. The response rate was approximately 34.0%. A minority (32.0%) reported very seriously or somewhat seriously considering leaving their training, while 35.2% casually considered doing so. Poor work-life balance in residency (38.9%) was the single most important factor, while concern about future unemployment (16.7%) and poor future quality of life (15.7%) were next. Enjoyment of work (41.7%) was the most frequent mitigating factor. Harassment and intimidation were reported factors in 16.7%. On analysis, only intention to practise in a nonacademic setting approached significant association with thoughts of leaving (OR 1.92, 95% CI 0.99–3.74, $p = 0.052$). There was no association with sex, program, postgraduate year, relationship status, or subspecialty interest. There was a nonsignificant trend toward more thoughts of leaving with older age. Canadian general surgery residents are less likely to seriously consider quitting than their American counterparts. Poor work–life balance in residency, fear of future unemployment, and anticipated poor future quality of life are significant contributors to thoughts of quitting. Efforts to educate prospective residents about the reality of the surgical lifestyle, and to assist residents in securing employment, may improve completion rates.

07

Nipple-sparing mastectomy: utility of intraoperative frozen section analysis of retroareolar tissue. ***S. Lyew, K. Briggs, A. Ayoub, M. Musgrave, H. Faragalla, R. George.*** **From St. Michael's Hospital, Toronto, Ont.**

Nipple-sparing mastectomy (NSM) is an increasingly popular option for women requiring mastectomy and preferring to undergo immediate reconstruction. Concern has been expressed regarding the safety of NSM, particularly the risk of occult malignancy within duct fragments that may remain within the preserved nipple and areola. Frozen section analysis (FSA) in NSM has the potential to detect occult neoplasias intraoperatively, selecting patients for preservation of the nipple areolar complex (NAC). Retrospective review of 94 NSMs captured clinicopathological information for patients from 2009 to 2014. The review assessed the accuracy of FSA in NSM, audited rate of clinically occult NAC cancers, and investigated pathological and clinical outcomes. Procedures included prophylactic and therapeutic operations. Prior radiotherapy was noted, method of reconstruction, nipple necrosis, and nipple loss. Of 94 NSMs, FSA identified 6 (6.4%) subareolar biopsies as positive for malignancy or atypia. Four were confirmed on permanent section (positive predictive value 66%). No additional positive findings were identified on subsequent permanent section analysis, (negative predictive value 100%). Sensitivity and specificity of FSA were 100% and 97%. Three of the positive frozen sections revealed in situ and 1 revealed invasive carcinoma. Five (5.3%) nipples developed postoperative necrosis, with 2 (2.2%) leading to postoperative loss of the NAC. FSA appears to be a useful tool selecting patients for preservation of the NAC. Sensitivity and specificity were high. Negative predictive value was 100% in this series. Positive predictive value was 66% overall, influenced by the difficulty of interpreting atypia. When restricted to frank cancer or in situ disease positive predictive value rose to 100%.

08

Withdrawn

09

Reliable assessment of operative performance. ***E. Bilgic, Y. Watanabe, K.M. McKendy, A. Munshi, G.M. Fried, L.S. Feldman, M.C. Vassiliou.*** **From McGill University, Montréal, Que.**

Surgical education is moving increasingly to a proficiency-based approach. This requires evidence of satisfactory performance for progression through the curriculum. There is lack of consensus regarding number of intraoperative assessments required to reliably measure a trainee's performance. Different factors in the clinical environment may impact performance, making it challenging to reliably assess skill. We evaluated the impact of case factors on performance assessment using generalizability theory, and determined the number of cases needed to establish reliable assessments in surgical training. Surgical trainees were assessed by attendings during direct observation of laparoscopic surgery over 2 months using the Global Operative Assessment of Laparoscopic Skills (GOALS). Data were collected prospectively, assessing each trainee multiple times. The reliability coefficient was calculated according to generalizability theory, with participants, cases, and attendings (raters) as factors, along with their interaction terms. The number of cases needed to achieve a reliability of 0.8 was determined using a decision study. Eighteen trainees (3 PGY2, 1 PGY3, 3 PGY4, 8 PGY5 and 3 Fellows) received a median of 2 GOALS assessments (range 1–12) each (total of 65 assessments). The reliability of 1 assessment per trainee was 0.66. "Attending surgeon" and "interaction between participants and cases" accounted for 2.3% and 31.6%, respectively, of the total variance. Increasing the number of cases per trainee assessed by a single attending increased reliability of the GOALS assessment incrementally: 0.66 (1 case), 0.79 (2 cases), 0.84 (3 cases), and 0.87 (4 cases). These preliminary data suggest that "interaction between participants and cases" accounted for most variance in assessment scores. More than 3 assessments per trainee should be required to obtain reliable performance scores using GOALS. This methodology may be used to determine the number of assessments needed per procedure to provide reliable assessment of technical proficiency in laparoscopic surgery.

10

Video assessment as a method of assessing surgical competence: the difference in video-rating skills after 4 years of residency. ***N. Gawad, G. Martel, I. Raiche, F.K. Balaa.*** **From University of Ottawa, Ottawa, Ont.**

There are increasing feasibility barriers to the assessment of basic technical skills in the clinical environment. While many studies

explore objective assessment of technical skills in the operating room, little data exist on alternative, less time- and resource-consuming methods. This study sought to determine if video assessment could be used as a method of assessing surgical competence in residents. Twelve residents (PGY1 & PGY2) used the Global Assessment of Laparoscopic Skills (GOALS) instrument to evaluate a prerecorded video of themselves laparoscopically dissecting a gallbladder in an ex-vivo porcine simulation model. At the same time, an attending surgeon independently evaluated the same video. The attending surgeons then provided the residents with qualitative feedback on their performance, after which each resident re-evaluated their same video. Four years later, each resident again re-evaluated the same video they had performed as a junior resident. The mean score (± SD) on the residents' initial self-evaluation was 14.9 ± 1.6, while that of the attending surgeons was 12.4 ± 3.0. The mean difference (MD) between these scores was statistically significant (MD = 2.5, p = 0.01) and showed poor correlation (Rho = 0.295, p = 0.353). After receiving qualitative feedback, the residents' scores were not significantly different from their initial self-evaluation (14.9 ± 2.6, MD = 0.0, p = 0.939) and showed strong correlation before and after receiving feedback (Rho = 0.664, p = 0.02). When the residents re-evaluated themselves 4 years later, their scores were 11.7 ± 2.0 with a statistically significant MD from their initial self-evaluation (MD = 3.2, p = 0.002). Unlike their initial self-evaluation, their scores 4 years later were no longer significantly different from the staff's initial evaluation (MD = 0.7, p = 0.357) and showed a moderate correlation (Rho = 0.481, p = 0.113). In an objective fashion, this study demonstrates that with training, surgical residents improve their video assessment skills. Our findings justify studying video assessment as a surrogate of surgical competence potentially leading to more cost-effective assessment tools.

11

Burnout among academic surgeons. ***A. Nassar, S. Reid, K. Kahnamoui, M. McConnell.* From McMaster University, Hamilton, Ont.**

The goal of this study is to identify the prevalence of burnout in academic clinicians in the faculty of health sciences at an academic institute in Canada and investigate potential demographic and workload variables that contribute to self-reported measures of burnout. A novel modification to the Maslach Burnout Inventory (MBI) scale was distributed to all academic clinicians at a teaching institute through an Internet-based survey. The MBI scale was modified to reflect 3 hypothesized sources of burnout for academic clinicians: interactions with students/trainees, interactions with patients and interactions with administration. The scale comprised 3 dimensions of burnout: emotional exhaustion (EE), depersonalization (DP) and personal accomplishment (PA). Demographic and workload data were also collected. Factor analysis and internal consistency showed that the modified MBI scale was associated with valid and reliable scores, respectively, within this population. Results showed that academic clinicians experienced high levels of burnout due to administration interactions relative to that attributed to patients and students. The prevalence of burnout for the EE subscale is 51.8% for administration, 26.4% for patients and 11.7% for students; the prevalence for the DP subscale is 44.8% for administration, 24.5% for patients and 9.8% for students; and the prevalence for the PA subscale is 16.3% for administration, 33.4% for patients and 33.7% for students. Regression analyses suggested that young age, surgical specialty, low academic rank, academic main practice, female sex, numerous night shifts and living alone contribute to EE and DP subscales. Meanwhile, high number of patients under their care was shown to contribute to increasing PA. Burnout syndrome is prevalent among academic clinicians at a teaching institute. The major source of burnout was attributed to interactions with administration. Surgical specialties and young faculty staff members correlated with burnout. Further studies are needed to further characterize the nature of administrative interactions that contribute to burnout and to solidify other contributing variables.

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Increased health services use by severely obese patients undergoing emergency surgery: a retrospective cohort study. ***S. Küpper, C.J. Karvellas, R.G. Khadaroo, S. Widder.* From Acute Care and Emergency Surgery Group (ACES), University of Alberta, Edmonton, Alta.**

The aim of this study was to assess perioperative outcomes in obese patients undergoing emergency surgery. We retrospectively reviewed the charts of all adult (> 17 yr) patients admitted to the Acute Care Emergency Surgery team at the University of Alberta Hospital between January 2009 and December 2011 who had a BMI ≥ 35. Patients were divided into subgroups for analysis based on "severe" (BMI 35–39.9) and "morbid" obesity (BMI ≥ 40). Multivariate logistic regression was performed to identify predictors of in-hospital mortality after controlling for confounding factors. Data on 111 patients (55% female, median BMI 39) were included in the final analysis. Intensive care (ICU) support was required for 40% of patients. Postoperative complications occurred in 42% of patients, and 31% required reoperation. Overall in-hospital mortality was 17%. Morbidly obese patients had increased rates of reoperation (40% v. 23%, p = 0.05) and increased lengths of stay compared with severely obese patients (14.5 v. 6.0 days, p = 0.09). Age (OR 1.08 per increment) and preoperative ICU (OR ~12) were significantly associated with in-hospital mortality after controlling for confounding, but BMI was not. Obese patients requiring emergency surgery represent a complex patient population at high risk for perioperative morbidity and mortality. Greater resources are required for their care, including ICU support, repeat surgery and prolonged ICU stay. Future studies could help identify predictors of reoperation as well as strategies to optimize nutrition, rehabilitation and resource allocation.

14

Novel models for advanced laparoscopic suturing: taking it to the next level. ***Y. Watanabe, K.M. McKendy, E. Bilgic, G. Enani, A. Madani, A. Munshi, L.S. Feldman, G.M. Fried, M.C. Vassiliou.* From McGill University, Montréal, Que.**

Current bench-top simulations for laparoscopic suturing do not reflect the complexity of the skills required in the operating room. The purpose of this study was to develop novel advanced suturing tasks with assessment metrics, and to collect validity evidence for them as measures of suturing skill. We developed 3 tasks using readily available materials, based on training gaps

identified through a previous needs assessment: needle handling (NH), suturing under tension (UT), and continuous suturing (CS). Minimally invasive surgeons (MIS) and senior general surgery residents (SR) completed these tasks and a questionnaire regarding their educational value. Performance was assessed by 2 raters based on time and accuracy. Validity was assessed by comparing performance according to level of training and self-reported experience. A total of 31 participants (13 MIS, 18 SR) were enrolled in the study. Compared with the SR group, the MIS group had significantly greater scores [25th; 75th percentiles] on all tasks (NH: 404 [353; 474] v. 349 [258; 434], $p = 0.04$; UT: 535 [369; 627] v. 246 [109; 440], $p < 0.01$; and CS: 820 [669; 886] v. 282 [83; 507], $p < 0.01$). While all MIS surgeons completed the 3 tasks within the allotted time, 6 (33%) residents could not complete at least 1 out of the 3 tasks. Laparoscopic suturing experience correlated positively with the scores of all tasks (NH 0.51, UT 0.70, CS 0.65. $p < 0.01$). Inter-rater reliability for all tasks was 0.99 and internal consistency was 0.80. The majority of participants agreed that the tasks were relevant to practice, helped improve technical competence, and adequately measured suturing ability. This study provides validity evidence for 3 novel advanced laparoscopic suturing tasks. Performance on all tasks correlated significantly with training level and self-reported experience. Integrating these tasks into educational curricula may help improve residents' suturing skills and better prepare residents for the operating room.

16

Pectoral nerve block in breast and axillary surgery. ***M. Elmi, N.L. Hong.*** **From Sunnybrook Health Sciences Centre — Odette Cancer Centre and the University of Toronto, Toronto, Ont.**

Inadequate perioperative pain control following breast and axillary surgery may lead to the development of chronic pain in up to 65% of women. To date, the efficacy and safety of intraoperative pectoral nerve block (PNB) has not been evaluated. We sought to determine whether PNB has opioid-sparing effects in patients postmastectomy and/or axillary lymphadenectomy (ALND). A retrospective study was conducted examining consecutive patients undergoing mastectomy and/or ALND with and without PNB. Primary outcome was 24-hour opioid requirements postprocedure. Secondary outcomes included the usage of nonopioid analgesics, antiemetics, and time to discharge. Comparisons between the 2 groups were assessed via Satterthwaite t test or Fisher exact test. Fifty-three patients were included, 34 (64%) in the PNB group. Overall, 33 (62%) patients had a mastectomy, 8 (15%) had an ALND, and 12 (23%) had both. There were no complications attributable to the PNB. There was no difference in mean 24-hour morphine usage in the PNB group (21.9 mg) versus the non-PNB group (22.7 mg, $p = 0.88$). Furthermore, patients in the 2 groups were similar for baseline clinical characteristics, procedure time and type, time to discharge, usage of antiemetics and nonopioid analgesics. PNB is safe and feasible when done under direct visualization. No significant opioid-sparing benefits were seen with PNB immediately following mastectomy and/or axillary lymphadenectomy. However, limited sample size and follow- up preclude definitive long-term conclusions. Long-term follow-up results examining the incidence of persistent pain are forthcoming.

17

Predictors for positive resection margins in gastric adenocarcinoma: a population-based analysis. ***M. Elmi, D. Kagedan, J.C. Correa, A. El-Sedfy, M. Dixon, A. Mahar, C. Roswell, L. Helyer, J. Vasilevska-Ristovska, C. Law, D. Cortinovis, B. Zagorski, N. Coburn.*** **From Sunnybrook Health Sciences Centre — Odette Cancer Centre and the University of Toronto, Toronto, Ont.; Queen's University, Kingston, Ont.; Maimonides Medical Center, Brooklyn, NY; Saint Barnabas Medical Center, Livingston, NJ; Dalhousie University, Halifax, NS**

Cure in gastric cancer is contingent upon complete resection, but the positive margin resection rates remain high in the West. We sought to determine the risk factors associated with positive resection margins. We conducted a province-wide chart review (116 institutions) and included all patients with nonmetastatic gastric adenocarcinoma (GA) who underwent a curative intent resection (2005–2008). Patients were excluded if they received neoadjuvant chemotherapy or radiation therapy, or were missing data on key variables pertaining to tumour staging and location. Multivariate logistic regression modelling was used to identify demographic, surgical and clinicopathologic risk factors associated with positive resection margins on final pathology. Out of 2414 GA patients, 1476 had an operation, of which 904 had a resection, with 691 resections performed as curative intent. In total 610 patients satisfied the inclusion criteria for analysis with no missing data, and 171 (28%) of these included patients had a positive resection margin. Multivariate analysis revealed only the following significant risk factors for positive resection margins on final pathology: positive nodal status (OR 2.2, 95% CI 1.6–3.1), higher T-stage (OR 5.2, 95% CI 3.9–6.9), signet cell histology (OR 2.0, 95% CI 1.4–3.0), and proximal tumour location (OR 2.7, 95% CI 1.9–3.7). In this population-based study of the largest western cohort to date, predictors for positive resection margins in gastric cancer surgery were identified; these pertained mainly to tumour characteristics, as opposed to patient or operative factors.

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Predictors of malignancy in thyroid nodules. ***B. Catton, F. Christian, G. Caspar-Bell.*** **From University of Saskatchewan, Saskatoon, Sask.**

By combining size, composition and calcification characteristics, we aimed to use this information to predict the risk of malignancy and potentially reduce the need for FNAB for all thyroid nodules > 1 cm in size. We conducted a retrospective analysis on patients with thyroid nodules who underwent thyroid ultrasound imaging followed by thyroidectomy between 2009 and 2013. Ultrasound imaging reports were analyzed for malignant and benign groups and matched with the histology of the excised thyroidectomy specimens. In total 146 patients met our inclusion criteria. Forty percent of patients with benign nodules displayed calcification, compared with 52% for patients with malignant nodules. Microcalcification was present in 17% of malignant nodules and 6% of benign nodules ($p = 0.06$). Ninety-two percent of malignant and 95% of benign nodules were greater than 1 cm. However, if we use nodule size > 1.5 cm, then proportion of malignancy is significantly lower in the < 1.5 cm group than the ≥ 1.5 cm group (28% v. 53.6%, $p = 0.009$). Using

multivariate analyses for multiple nodule characteristics, the strongest correlations were when a nodule was solid and calcified (OR 2.35, $p = 0.06$), or when the nodule was greater than 1 cm and microcalcified (OR 2.62, $p = 0.10$). Using multiple logistic regression for nodule size > 1 cm, older age had significantly lower odds of malignancy ($p = 0.03$). Moving the nodule size threshold up from 1 cm to 1.5 cm significantly increases the prediction value of using size as predictor of risk of malignancy. In addition, malignancy is seen significantly less in the older age group of patients. Our study, by attempting to define the specific ultrasound and demographic characteristics that predict malignancy, has the potential of refining and redefining the diagnostic process, so that unnecessary FNAB and thyroidectomies are not carried out.

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Safety and efficacy of POEM for treatment of achalasia: a systematic review of the literature. ***O.M. Crespin, A. Parmar, L.W.C. Liu, T.D. Jackson, E. Shlomovitz, A. Okrainec.* From the University of Toronto, Toronto, Ont.**

Peroral endoscopic myotomy (POEM) is a novel intervention for the treatment of achalasia, which combines the advantages of endoscopic access and myotomy. Although initial results have been encouraging, laparoscopic Heller myotomy (LHM) and pneumatic dilation (PD) remain the current standard of care. The purpose of this study is to perform a systematic review of the literature to evaluate the efficacy and safety of POEM. Four data sources were searched for POEM studies and analyzed following PRISMA guidelines, using the keywords "esophageal achalasia," "peroral endoscopic myotomy," "endoscopy," "natural orifice surgery," "laparoscopic Heller myotomy" and related terms. Articles using human participants published between 1946 and Feb. 6, 2015, with no language restrictions were included. Reductions of Eckardt score and lower esophageal sphincter (LES) pressure as well as reported complications were the main outcomes. Two authors reviewed the search result independently. A third reviewer resolved all disagreements. Data abstraction was pilot tested and approved by all authors. Our data assessment resulted in qualitative synthesis rather than meta-analysis due to heterogeneity among the studies. A total of 2894 studies were retrieved. After duplicates were removed, 2 reviewers assessed 2112 titles and abstracts, of which 54 studies were eligible for full text evaluation and 19 were included in the qualitative analysis. There was no randomized control trial. The 19 studies reported 1299 POEM procedures. Differences between pre- and post-POEM Eckardt scores and LES pressure were significant. The most frequently reported complications consisted in mucosal perforation, subcutaneous emphysema, pneumoperitoneum, pneumothorax, pneumomedastino, pleural effusion and pneumonia. Our analysis suggests that POEM may offer a safe and effective alternative for the treatment of achalasia. RCTs and long-term follow-up studies using validated symptom score and objective manometric assessments are needed to establish the efficacy and safety of POEM in the management of patients with achalasia.

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Informed consent for surgery. ***M. Hanson, D.M. Pitt.* From the University of Ottawa, Ottawa, Ont.**

Surgeons have a professional and legal obligation to obtain and document informed consent for surgery. Provincial legislation requires surgeons to advise their patients of the material risks of surgery with proper documentation. Between 2008 and 2013, 21% of all CMPA legal cases included an issue related to informed consent and consent is often a component of a patient's complaint to a provincial regulatory authority. The aim of this study is to obtain data about the current practice of documenting informed consent for surgery. The hypothesis is that it is deficient. The relevance is that awareness and education can correct this deficiency, benefiting patients and providing medical legal protection for surgeons. A retrospective chart review over 4 consecutive weeks of all surgery performed at our institution by general surgeons between Jan. 4 and Feb. 1, 2015, was done to assess the documentation of informed consent for surgery. In total 161 cases were identified. In 41 cases there was no documentation of risks pertaining to the surgery. This accounted for 25.5% of all cases. When risks were documented, the number of common risks per case was 2.71 (range 0–9) and 2.00 (range 0–10) for unique risks. Whether the documentation was done by staff or fellows/residents the results were statistically similar for common and unique risks ($p = 0.064$ and $p = 0.464$). In elective cases the average number of common and unique risks were similar to the emergent cases ($p = 0.176$ and $p = 0.357$). Our results indicate that informed consent for surgery was not consistently well documented by the general surgery service at our institution and often did not follow the guidelines of the College of Physicians and Surgeons of Ontario. Improvement is necessary. It may be beneficial for other surgical divisions to examine their documentation of informed consent for surgery.

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Meconium ileus: 20 years of experience. ***D. Kinnear, P. Prasil.* From Université Laval, Québec, Que.**

A retrospective review of all cases of meconium ileus treated at a tertiary care centre over the past 20 years was completed. Complete data were obtained from 36 patients, of which 23 were male (64%). Mean gestational age was 37.4 weeks. Mean birthweight was 2.912 kg. Thirty patients (83%) were confirmed to have cystic fibrosis. Thirty patients (83%) had surgical treatment. Eleven patients (37%) underwent enterotomy and irrigation, 9 patients (30%) were treated with a stoma, 5 (17%) were treated with enterotomy and a T-tube, 3 (10%) with stoma and resection and 2 (7%) with resection only. Eleven out of 12 (92%) stomas were performed during the first decade of the total 20 years studied. Apart from elective stoma closure, 9 patients (30%) required reoperation for complications, 5 during the original hospitalization and 4 within the following 2 years. No correlation could be demonstrated between the number of complications and a specific surgical technique. In this cohort, 83% of patients required surgery to resolve their meconium occlusion, this value being greater than what is usually reported in the literature. The tendency was for the surgeries to become less invasive over time; however, a decrease in complications could not be demonstrated along with this trend.

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Paraesophageal hernia repair in the elderly: outcomes in a 10-year retrospective study. ***N. Ahmadi, A. Neville, J. Mamazza.* From the University of Ottawa, Ottawa, Ont.**

Surgical management remains the gold standard of treatment for paraesophageal hernia (PEH). With the growing elderly

population, an increasing number of patients are presenting with symptomatic PEH at a later age. This study is a retrospective review of the presenting symptoms in elderly patients with PEH, as well as outcomes after hernia repair. Data were obtained for all patients above 70 years of age undergoing PEH (Type II-IV) repair at a single institution between 2004 and 2014 from a prospective database. Information regarding patient demographics, complaints, surgical technique, complications and follow up were obtained. The Clavien classification of complications was used to classify the postoperative complications. A total of 113 patients were identified with mean age of 78 years. The majority were females (n = 83). Chest pain was the most common presenting complaint (64%). Forty patients (35%) had anemia on presentation. Among all surgical indications, incarceration was the most common indication (59%). The majority of the surgeries were performed laparoscopically (n = 66, 60%). Intraoperative complications occurred in 22 (19%) of the patients, with bleeding being the main complication (n = 14, 13%). Fifty-two patients (46%) had a postoperative complication within the first 30 days. The majority of postoperative complications were grade I and II (n = 29, 25%); 16 patients (14%) had grade III and IV complications. The 30-day mortality was 6% (n = 7). Postoperative complications were significantly higher in patients undergoing open compared with laparoscopic repair (p = 0.001). Mean follow-up was 16 months, with 35% (n = 40) having over 1 year follow-up. Twelve patients (11%) had poor symptom relief. Elderly patients with PEH may present with a number of different presenting symptoms; chest pain is the most common presenting complaint. PEH repair has a low associated mortality, and laparoscopic repair is associated with significantly less postoperative complications. Overall, the majority of patients have good symptom relief after surgical repair.

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The changing face of breast cancer: younger age and aggressive disease in Filipino Canadians. ***K. Briggs, J. Simpson, A. Ayoub, R. George.* From St. Michael's Hospital, Toronto, Ont.**

Breast cancer incidence is increasing worldwide, but remains highest in the West. Migration from low- to higher-risk areas seems to rapidly confer greater risk. Most of our Canadian experience and knowledge is based on study of Caucasian cohorts. This study looks at patterns of breast cancer in Filipino migrants. A literature review was conducted to summarize breast cancer incidence, screening practices and trends in treatment among Filipino migrants. In addition, a retrospective cohort study was conducted specifically examining the age in which Filipino women were diagnosed with breast cancer compared with Asian and Caucasian counterparts, as well as their cancer characteristics and surgical treatments. Filipino women are diagnosed with breast cancer at a significantly younger age (53.2) than their Asian (55.2) and Caucasian (58.4) counterparts. In addition, they are at an increased risk of more aggressive breast cancer with disparities in the care they are receiving. The evidence suggest this group is worthy of special focus when diagnosing and treating breast cancer. The younger age of onset with a greater proportion under 50 may have screening implications.

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A systematic review of intraoperative blood loss estimation methods for major noncardiac surgery: a 50-year perspective. ***A. Tran, J. Heuser, D. Fergusson, G. Martel.* From the University of Ottawa, Ottawa, Ont.**

There is no clearly established gold standard method of estimating intraoperative blood loss. The objective of this study is to identify, describe and compare methods of intraoperative blood loss estimation in major noncardiac surgery. The primary outcome of interest is the variation of estimated blood loss among techniques and between techniques. We performed a search using Embase, Medline and the Cochrane Library Database to identify studies evaluating or comparing methods of intraoperative blood loss estimation in adults undergoing major noncardiac surgery. Studies describing open, laparoscopic or robotic neurological, otolaryngological, thoracic, vascular, general, orthopedic, urologic and gynecological surgeries were included. All studies published in English between 1965 and 2015 were included. Of the 1830 studies identified in the database search, 19 studies met eligibility for inclusion. Approaches to intraoperative blood loss estimation included the visual estimation by anesthesiologists and surgeons, the colorimetric method, the gravimetric method, the radioactive tracer dilution method, direct measurement of fluid losses, and formula-based methods. The formula-based methods were predominantly based on Nadler's formula for blood volume estimation and perioperative changes in hemoglobin or hematocrit. These were found to correlate well with strict, direct measurement of hemoglobin-adjusted fluid losses and were often used as the gold standard for comparison. In doing so, non–formula based methods were often found to significantly underestimate the calculated blood loss. Direct comparison between non–formula based methods yielded inconsistent findings. Intraoperative blood loss estimation is difficult to study due to technical variations across studies for particular methods and the lack of an accepted gold standard comparison. These methods were studied across a diverse range of surgical disciplines and as such, the reliability of a particular method across different procedures may vary. However, the general lack of reliability and consistent underestimation of non-formula based methods suggests formula-based methods as a preferred method of estimation.

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The AVATAR trial: applying vacuum to accomplish reduced wound infections in laparoscopic pediatric surgery. ***R. Visser, K. Milbrandt, S. Lum Min, N. Wiseman, B.J. Hancock, M. Morris, R. Keijzer.* From the University of Manitoba, Winnipeg, Man.**

Surgical site infections are the most common complication of surgery, yet very little literature has addressed their prevention in pediatrics. Negative pressure wound therapy is commonly used to treat complex wounds. We hypothesized that this principle may also be applied to simple uncomplicated wounds to reduce the incidence of wound infections following laparoscopic surgery. The aim of this study was to test this in a randomized controlled clinical trial. Pediatric patients undergoing emergent or elective laparoscopic surgery requiring an umbilical port site were recruited and divided into 2 treatment arms: standard dressing versus simple vacuum dressing. Umbilical port site wounds were

inspected between postoperative days 7 and 10 by a research nurse unaware of the treatment arm. Surgical site infections were diagnosed using the United States Centers for Disease Control criteria. Data comparison was performed using a Fisher exact test with a 95% confidence interval. Ninety patients were recruited over 2 years; 35 were assigned to the vacuum or treatment arm and 30 assigned to the control arm. We observed a 2.8% (n = 1) infection rate in the vacuum study group and 3.3% (n = 1) in the control group (p = 1.0). An interim power calculation based on the absolute difference between treatment groups revealed that an additional 29 232 patients would be required to fully power this study. The trial was discontinued early due to low volume recruitment and the impractical number of patients required to prove that a simple vacuum dressing reduces postoperative wound infections in uncomplicated surgical wounds. Alternative methods for reducing wound infections should be sought.

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Indications for use of damage control surgery in civilian trauma patients: a content analysis and expert appropriateness rating study. ***D.J. Roberts, N. Bobrovitz, D.A. Zygun, C.G. Ball, A.W. Kirkpatrick, P.D. Faris, K. Brohi, S. D'Amours, T.C. Fabian, K. Inaba, A.K. Leppäniemi, E.E. Moore, P.H. Navsaria, A.J. Nicol, N. Parry, H.T. Stelfox.*** **From the University of Calgary, Calgary, Alta.**

Although damage control (DC) surgery may improve survival in select, severely injured patients, the procedure is associated with significant morbidity, suggesting that it should only be used when appropriately indicated. We sought to characterize and evaluate indications for use of DC surgery in civilian trauma patients. Two investigators used a grounded theory approach to synthesize indications for DC surgery reported in peer-reviewed articles between 1983 and 2014 into a reduced number of named, content-characteristic codes representing unique indications. An international panel of trauma surgery experts (n = 9) then rated the appropriateness (expected benefit-to-harm ratio) of the coded indications for use in adult civilian trauma patients. The 1107 indications identified in the literature were synthesized into 123 unique pre- (n = 36) and intraoperative (n = 87) indications. The panel assessed 101 (82.1%) of these indications to be appropriate. The indications most commonly reported and assessed to be appropriate included pre- and intraoperative hypothermia (median temperature < 34º C), acidosis (median pH < 7.2), and/or coagulopathy. Others included 5 different injury patterns (a difficult to access major venous [intrahepatic, retrohepatic, retroperitoneal, or pelvic] injury; a major liver or combined pancreaticoduodenal injury with significant intraoperative hemodynamic instability; a combined pancreaticoduodenal injury with massive hemorrhage from the head of the pancreas; or devascularization or massive destruction of the pancreas, duodenum, or pancreaticoduodenal complex), inability to control bleeding by conventional methods, administration of a large volume of packed red blood cells (median > 10 units), inability to close the abdominal wall without tension, development of abdominal compartment syndrome during attempted abdominal wall closure, and need to reassess extent of bowel viability. This study identified a comprehensive list of candidate indications for use of DC surgery in adult civilian trauma patients. These indications provide a practical foundation to guide surgical practice while studies are conducted to evaluate their impact on patient care and outcomes.

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Indications for use of thoracic, abdominal, pelvic, and vascular damage control interventions in trauma patients: a content analysis and expert appropriateness rating study. ***D.J. Roberts, N. Bobrovitz, D.A. Zygun, C.G. Ball, A.W. Kirkpatrick, P.D. Faris, N. Parry, A.J. Nicol, P.H. Navsaria, E.E. Moore, A.K. Leppäniemi, K. Inaba, T.C. Fabian, S. D'Amours, K. Brohi, H.T. Stelfox.*** **From the University of Calgary, Calgary, Alta.**

Use of abbreviated or damage control (DC) interventions may improve outcomes in severely injured patients when appropriately indicated. We sought to determine which indications for DC interventions have been most commonly reported in the peer-reviewed literature to date and evaluate the opinions of experts regarding the appropriateness (expected benefit-to-harm ratio) of the reported indications for use in practice. Two investigators used a grounded theory approach to synthesize indications for 16 different DC interventions reported in peer-reviewed articles between 1983 and 2014 into a reduced number of named, content-characteristic codes representing unique indications. For each indication code, an international panel of trauma surgery experts (n = 9) then rated the appropriateness (expected benefit-to-harm ratio) of conducting the DC intervention of interest in an adult civilian trauma patient. The 424 indications identified in the literature were synthesized into 101 unique indications. The panel assessed 12 (70.6%) of the coded indications for the 7 different thoracic, 47 (78.3%) for the 7 different abdominal/pelvic, and 18 (75.0%) for the 2 different vascular interventions to be appropriate for use in practice. These included indications for rapid lung-sparing surgery (pneumonorrhaphy, pulmonary tractotomy, and pulmonary wedge resection; n = 1); pulmonary tractotomy (n = 3); rapid, simultaneously stapled pneumonectomy (n = 1); therapeutic mediastinal and/or pleural space packing (n = 4); temporary thoracic closure (n = 3); therapeutic perihepatic packing (n = 28); staged pancreaticoduodenectomy (n = 2); temporary abdominal closure (n = 12); extraperitoneal pelvic packing (n = 5); balloon catheter tamponade (n = 6); and temporary intravascular shunting (n = 11). This study identified a list of candidate indications for use of 12 different DC interventions that were suggested by authors of peer-reviewed articles and assessed by a panel of independent experts to be appropriate. These indications provide a practical foundation to focus future research and (in the interim) guide surgical practice while studies are conducted to evaluate their impact on patient care and outcomes.

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The impact of health care contact and invasive procedures on *Staphylococcus aureus* bacteremia: a 5-year retrospective cohort study. ***P. Murphy, D. Pepe, R. Anantha, F. Priestap, J. McCormick, T. Mele.*** **From Western University, London, Ont.**

Staphylococcus aureus bacteremia (SAB) results in significant morbidity and mortality; yet it is not known if health care contact or invasive procedures are a risk factor for mortality due to SAB. All patients (age ≥ 18 yr) admitted with SAB were retrospectively reviewed between 2008 and 2012. Patients with any health care contact 90 days before admission were included. Invasive procedures performed before and after admission for SAB were identified. Cox regression analysis was used to evaluate associations between predictor variables and all-cause, in-hospital and 90-day mortality. Among 925 patients with SAB, 454 patients had health care contact

within 90 days before hospital admission for SAB. Prior to admission for SAB 26.0% of patients underwent an invasive procedure, such as surgery (16.3%) or vascular access (9.4%), while 60% underwent a procedure after admission for SAB. In-hospital mortality was 22.5%, and 11.7% died within 90 days of discharge. Risk factors associated with in-hospital mortality after multivariate analysis included age, hepatic failure, metastatic cancer, and ICU admission. Undergoing a procedure after admission was protective against mortality (OR 0.3, 95% CI 0.2–0.5, $p < 0.001$). Postdischarge mortality was associated with MRSA, metastatic cancer, COPD and prolonged ventilation. The impact of health care contact and invasive procedures before SAB is likely minimal. We identified several factors associated with increased mortality in this population. Furthermore, invasive procedures after admission are protective and decrease the risk of mortality due to SAB.

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Acute care surgery — positive impact on gallstone pancreatitis. ***P. Murphy, J. Koichopolos, D. Paskar, N. Parry, K. Leslie, T. Mele*. From Western University, London, Ont.**

The adherence to the best practice guidelines for gallstone pancreatitis (GSP) historically has been poor. In this follow-up study we investigated whether the impact of 2 acute care surgery models at academic hospitals within the same catchment area improved the adherence to such guidelines. We retrospectively reviewed all patients admitted with a diagnosis of GSP to 2 tertiary care university based teaching hospitals from July 2009 to January 2015. Diagnosis was confirmed upon review of clinical, biochemical and radiographic criteria. Over the 5-year period an acute care team was implemented at Hospital A in July 2010 and at Hospital B in July 2014. Data were collected regarding demographics, admissions, timing of cholecystectomy and emergency department visits. Student t tests and Pearson χ^2 tests were used to determine statistical significance with an α of 0.05. Of the 329 patients admitted with GSP, 181 (55%) were seen at Hospital A. The implementation of an acute care surgery team increased index cholecystectomy rate from 15% to 70% ($p < 0.001$) at Hospital A and reduced the number of patients who did not receive an operation from 38% to 14% ($p = 0.003$). Hospital B had similar increased rate for index cholecystectomy from 25% to 83% ($p = 0.3$) and reduced rate for those not undergoing cholecystectomy from 28% to 8% ($p = 0.2$). Gallstone pancreatitis–specific readmission rates at both hospitals were 26% for patients undergoing an out-patient operation and 25% for patients who had no operation. In this follow-up study an increased adherence to clinical guidelines for GSP was seen due to the resources an ACS service provided. Index cholecystectomy increased and there was a reduction in the total number of patients who did not undergo cholecystectomy. Readmission rates for GSP are unacceptably high when an index operation is not performed.

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Safety and efficacy of a step-up approach to management of severe, refractory *Clostridium difficile* infection. ***B. Kidane, K. Lung, G. McCreery, M. Ott, C. Vinden, R. Hernandez-Alejandro, K. Leslie, D. Gray, N. Parry, T. Mele*. From Western University, London, Ont.**

Although total colectomy has been the standard surgical treatment for severe, refractory *Clostridium difficile* infection (CDI), colonic irrigation via loop ileostomy (Pittsburgh protocol [PP]) has shown promising results. We have tried this approach. We have also used a protocol of colonic irrigation via nasojejunal tube (nasojejunal protocol [NJP]). Our objective was to assess safety of a step-up approach to management of severe CDI. We conducted a retrospective cohort study of consecutive patients with severe refractory CDI referred for surgical consultation. The PP and NJP were undertaken at our tertiary hospital in the last 2 years. Surgeons decided whether to undertake PP or NJP. In both protocols, surgeons proceeded to colectomy if they felt PP/NJP had failed. These patients were compared with those who went directly to colectomy over the last 5 years. Nineteen, 9 and 17 patients underwent NJP, PP and direct colectomy, respectively. No significant differences between groups in demographics, ASA class, immunosuppression, mechanical ventilation, vasopressors, lactate and proportion presenting with hypotension, acute kidney injury and WBC > 16 or < 4 ($p > 0.1$). More patients in PP than NJP failed treatment and required colectomy (5/9 v. 1/19, $p = 0.007$). In-hospital mortality was 26% (5/19), 44%(4/9) and 41%(7/17) for NJP, PP and colectomy groups, respectively ($p = 0.56$). Of the 5 deaths in the NJP group, 3 had withdrawal of active care later in their course due to their primary non-CDI illness. Another patient's family withdrew active care on day 1 of NJP, and that patient died within 24 hours. The remaining patient started NJP at a delayed stage, could not tolerate irrigation and immediately had colectomy; she died within 48 hours. Mortality, excluding the 4 withdrawal patients, was lower in the NJP group ($p = 0.046$). Colonic irrigation via nasojejunal tube as part of the step-up NJP appeared to be safe and effective. Intention to treat analysis shows no mortality increase. Per-protocol analysis shows there may be mortality reduction.

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Clinical and operative outcome of patients with acute cholecystitis who are treated initially with image-guided cholecystostomy. ***I. Molavi, A.E. Schellenberg, F. Christian*. From University of Saskatchewan, Saskatoon, Sask.**

The current gold standard for treatment of acute cholecystitis is laparoscopic cholecystectomy. However, image guided percutaneous cholecystostomy has become a common and perceived safe and effective alternative to cholecystectomy in high-risk patients with serious comorbidities. The goals of our study were to determine short and long-term outcomes of patients with acute cholecystitis who are treated initially with tube cholecystostomy. A retrospective study of patients diagnosed with acute cholecystitis who underwent cholecystostomy tube insertion between 2001 and 2011 was completed. A total of 125 medical charts from 2 Canadian university hospitals were reviewed. Demographic data, comorbidities, laboratory findings, image findings, and follow up including readmissions due to cholecystostomy tube complications and elective cholecystectomy were recorded. Patients who received cholecystostomy tubes for reasons other than acute cholecystitis, such as cholangiocarcinoma, were excluded. The mean age of the patients in the study was 64 years, with 51% male and 49% female patients. The percentage of patients who had subsequent elective surgery following an initial cholecystostomy tube insertion was 33.6%. The percentage of those who underwent laparoscopic cholecystectomy was 73.8% whereas 9.5% underwent open cholecystectomy and 16.7% underwent

laparoscopic converted to open cholecystectomy. Cholecystostomy tube insertion can be performed in patients who are elderly or have numerous comorbidities with low morbidity and mortality. However, only one-third of these patients subsequently had the definitive intervention of cholecystectomy. In addition, the rates of initial open cholecystectomy and conversion from laparoscopic to open cholecystectomy were quite high in this group, compared with a control group of patients subjected initially to laparoscopic cholecystectomy.

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Assessment of preoperative carbohydrate loading and blood glucose concentration in patients with diabetes. ***M. Laffin, P. Quigley, R. Brisebois, P. Senior, and H. Wang.*** **From the University of Alberta, Edmonton, Alta.**

People with diabetes (PWD) have been excluded from enhanced recovery after surgery (ERAS) interventions due to the theoretical risk of increased blood glucose concentration (BG) after consuming a carbohydrate-rich drink (CRD). This exclusion may deprive PWD the benefits of ERAS. Fasting guidelines instructed PWD to consume a CRD the evening prior and 3 hours before their operation. A form was designed as part of a quality-improvement project by a multidisciplinary team. It was administered to consecutive PWD undergoing elective operations from September to November 2014. BG was recorded on arrival and analyzed in relation to compliance with fasting guidelines. In total, 106 PWD were recruited. Average age was 63 year and 61% were male. Twelve percent were treated with diet alone; 28% were type 1. Forthy-three percent of patients complied with fasting guidelines; 8% consumed CRD only the day of operation, and 10% only the evening prior. There was no difference in BG between those who complied with fasting guidelines and those who did not (8.3 v. 8.1 mmol/L, $p = 0.71$). There was no difference in BG between patients who consumed a CRD the evening before surgery and those who did not (8.3 v. 8.1 mmol/L, $p = 0.99$). The same was seen in those who only consumed the CRD the day of their operation (8.4 v. 8.0 mmol/L, $p = 0.42$). The lack of significant differences between groups persisted when type 1 diabetics were analyzed separately. No operations were cancelled due to hyperglycemia or related complications. Patients who consumed CRD the evening before and/or the day of their operation were less likely than those who did not consume any CRD to require an insulin-infusion (8% v. 22% $p = 0.043$). CRD loading did not increase BG in PWD. It is reasonable to further investigate the safety and benefits of CRD in PWD.

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Impact of pre-emptive lidocaine infiltration at trocar sites (PLITS) and intraoperative ketorolac administration on postoperative pain and narcotics consumption after endocholecystectomy: a randomized-controlled trial. ***M. Qiabi, A. Paré, A. Dudemaine, S.K. Mayer.*** **Centre Hospitalier Universitaire de Sherbrooke, Sherbrooke, Que.**

Contradictory results regarding the impact of PLITS and intraoperative ketorolac administration on posterative pain and narcotics consumption have been observed in the literature. We measured the impact of PLITS (lidocaine 2%) and intraoperative ketorolac administration on postoperative pain and narcotics consumption after endocholecystectomy. Ninety-nine patients were included in a double blind randomized-controlled trial. Pain (10-point visual analogue scale) and narcotics consumption were evaluated at patient arrival in recovery room and at 1, 2, 4, 12 and 24 hours following surgery. There was no significant difference between PLITS ($n = 52$) and control (normal saline 0.9%, $n = 47$) groups regarding age, sex, surgery duration and postoperative complications. Female sex was more represented in ketorolac group ($n = 43$) compared with nonketorolac group ($n = 56$, 86.0 v. 67.9%, $p = 0.036$). PLITS did not result in any significant reduction of pain or narcotics consumption. The prevalence of moderate to high level of pain ($\geq 4/10$) was significantly inferior in the ketorolac group in the recovery room (5.9 v. 22.4%, $p = 0.014$) and 2 hours following the surgery (12.3% v. 33.3%, $p = 0.033$). The narcotics consumption (milligrams of morphine equivalent) in the ketorolac group was significantly inferior to the nonketorolac group 1 hour (7.1 ± 10.7 mg v. 17.1 ± 19.8 mg, $p = 0.002$), 2 hours (9.4 ± 12.4 mg v. 20.9 ± 22.2 mg, $p = 0.002$), 4 hours (13.9 ± 17.6 mg v. 26.7 ± 24.4 mg, $p = 0.008$), 12 hours (19.4 ± 23.2 mg v. 35.0 ± 29.5 mg, $p = 0.014$) and 24 hours (40.7 ± 22.5 mg v. 43.4 ± 36.0 mg, $p = 0.003$) following the intervention. Intraoperative ketorolac administration has a significant impact on postoperative pain and narcotics consumption following an endocholecystectomy while PLITS does not. Therefore, intraoperative ketorolac should be administrated to the patient if its condition allows it.

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Expert intraoperative judgment and decision-making: defining the cognitive competencies for safe laparoscopic cholecystectomy. ***A. Madani, Y. Watanabe, R. Aggarwal, M.C. Vassiliou, J.S. Barkun, G.M. Fried, L.S. Feldman.*** **From McGill University, Montréal, Que.**

Bile duct injuries related to laparoscopic cholecystectomy remain a significant source of morbidity and are often the result of intraoperative errors in judgment and decision-making. This qualitative study aims to define and characterize complex and higher-order cognitive competencies required to perform a laparoscopic cholecystectomy safely. Hierarchical and cognitive task analyses for establishing a critical view of safety during laparoscopic cholecystectomy were performed using qualitative methods to map the thoughts and practices that characterize expert performance. Using interview templates, experts with more than 5 years of experience and 20 annual laparoscopic cholecystectomies were invited to participate in semistructured interviews and field observations. Verbal data were transcribed verbatim, supplemented with content from textbooks and published literature, coded, thematically analyzed using grounded theory by 2 reviewers, and synthesized into a list of items. Data collection was terminated after saturation of qualitative data. A conceptual framework, based on 10 interviews, 9 recorded cases and content analysis from 15 literary sources, was synthesized. Experts included 6 minimally invasive surgeons, 2 hepato-pancreatico-biliary surgeons and 2 acute care surgeons (median ry in practice 11, interquartile range 8–14 yr). A total of 109 cognitive elements and 77 potential errors were identified and categorized into 6 general operative themes (anatomical considerations, tactical approach, retraction and optimal exposure, management of bleeding, dissection techniques, and bile in the surgical field), 4 sections of the procedure (preoperative planning, initial access and exposure,

exposure of the hepatocystic triangle, and dissection of the hepatocystic triangle) and 14 procedural tasks. This study defined the most important competencies required to establish a critical view of safety and avoid bile duct injuries during laparoscopic cholecystectomy. This framework serves as the basis for instructional design and objective assessment tools to help reinforce a culture of safety.

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Teaching clinical anatomy to postgraduate surgical trainees. ***M. Ernjakovic, I. Raiche, T. Wood, M.T. Hincke, C. Seabrook, C. Ramnanan, F. Balaa.*** **From the University of Ottawa, Ottawa, Ont.**

There is a widely recognized decline in the amount of anatomy teaching that is being delivered in medical schools, which may have a negative impact on the level of anatomic knowledge among postgraduate trainees. In addition, a concern has been raised that postgraduate surgical trainees do not acquire an optimal level of knowledge and understanding of clinical anatomy during their surgical training. The purpose of this literature review was to explore the evidence on the most optimal way to teach clinical anatomy to surgical trainees. A literature search was performed in Ovid Medline, which identified the appropriate keywords and MeSH terms for the following concepts: clinical anatomy teaching and surgical residency. Inclusion criteria were studies focusing on clinical anatomy teaching to postgraduate surgical trainees. Exclusion criteria were non-English studies, studies focusing on undergraduate teaching only and studies not focused on anatomy or clinical anatomy teaching. We identified 129 articles published since 1949, out of which 80 were excluded (24 were not in English, 26 addressed undergraduate teaching but not postgraduate, 30 did not meet the inclusion criteria for other reasons). Forty-nine studies met the inclusion criteria, addressing the clinical anatomy teaching to surgical trainees; 22 of them were describing a specific model for teaching anatomy, 20 were personal viewpoints and editorials and 7 of them described a postgraduate anatomy course. A great number of postgraduate programs have recognized the need for introducing formal anatomy teaching to their existing curricula. Cadaver dissection seams to be a preferred method of anatomy teaching among many programs; however, there is considerable bias rather then scientific evidence to support such a method of teaching. Overall there is suboptimal quality and the amount of evidence on the best methods to teach clinical anatomy to postgraduate surgical trainees.

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Investigating the role of TNFR1 in gastric adenocarcinoma peritoneal metastasis. ***M. Alzabrani, R. Kayano, B. Giannias, F. Bourdeau, L. Ferri.*** **From McGill University, Montréal, Que.**

Gastric adenocarcinoma is one of the fastest rising malignancies in North America and is associated with a high rate of peritoneal recurrence. The mechanism of this process is poorly understood; however, there are emerging evidences to suggest that postoperative infection may increase the risk of metastasis. TNF-α is a key mediator common to many inflammatory pathways. The influence of this cytokine and its receptor (TNFR1) on gastric cancer peritoneal metastasis is still entirely unknown. We hypothesize that TNFR1 activation increases the potential of gastric cancer peritoneal metastasis. The influence of TNFR1 activation on the adhesion and invasion of gastric cancer cells to human peritoneal mesothelial monolayers were assessed both in vitro and ex vivo after coincubation with TNF-α in the presence of functional monoclonal blocking antibody to TNFR1 or isotype control antibodies. A novel ex vivo peritoneal metastasis model was developed to further validate in vitro results. The peritoneal lining from C57Bl6 or TNFR1–/– knockout mice was placed in 24 well plates and coincubated overnight with TNF-α. Adhesion of SNU-5 to the treated peritoneum was assessed in the presence of TNFR1 monoclonal antibodies. TNF-α incubation of mesothelium increased both SNU-5 and MKN-45 adhesion 2- to 4-fold, and this effect is completely attenuated with anti-TNFR1 blockade but not with isotype control antibodies. Similarly, invasion is increased with TNF-α by 3- to 4-fold. TNF-α incubated murine peritoneum increases ex vivo cancer cell adhesion. This effect is completely attenuated when antibody blockade of TNFR1 is added or when peritoneum derived from TNFaR1–/– knockout mice is used. TNF-α–TNFR1 interaction appears to be a central cellular player in promoting cancer cell progression by enhancing gastric cancer cell adhesion and invasion to human mesothelium. Therefore, TNFR1 can be considered as a potential therapeutic target for this devastating manifestation of gastric adenocarcinoma.

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Selective outcome reporting and publication biases in surgical randomized controlled trials. ***P. Glen, R. Wu, S. Bennett, H. Moloo, R. Breau, D. Fergusson.*** **From the University of Ottawa, Ottawa, Ont.**

Randomized controlled trial (RCT) evidence guides surgical practice; however, to be impactful these trials must be published. We present an estimate of surgical RCT publication rate and factors associated with publication, and an assessment of trial reporting to determine the rate of selective outcome reporting. The clinicaltrials.gov database was systematically searched to identify surgical randomized controlled trials completed between 2006 and 2012. The outcomes sought in these trials were recorded. A systematic search of 3 online publication databases was performed to identify publications associated with these protocols that had been published within at least 1 year of trial completion. The published outcomes were compared with registered outcomes by 2 independent reviewers. A sample size of 270 trials was required for the assessment of selective outcome reporting. A total of 17 498 trial protocols were retrieved from clinicaltrials.gov, of which 745 used an RCT to study a surgical intervention. In total 364 (49.3%) of the trials were published within at least 12 months of completion. About 22.1% of trials were published within the recommended 1 year of trial completion. Selective outcome reporting was found in 24.6% of studies, significantly different from the rate of 45% quoted in the literature ($p < 0.001$). Of trials that selectively reported outcomes, 73% reported a primary trial outcome not listed in the trial protocol and 27% promoted a secondary outcome measure. Statistically significant outcomes were reported in 53.4% of studies; authors endorsed the studied intervention in 84% of the published studies. Statistically significant primary outcomes were more likely to be endorsed ($p < 0.001$). Full and proper reporting of RCTs is necessary to ensure the

integrity of evidence-based practice. Our work suggests that less than half of completed studies are published and 25% change the primary outcome under study.

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Definitive percutaneous management of symptomatic cholelithiasis. ***S. Sun, W. Harris, A. Kavanagh.*** **From the Northern Ontario School of Medicine, Thunder Bay, Ont.**

The preferred solution to symptomatic cholelithiasis is laparoscopic cholecystectomy. However, patients with acute cholecystitis may be temporized with cholecystostomy drainage. Unfortunately, these do not provide definitive management. We present 4 patients who were poor operative candidates, had cholecystostomy tubes placed, and subsequently underwent percutaneous lithotripsy followed by stone extraction. Two patients were elderly with significant comorbidities, and their families declined surgery. Two others underwent attempted laparoscopic cholecystectomies, but had prohibitively severe cholecystitis to permit safe operations. Cholecystostomy tubes were placed in each case, either percutaneously or laparoscopically. After several weeks, lithotripsy and percutaneous extraction was performed. In 3 cases, laser lithotripsy was conducted via the cholecystostomy tract using rigid and flexible ureteroscopes. In all patients, debris was extracted with ERCP mechanical lithotripsers. General anesthesia was required in 1 instance and conscious sedation in 2 others. One patient needed no sedation. In general, these patients had large gallstones, ranging from 7 to 50 mm. Operative times varied from 25 to 250 minutes. Two complications were observed. One patient had a stone fragment migrate into the common bile duct. This was asymptomatic and detected on fluoroscopy, requiring an uneventful ERCP. A second patient developed a small abscess at the cholecystostomy site and proceeded to have an incision and drainage locally. All patients were placed on ursodeoxycholic acid and followed with serial ultrasounds; they remain asymptomatic through an observational period of 5–15 months. Laparoscopic cholecystectomy remains the gold standard for treatment of symptomatic gallstones. In patients who are poor operative candidates, there is a need for a nuanced approach and other definitive methods of therapy. Our case series above illustrate that percutaneous techniques via cholecystostomy tubes show promise as a feasible alternative, and adds to our arsenal in the approach to cholelithiasis. Continued surveillance will aid in evaluating its long-term success.

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Peer-based coaching: an innovative method to teach faculty an advanced laparoscopic technique. ***V.N. Palter, A. Jokhio, K. Beyfuss, A. Ryzynski, S.A. Asbamalla.*** **From the University of Toronto, Toronto, Ont.**

Much of the current surgical educational literature focuses on the development of comprehensive curricula to teach procedures to surgical trainees. These curricula may be more suited to learners who have protected clinical time and who need to learn operations in their entirety. For faculty members wanting to learn a new surgical technique, a more flexible method of simulation training may be more suitable. The purpose of this study is to assess the efficacy of a simulation-based coaching program to teach laparoscopic suturing to faculty surgeons. This prospective single-blinded randomized controlled trial allocated 18 novice faculty surgeons to receive either conventional training in laparoscopic suturing or peer-based coaching. Peer-based coaching consisted of 2 half-hour coaching sessions on a laparoscopic box-trainer with an expert surgeon. Conventional training consisted of independent practice on a box-trainer with an instructional video. The primary outcome measure in this study was technical performance on the box-trainer as measured by the Objective Structured Assessment of Technical Skill (OSATS). Secondary outcome measures included anticipated use of laparoscopic suturing in the participants' future practice. Nine general surgeons and 9 gynecologists participated. Median number of years in practice was 6.5 (range 1–24). At the study pretest there was no difference in performance between the 2 groups on the box-trainer (control 10 [8.5–15]; intervention 13 [10.5–14], $p = 0.44$). After the intervention, however, the peer-based coaching group performed significantly better (18 [17–19] v. 11 [8.5–12.5], $p < 0.01$). At the time of the post-test 6 (67%) participants in the control group disagreed with the statement "I feel comfortable performing laparoscopic suturing in the operating room" compared with 1 (11%) participant in the intervention group ($p = 0.15$). Peer-based coaching is an effective means by which to teach surgical faculty an advanced laparoscopic skill. Future work to assess whether this translates to a change in practice is warranted.

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Improving teaching and learning in the operating room: Does the surgical procedure feedback rubric support learning? ***A. Toprak, U. Lubanga, S. Jones, A. Winthrop, L. McEwen.*** **From Queen's University, Kingston, Ont., and Western University, London, Ont.**

The Surgical Procedure Feedback Rubric (SPR) is a workplace-based assessment tool designed to document resident performance during a single, directly observed operative encounter and provide targeted feedback to support learning. It differs from other tools because it defines performance criteria by increasing complexity through the use of behavioural anchors, thus embedding standards of performance in the tool. Evidence to support the construct and discriminative validity of the SPR has been previously reported. The purpose of this study is to add to this validity evidence by examining how the introduction of the SPR has changed feedback practices to support resident learning at our institution. The SPR was introduced to 3 postgraduate programs: general surgery, orthopedics, and obstetrics and gynecology. Written comments were analyzed to assess quality of written feedback provided to residents. Interviews were conducted with faculty and residents to explore SPR use, perceived effectiveness, quality of feedback, and the impact on faculty–resident interactions. Purposeful sampling was used to ensure representation from high and low frequency users, and junior and senior trainees within each discipline. Fourteen interviews were conducted: 7 faculty interviews and 7 resident interviews. Preliminary analysis of our data suggests that introduction of the SPR improved the timeliness and frequency of feedback available to residents. In addition, residents felt that feedback generated with this tool was useful to structure their learning and monitor their progress. Faculty felt that the SPR helped focus their observations and guide their feedback discussions with residents. In fact, some faculty described altering their behaviour in the OR to better assess

resident performance. Both residents and faculty felt that the SPR was easy to use. Results from this study provide evidence to support the use of the SPR as a tool to promote feedback to support learning in a competency-based model of surgical education.

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Withdrawn

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Mislabelling study designs as case–control in surgical literature. ***S. Knowles, D. Paskar, V. DeMelo, H. Yan, T. Mele.*** **From Western University, London, Ont.**

Case–control study is a common epidemiological design used to examine risk factors for rare diseases and/or diseases occurring long after risk exposure. Case–control studies are considered lower on the evidence hierarchy than other methodologies, such as cohorts. Despite this, many surgical studies are misidentified as case–control by authors and journals. The objective of this study is to estimate the rate of misidentification in the surgical literature and to identify factors associated with misidentification. All self-described case–control studies published between 1985 and 2014 in a subset of 200 international, English surgical journals were identified in the Medline database. This search strategy yielded 3118 studies, from which 200 were randomly sampled for full review by 2 independent reviewers, with 198 included in the final analysis. The mislabelling rate was 65.6%. The most common study design to be mislabelled was cohort. The rate of mislabelling was 56.9% in studies whose authors had formal epidemiology training compared with 78.9% in studies whose authors did not. The rate of mislabelling was 64.1% from high-impact journals, 82.9% medium-impact journals and 45.8% from low-impact journals. The specialty with the highest rate of mislabelling was general surgery at 80.0% and the lowest was vascular surgery at 44.4%. The rate was lower in articles originating from English-speaking countries (56.1% v. 73.4%) and higher in papers originating from Asia (72.7%) than those from Europe (64.7%) or North America (67.7%). More recently published studies were more likely to be misidentified (83.3% for 2009–2014 v. 53.6% for 1985–2008). This study has recognized a serious problem of misidentifying studies in the surgical literature as case–control that may cause readers to misinterpret results. This review highlights the need either for more formal epidemiology training for academic surgeons or increased utilization of epidemiologists in the design and publication phases of surgical studies.

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Measured resting energy expenditure in patients with open abdomens: preliminary data of a prospective pilot study. ***M.E. Hassan, S. Iqbal, N. Fong, J. Grushka, D. Deckelbaum, L. St. Laurent, E. Eckert, T. Razek, K. Khwaja.*** **From McGill University, Montréal, Que.**

Resting energy expenditure (REE) can be affected by various factors in acute illness. However, the relationship between an open abdomen (OA) and the measured REE remain unclear. Our objective is to explore the impact of the OA on REE and determine other potential factors that may influence the REE in OA patients. A prospective study was conducted on 7 mechanicall ventilated nonseptic OA patients admitted to the ICU at a Level 1 trauma centre between August and November 2014. The indirect calorimetry was used to measure REE before and after abdominal closure. Body temperature, sedation medications and route of feeding were evaluated at the time of each measurement. Patients' demographic, predicative equations and standard clinical outcomes were recorded. A total of 31 REE measurements were performed (16 before v. 15 after closure) in 7 OA patients. The measurements of REE before abdominal closure were lower compared with after closure (1770 v. 2179kcal/d, $p = 0.012$). Furthermore, before the abdominal closure, propofol, fentanyl and Levophed use was significantly higher than after closure ($p = 0.033$, $p = < 0.0001$, $p = 0.043$, respectively). However, body temperature, proportion of enteral feeding and pneumonia were higher after abdominal closure ($p = 0.027$, $p = 0.053$, $p = 0.043$, respectively). There is a significant unadjusted correlation between REE and temperature ($p = 0.001$, $r^2 = 0.29$). No significant correlation was identified between REE and abdominal status in the multivariate generalized estimating equation using repeated measures. This pilot study identifies several factors that are associated with an increased measured REE after abdominal closure. Careful monitoring of REE may better guide nutritional targets in open abdomen patients.

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Open abdomen management and primary abdominal closure in a surgical abdominal sepsis cohort: a retrospective review. ***M.S. Bleszynski, T. Chan, A.K. Buczkowski.*** **From the University of British Columbia, Vancouver, BC**

Staged abdominal closure (STAR) with temporary abdominal closure has become an accepted alternative to standard single operation and on demand relaparotomy for surgical abdominal sepsis (SABS). There is an insufficient amount of data in the literature comparing outcomes of primary abdominal closure (PAC) and STAR management with vacuum assisted closure (VAC) in the severe abdominal sepsis/septic shock population. The primary objective was to compare mortality between PAC and VAC. We conducted a retrospective review of 691 ICU admissions between 2006 and 2010 at a tertiary centre. Inclusion criteria were suspected or diagnosed severe abdominal sepsis/septic shock requiring source control (SC) laparotomy. Cases were categorized according to closure method at initial SC, PAC, failed PAC and VAC. APACHE 4 PMRs were calculated using an online Cerner calculator and following the Cerner protocol. In total 211 patients met inclusion criteria for SABS, consisting of 75 PAC and 136 VAC cases. Overall in-hospital mortality was 28%, and APACHE 4 PMR was 45%. VAC mortality was 22.8% compared with 38.6% in the PAC group ($p < 0.05$), and mean APACHE 4 PMR was 45% in both groups. Failed PAC had the highest mortality (58.7%), with a mean APACHE 4 PMR of 48.6%. A significant reduction in all-cause hospital mortality was observed in VAC compared with PAC. APACHE 4 PMR overestimated observed mortality.

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The effect of early mobilization protocols on postoperative outcomes following abdominal and thoracic surgery: a systematic review. ***T. Castelino, J.F. Fiore Jr., P. Niculiseanu, B. Augustin, L.S. Feldman.*** **From McGill University, Montréal, Que.**

The negative effects of prolonged immobilization are well described, and early postoperative mobilization is strongly

recommended. However, there is low evidence regarding the relative contribution of early mobilization to patient recovery. This systematic review aims to summarize the evidence regarding the impact of early mobilization on outcomes after thoracic and abdominal surgery compared with standard care. Studies were identified from a comprehensive search of 8 electronic databases. Studies were included if they compared a group of adult patients receiving a protocol of early mobilization (no later than postoperative day 1) to a control group receiving no structured protocol. Studies were also included if the control group received an institution-specific standardized mobilization protocol compared with an intervention group receiving additional mobilization goals and exercises. Outcomes of interest included complications, length of stay (LOS), gastrointestinal (GI) function, performance-based functional tests, and patient-reported outcomes (PROs). Four studies in abdominal surgery and 4 studies in thoracic surgery met the inclusion criteria. The overall methodological quality of the studies was moderate. A wide variety of protocols were used, some including supervised exercises and others providing education and clear goal-setting. Outcomes reported were variable. In abdominal surgery, 1 study evaluating LOS reported a shorter stay in patients who were mobilized. One study reported faster recovery of GI function. None of the studies reported differences in postoperative complications, performance-based tests or PROs. In thoracic surgery, while 2 of the studies reported that mobilization was safe, none reported differences in any of the outcomes of interest. Few comparative studies evaluated the impact of early mobilization on outcomes after thoracic and abdominal surgery. The quality of these studies was generally moderate; however, results were conflicting. Further studies of high methodological quality must be done to contribute evidence about the importance of early mobilization in postoperative care.

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Program directors and trainees attitudes toward the introduction of multi-source feedback as part of surgical residents' formative assessment process at the University of Calgary: a qualitative study. ***A. Reso, K. Dalrymple, A. Harvey, E. Jost.* From the University of Calgary, Calgary, Alta.; Imperial College London, London, UK**

Assessment in postgraduate surgical education is a very challenging process. Multi-source feedback (MSF), as part of formative assessment process, has been demonstrated to be reliable and valid in different settings. Currently, MSF is not part of the assessment process of surgical trainees at our institution. This qualitative study aimed to explore the attitudes and intentions of program directors and trainees toward the potential implementation of the MSF in the assessment process of surgical trainees at our institution. Data collection was accomplished through semi-structured individual and focus group interviews. Our study focused on either previous or current program directors of surgical residency programs and residents currently training in these programs. Individual interviews with 6 program directors and a focus group interview with 7 residents were conducted. All interviews were transcribed verbatim and analyzed. Data analysis was based on emerging themes and a template analysis was used to analyze the transcripts. Themes and subthemes were identified and grouped on a template and analyzed in detail. Main themes identified through analysis were need for application of MSF, ability of the organization to apply MSF, benefits associated to MSF, barriers and drawbacks related to MSF implementation, suggestions on implementation. Deficiencies in the current assessment system were identified as one of the main reasons for implementing MSF. Attitude toward implementation of MSF were positive. Education of participants and tools to deal with negative findings should be available to program directors and residents before MSF implementation. There are noteworthy deficiencies on current assessment method of non–medical expert CanMEDS competencies. Program directors and residents have a positive attitude toward potential implementation of MSF. MSF is considered by participants a valuable tool to fill the gap on assessment of non–medical expert competencies in surgical training programs.

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Outcomes associated with alternate blunt cerebrovascular injury detection strategies in major trauma patients: a systematic review and meta-analysis. ***M. Lipson, D.J. Roberts, A.W. Kirkpatrick, C.G. Ball.* From the University of Calgary, Calgary, Alta.**

When compared with digital subtraction angiography (DSA), computed tomographic angiography (CTA) has poor sensitivity for blunt cerebrovascular injury (BCVI) detection. However, CTA is widely available, easily and rapidly obtained, and has few complications. We sought to examine screening rates and clinical outcomes associated with alternate BCVI detection strategies in trauma patients. We conducted a systematic review by searching Medline, PubMed, Embase, and the Cochrane Database for studies reporting clinical outcomes associated with use of CTA and/or DSA for BCVI detection in injured adults. Two investigators extracted data from included studies. We used random-effects models to compute pooled outcome estimates and examined heterogeneity using I^2 statistics. Among 4728 citations identified, 24 studies were included. Fourteen studies used a DSA-based BCVI detection strategy, 2 a CTA-based strategy, and 8 studies a combined CTA/DSA-based strategy (i.e., some or all patients undergoing CTA also underwent DSA). CTA-based strategy had a higher pooled percentage of patients screened (11.6%, 95% CI 4.9%–18.2%, I^2 = 99.7%, n = 6 studies) versus a DSA-based strategy (2.9%, 95% CI 0.5%–5.2%, I^2 = 99.7%, n = 5 studies). However, the pooled incidence of BCVI was lower in patients screened with a combined CTA/DSA-based strategy (10.6%, 95% CI 6.2%–14.9%, I^2 = 95.2%, n = 7 studies) or CTA-based strategy (9.9%, 95% CI 6.0%–13.8%, n = 1 study) versus a DSA-based strategy (29.7%, 95% CI 20.7%–38.7%, I^2 = 92.9%, n = 5 studies). The pooled mortality associated with use of a combined CTA/DSA versus DSA-based strategy were similar (14.3%, n = 4 studies v. 17.8%, n = 14 studies). The pooled risk of stroke was higher with use of the DSA-based strategy (19.4%, n = 11 studies v. 8.0%, n = 7 studies). Use of a combined CTA/DSA-based BCVI detection strategy is associated with a higher screening rate, lower incidence of detection, and similar mortality for BCVI. The higher risk of stroke should be interpreted cautiously given the different time periods over which these studies were published.

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Assessing the effect of preoperative nutrition on the surgical recovery of elderly patients. ***T. Sikder, M. Tahiri, G. Maimon, D. Teasdale, N. Sourial, S. Demyttenaere, S. Fraser, S. Bergman.* From McGill University, Jewish General Hospital, St. Mary's Hospital Center, Montréal, Que.**

This study aims to understand the effect of nutritional status on the postoperative recovery of elderly patients. A prospective cohort study of patients aged 70 years and older undergoing elective general surgery (n = 114) was conducted between July 2012 and July 2014. The Subjective Global Assessment (SGA), a validated tool for evaluating nutritional status, was used to determine preoperative nutritional status of each patient. The primary outcomes were upper body function (measured by grip strength) and lower body function (measured by the Short Physical Performance Battery [SPPB]). Patients were evaluated at 1, 4, 12 and 24 weeks postsurgery. Repeated-measures analyses were used to test whether SGA nutritional status affects the rates of recovery of grip strength and SPPB scores. Sixty-five males and 49 females with a mean age of 77.6 ± 5.1 years were enrolled. The mean BMI was 28.4 ± 4.5 and the median CCI was 5 (2–7). Participants were categorized as well nourished (n = 99), moderately malnourished (n = 15) and extremely malnourished (n = 0). The mean preoperative grip strength for each SGA group was 25.6 ± 8.1 kg and 20.1 ± 7.2 kg, respectively. The mean preoperative SPPB score for each SGA group was 9.9 ± 2.1 and 9.5 ± 1.9, respectively. SGA group was found to significantly affect grip strength, with a well-nourished patient on average having an increase of 2.4 kg of strength as compared with a moderately malnourished patient. However, the rate of recovery for grip strength did not significantly differ between the SGA groups (p = 0.47). As for lower body function, SGA group was found to have no significant effect on SPPB score or its recovery rate. Our study suggests that patients with superior preoperative nutritional status benefit from greater upper body function during recovery. Therefore, optimizing patient nutrition before surgery may have a moderate to long-term impact on postoperative recovery.

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Why is the percentage of medical students selecting a general surgery career different between Canadian medical schools? ***J. Hollett, T. Scott, A. Karimuddin.* From the University of British Columbia, Vancouver, BC**

In Canada, the number of medical students interested in surgical careers has declined. While individuals with certain characteristics may be more drawn to surgery than others, choice of a surgical career may be influenced by the following experiences: exposure to surgeons, observerships, skills sessions, positive staff or resident role models, meaningful operative experience, appropriate level of responsibility, and sense of team environment. The purpose of this study is to determine if there is a difference in the percentage of graduating medical students from each Canadian medical school selecting general surgery as a first choice career. Canadian Resident Matching Service (CaRMS) reports were accessed to obtain the percentage of Canadian medical students selecting general surgery as their first choice career between 2002 and 2013. Data were grouped by medical school and mean percentage calculated. Five medical schools were excluded due to incomplete data sets. One-way analysis of variance (ANOVA) using SPSS version 22 was performed to determine if between-group differences in mean percentage were present followed by post hoc Tukey analysis. Mean percentage of graduating students selecting general surgery as a first choice career between 2002 and 2013 ranged from 3.39% to 7.07%. One-way ANOVA demonstrated that significant between-group differences were present ($p < 0.001$). Post hoc Tukey analysis revealed that Western University and McGill University had a significantly higher percentages of graduating medical students selecting general surgery as a first choice career than with other Canadian medical schools. While student characteristics and admissions criteria may differ among Canadian medical schools, it is possible that the observed difference in selection of a general surgery career could be explained by different educational experiences before or during clerkship. Therefore, future research to determine what learning experiences may be considered positive, and if schools with a higher percentage of students selecting general surgery incorporate them, would be beneficial.

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Colorectal cancer patient perspectives of preoperative repeat endoscopy: a qualitative study. ***W.J. Choi, D.H. Hirpara, M.C. Cleghorn, T.D. Jackson, A. Okrainec, F.A. Quereshy.* From the University Health Network, University of Toronto, Toronto, Ont.**

Many surgeons consider preoperative re-endoscopy to be the standard of care; however, the impact of repeating a colonoscopy from the patient's perspective has not been studied. This study explored patient understanding of and experience with re-endoscopy as part of preoperative care for colorectal cancer (CRC) surgery. Fourteen patients who underwent re-endoscopy before elective CRC surgery participated in this study. Semi-structured telephone interviews were conducted until thematic saturation was achieved. Interviews were transcribed and thematic analysis was used to identify concepts and overarching themes in an iterative process. Two central themes emerged. First, re-endoscopy has a positive role in care transition between providers and surgical planning. Specifically, re-endoscopy provides the patient with a second opinion, and enables tattooing and accurate localization of the lesion. This improves patient comfort and confidence in their preoperative care knowing that the surgeon who will perform the operation also performs the endoscopy. Second, perceived risk and discomfort associated with re-endoscopy is minimal. Any concerns patients have about the procedure are overridden by preoccupation with quality of life issues, namely the possibility of having to live with a colostomy, and are mitigated by trust in the surgeon and the explanations they receive. Overall, patient perception of re-endoscopy did not differ based on age, sex, ethnicity, and socioeconomic status, and the experience of re-endoscopy was consistent with previous colonoscopy experiences. Findings from this study suggest that CRC patients understand and support the use of re-endoscopy within the preoperative setting. Establishing surgeon–patient communication and trust can reassure patients going through re-endoscopy. Additional studies are needed to further elucidate the role of re-endoscopy in psychosocial oncology and its relationship to other preoperative patient stressors.

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***Staphylococcus aureus* bacteremia in a pediatric population: a retrospective study in a tertiary-care referral centre.** ***R.V. Anantha, A. Bateman, P. Murphy, J. Delport, S.M.M. Haeryfar, J.K. McCormick, T. Mele.* From Western University, London, Ont.**

Staphylococcus aureus is a leading cause of community- and hospital-acquired bacteremia in children. We sought to evaluate the clinical course of pediatric patients admitted with *S. aureus* bacteremia (SAB) within a large tertiary care children's hospital. This was a retrospective study. We reviewed comorbidities, complications, and mortality among pediatric (< 18 yr) patients admitted with at least 1 positive blood culture for *S. aureus* between 2008 and 2012 at a pediatric tertiary care centre. We also examined the medical records to identify prior hospitalizations within 60 days of an admission for SAB to determine the incidence of health care–associated SAB. We identified 57 patients admitted with SAB, with a median age of 3 years. Thirty-six patients (63%) were male, and 8 patients (14%) were diagnosed with methicillin-resistant *S. aureus* (MRSA). The median length of hospital stay was 20 days, and 21 patients (37%) had health care–associated SAB. Forty-four patients (77%) were diagnosed with sepsis. The presence of peripheral or central venous catheters (46%), skin or soft tissue infections (40%), and pneumonia (14%) were identified as the most common sources of SAB. In our study, 33% of patients required admission to the intensive care unit (ICU), and 4 deaths (7%) were identified. Nine patients (16%) had surgical intervention for complications of SAB, of whom 6 underwent débridement of a septic joint. This study features a modest cohort of pediatric patients with SAB, and may provide the impetus for larger multi-institutional retrospective and prospective studies to examine pediatric SAB and evaluate risk factors for morbidity and mortality.

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The impact of postoperative complications on the recovery of elderly surgical patients. ***M. Tabiri, T. Sikder, G. Maimon, D. Teasdale, N. Sourial, L.S. Feldman, J. Guralnick, S.A. Fraser, S. Demyttenaere, S. Bergman.* From McGill University and Lady Davis Institute for Medical Research, Montréal, Que.; University of Maryland School of Medicine, Baltimore, MD**

While the negative impact of postoperative complications on hospital costs, survival and cancer recurrence are well known, few studies have quantified the impact of postoperative complications on patient-centred outcomes such as functional recovery. The objective of this study was to estimate the impact of complications on recovery functional status after elective abdominal surgery in elderly patients. Elderly patients (≥ 70 yr) undergoing elective abdominal surgery with a planned length of stay > 1 day, were prospectively enrolled between July 2012 and December 2014. The primary outcome was time to recovery to baseline Short Physical Performance Battery (SPPB), performed preoperatively (T0) and at 1 week (T1), 1 month (T2), 3 months (T3), and 6 months (T4) after surgery. A complication score (CS) was calculated to grade the severity of complication(s) experienced by each patient using the Comprehensive Complication Index. The impact of postoperative complications on recovery of physical performance was investigated using Weibull survival analysis with interval censoring. In total 149 patients (79 men and 70 women) were prospectively enrolled. Mean age was 77.7 ± 4.9 years, median Charlson Comorbidity Index (CCI) was 3 (IQR 2–6). In total 130 (87.3%) of the patients were well nourished as per their preoperative SGA score. Fifty-two patients (34.9%) had 1 or more complications. Significant predictors of time to physical performance recovery included complications, major surgery, older age, benign disease and higher preoperative physical performance. Following elective abdominal surgery, elderly patients who experience postoperative complications take longer to return to their preoperative functional status. Future research should focus on quality improvement directed at preventing complications.

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Withdrawn

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The economics of recovery after pancreatic surgery: detailed cost minimization analysis of a postoperative clinical pathway for patients undergoing pancreaticoduodenectomy. ***D.J. Kagedan, A. Ramjaun, A. Tremblay-St. Germain, K.S. Devitt, S.P. Cleary, A.C. Wei.* From the University of Toronto, Toronto, Ont.**

Postoperative clinical pathways (CPWs) have been demonstrated to be safe and effective at decreasing postoperative length of stay. This study aims to elucidate the effect of a CPW on economic hospitalization costs for patients undergoing pancreaticoduodenectomy (PD). A postoperative CPW for patients undergoing PD was implemented in 2012 at a single academic institution. The CPW encompassed the episode of care from surgery to discharge from hospital (index hospitalization). Achievement of pre-specified clinical milestones distinguished patients who were able to achieve the CPW goals from those who deviated. Outcomes included length of stay, 30-day readmissions, and direct costs of hospital care. Costs for each patient, subdivided by departmental budgetary category (e.g., PACU, ICU, nursing, medications) were obtained from an institutional costing department, reported using inflation-adjusted 2014 Canadian dollars. A retrospective cost minimization analysis was performed comparing CPW patients to historical controls. Statistical significance was defined using the 2-tailed Mann–Whitney and χ^2 tests ($p < 0.05$). Eighty-two patients initiated on the CPW were compared with 49 historical controls. The groups were similar in duration of index hospitalization and in readmission rate and duration ($p > 0.05$). The median total cost of index hospitalization per patient was similar between the groups ($12 081.85 CPW v. $11 237.38 control, $p = 0.88$), but a significant cost savings of $800.87 in laboratory investigations per patient associated with use of the CPW was observed ($p < 0.001$). The groups did not differ significantly in 30-day hospitalization costs ($p = 0.77$). Among patients initiated on the CPW, those deviating from it cost $8109.58 more than those who completed it (median per patient total cost, $p < 0.001$). A postoperative CPW for PD patients did not increase hospitalization costs, and may have decreased laboratory investigation costs. Deviation from the CPW significantly increased the hospitalization costs. Greater detail is needed in future CPW economic analyses.

59 ***2015 CJS Editor's Choice Award Recipient***

Achalasia-specific quality of life after pneumatic dilation and laparoscopic Heller myotomy with partial fundoplication: a randomized clinical trial. ***C.C. Chrystoja, G.E. Darling, N.E. Diamant, P.P. Kortan, G.A. Tomlinson, W. Deitel, A. Laporte, J. Takata, D.R. Urbach;*** **for the Canadian Achalasia Trial Study Group.**

Achalasia is a chronic, progressive and incurable esophageal motility disease. There is clinical uncertainty about which treatment should be recommended as first-line therapy. Our objective was to evaluate the effectiveness of pneumatic dilation (PD) compared with laparoscopic Heller myotomy (LHM) with partial fundoplication in improving achalasia-specific quality of life. We conducted a prospective, multicentre, 2-arm parallel-group randomized trial with balanced allocation at 6 academic hospitals in Canada. Functional and imaging studies were performed blinded and all outcome assessors were blinded. Fifty treatment-naive adults with a clinical diagnosis of primary achalasia, confirmed by manometric tests, were enrolled between November 2005 and March 2010 and followed for 5 years. The primary outcome was the difference between the treatments in the mean improvement of the achalasia severity questionnaire (ASQ) score at 1 year from baseline. Prespecified secondary outcomes included general and gastrointestinal quality of life, symptoms, esophageal physiology measures (lower esophageal sphincter relaxation and pressure, esophageal emptying, abnormal esophageal acid exposure), complications, and incidence of retreatment. There were no significant differences between treatments in the improvement of ASQ score at 1 year from baseline (27.5 points in LHM arm v. 20.2 points in PD arm; difference 7.3 points, 95% CI –4.7 to 19.3, p = 0.23). Furthermore, there were no differences between treatments in measures of esophageal physiology at 4–6 months or improvement of symptoms, general and gastrointestinal quality of life at 1 and 5 years. Improvements in ASQ score diminished over time for both interventions. There were no serious adverse events. No patient who received LHM required retreatment, while 20% of patients treated with PD received subsequent LHM and, occasionally, further dilations. Treatment with PD or LHM similarly improved achalasia quality of life at 1 year. These findings support the recommendation of either intervention as a first-line therapy for patients with primary achalasia. ClinicalTrials.gov Identifier: NCT00188344, ISRCT number: ISRCTN05714772, CIHR: MCT-76449.

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NSAID use is associated with an increased risk of anastomotic leak after colorectal surgery: results of a frequentist and Bayesian meta-analysis. ***L. Sandhu, F. Angarita, G. Tomlinson, R.S. McLeod, A. Govindarajan.*** **From the University of Toronto, Toronto, Ont.**

Uncertainty remains regarding the association between nonsteroidal anti-inflammatory drugs (NSAIDs) and anastomotic leaks among patients undergoing colorectal surgery. Our aim was to synthesize the evidence from nonrandomized studies (NRS) and randomized, controlled trials (RCTs) examining the risk of anastomotic failure in patients exposed to NSAIDs. A systematic literature review was conducted (Medline and Embase) and the primary outcome of interest was the frequency of anastomotic leak. Random-effects meta-analyses were designed using both frequentist and Bayesian frameworks. Bayesian models were used to predict the probability that the true OR is greater than 1.0 (i.e., that NSAIDs are associated with harm). Heterogeneity was assessed using I^2 values. Fifteen studies examined the frequency of anastomotic leaks in colorectal surgery patients exposed to perioperative NSAIDs (6 RCTs and 9 NRS). Studies were published across a 10-year span (2005–2015) and included a total of 19 240 patients. Data from RCTs and NRS (excluding a case–control study) were included in the meta-analysis. NSAID exposure was associated with an increased risk of anastomotic leak (OR 2.16, 95% CI 1.33–3.53, p = 0.002). The probability that NSAIDs are associated with increased rates of anastomotic failure is 82%. There was notable heterogeneity among the studies with regards to the type of NSAID used, frequency of delivery and duration of use (I^2 = 78.6%, 95% CI 64.7%–87.1%). NSAID use appears to be associated with a significantly increased risk of anastomotic leak among patients undergoing colorectal surgery.

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Miracles for babies with abnormal lungs: the story of miR-10a and lung development. ***R. Visser, C. Fraser, D. Mulhall, F. Zhu, B. Iwasiow, T. Mahood, R. Keijzer.*** **From the University of Manitoba Children's Hospital Research Institute of Manitoba, Winnipeg, Man.**

Worldwide, 150 babies are born every day with congenital diaphragmatic hernia (CDH). One-third of these infants will die from respiratory failure due to pulmonary hypoplasia. MicroRNAs (miRNAs) are essential epigenetic factors in lung development. We have identified 2 miRNAs as regulators of lung development in CDH: miR-200b and miR-10a. The purpose of our investigation is to define the role of miR-10a in both normal and abnormal lung development. Using our nitrofen rat model to induce abnormal lung development and CDH, we employed real-time quantitative polymerase chain reaction (RT-qPCR) and fluorescent in situ hybridization to study miR-10a expression during development. In addition, control- and nitrofen-treated fetal rat lungs were extracted for explant cultures and treated with miR-10a inhibitors and mimics. We are investigating miR-10a's interaction with the retinoic acid signalling pathway using RT-qPCR and will confirm its participation in vitro using a retinoic acid response element (RARE) dual luciferase assay. We found that miR-10a expression is localized in the epithelium of fetal airways late in development. Nitrofen treatment reduces miR-10a's overall expression throughout gestation. Using nitrofen-treated fetal rat lungs as explant cultures, we could reverse the hypoplastic phenotype by treating lungs early in development with a miR-10a mimic. We are currently using RT-qPCR on total RNA extracted from the lung explants to confirm that miR-10a affects lung development through the retinoic acid signalling pathway. These results will be validated using a RARE luciferase assay in a human pulmonary cell culture model. MiR-10a contributes to lung organogenesis via the retinoic acid pathway. In CDH, reduced expression of miR-10a in development contributes to pulmonary hypoplasia. By treating developing lungs with miR-10a mimics, we can reverse the hypoplastic phenotype in vitro. We believe these microRNAs are the key to developing a prenatal treatment to improve the outcomes of CDH babies.

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Investigating hospital readmissions and unplanned ED visits following general surgical procedures at a tertiary care centre. ***R.P. Musselman, T. Jackson, M. Aupitz, F. Queresby, A. Tse, A. Okrainee, R. McLeod.* From the University of Toronto, Toronto, Ont.**

Hospital readmissions following surgery have been well studied. Less is known about unplanned ED visits not resulting in admission. The purpose of this study is to investigate factors differentiating hospital readmissions from unplanned ED visits. Data on ED presentations following general surgical procedures between Mar. 21, 2012, and Mar. 29, 2013, were obtained from the American College of Surgeons National Surgical Quality Improvement Program (NSQIP). All patients with unplanned hospital readmissions or ED visits were recorded and a retrospective chart review was performed. Univariate and multivariate logistic regression analysis were performed to determine predictors of hospital admission. Cost analysis data on a per-visit basis were recorded. We identified 1081 procedures; 109 (10.1%) patients presented to the ED within 30 days of their index procedure, 58 patients (53.2%) were readmitted, while 51 (46.8%) were discharged from the ED. Univariate analysis indicated admitted patients were more likely to be male (66.7% v. 45.2%, $p = 0.045$) with no significant difference in age or comorbidities. Multivariate logistic regression analysis demonstrated that patient's proximity to the hospital, elective versus emergency surgery, laparoscopic versus open surgery, postoperative complications, or multiple ED presentations did not independently predict readmission. Patients who presented within 2 weeks of discharge were significantly less likely to be readmitted (OR 0.23, 95%CI 0.102–0.533) when compared with patients who presented later. The average hospital related costs per unplanned ED visit without admission was $348.67. Nearly half of return visits to hospital following a general surgery procedure in a tertiary care centre did not result in readmission. In addition to reducing readmissions following surgery, targeted interventions to reduce unplanned ED visits could result in significant cost savings and improved patient care.

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Remote FLS testing: ready for prime time. ***A. Okrainec, M. Vassiliou, M.C. Jimenez, O. Henao, P. Kaneva, M. Ritter.* From Temerty/Chang Telesimulation Centre — Toronto Western Hospital, University Health Network, Toronto, Ont.; Montreal General Hospital, McGill University, Montréal, Que.; Uniformed Services University, Bethesda, MD**

Preliminary work suggests that it may be possible to reliably score the fundamentals of laparoscopic surgery (FLS) manual skills component remotely using videoconferencing software. Further work is needed to ensure that testing protocols and procedures can be maintained according to defined standards, emphasizing test integrity and security. We assessed the integrity and validity of the FLS manual skills exam administered remotely in a real-world environment according to standard testing protocols. Two rooms were set up and connected via Skype using a previously described telesimulation configuration. The test taker was greeted by an invigilator who established the Skype connection. The remote proctor (RP) registered the test taker, directed the entire exam and scored the test. An onsite proctor (OP) was present as a control. Participants completed a pre- and post-test questionnaire. Paired sample t test was used to compare OP and RPs' mean recorded times for all 5 tasks. Intraclass correlation coefficient (ICC) was used to assess interrater reliability of onsite and remote scores. Twenty participants completed the study. The majority were male, junior residents, with previous laparoscopic experience. We found no significant difference in mean times recorded between OP and RP for any of the 5 tasks. Interrater reliability was excellent between total FLS scores by OP and RP (ICC 1.00, 95% CI 1.00–1.00). No critical errors were identified. Four testing sessions experienced a dropped Skype connection. In the post-test questionnaire, 85% of participants indicated an excellent or good experience with the remote testing experience; 90% thought that the results reported by the RP would be accurate. Participants familiar with the FLS test considered that in person and remote testing were comparable. We demonstrate that a RP is able to reliably administer the FLS manual skills exam in a real-world environment, while following FLS standards.

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Contrast blush (CB) significance on computed tomography (CT) and correlation with noninterventional management (NIM) failure for blunt splenic injury (BSI) in children. ***A. Bougie, A. Paré, F.C. Malo, N. McFadden, A. Ouimet, S.K. Mayer.* From Sherbrooke University, Sherbrooke, Que.**

The significance of the CT blush (CB) sign for blunt splenic injury (BSI) in children is controversial. Some studies suggest that CB predicts noninterventional management (NIM) failure while others found no such correlation. Since NIM is the preferred treatment, it is important to clarify CB significance in NIM outcome. A retrospective medical records review was performed for all children who had a BSI investigation with an initial CT between January 2000 and December 2010 in 2 Quebec pediatric tertiary centres. Included were 157 children (mean age, 11.1 ± 4.0 yr, 67.5% males, median BSI grade 3). CB was found in 8 (5.1%). CB and non-CB patients did not differ significantly for age and sex. However, 75% of CB patients had a grade IV/V BSI compared with 8.2% of non-CB ($p < 0.001$) and required significantly more blood transfusion during hospitalization (28.7 ± 33.0 v. 3.0 ± 9.3 mL/kg, $p = 0.001$). An intervention (embolization, splenectomy or splenorrhaphy) was performed for 25% of CB patients compared with 2.8% of non-CB patients ($p = 0.033$). In-hospital mortality was significantly higher for blush patients than non-blush (37.5 v. 2.7%, $p = 0.003$). The in-hospital mortality of patients who received NOM was 50% (3/6) in blush group and 2.9% (4/145) in non-CB group ($p = 0.001$). Mortality was not secondary to BSI, but related to head trauma. In-hospital mortality of patients who received an intervention was 0% (0/2 v. 0/4). CB is infrequent but associated with higher grade BSI, higher needs of blood transfusion and in-hospital mortality. Unlike in adult management, intervention is not mandatory for patients presenting a CB in children BSI. Particular attention should be considered for prevention of secondary brain injury in this subpopulation.

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Bridging the gap on the surgical ward: enhancing resident–nurse communication through a CUSP pilot project. ***S.Y.S. Yeh, J.M. Aubin, A. Berg, D. Carver, P. Glen, K. Lacelle, M. McGrath, J. Rekman, B. Skinner, H. Moloo.*** **From the University of Ottawa, Ottawa, Ont.**

Our hospital has identified poor communication between physicians and nurses as a deficit in the provision of patient care. A pilot project was created to further elucidate and address these gaps in communication and to create a framework for effective communication. A group of frontline nurses and physicians underwent a root cause analysis exercise to identify areas of lapses in communication. Using a table of process steps, a consensus of interventions to pilot were carried out on 2 surgical wards. A validated survey (SAQ – communication portion) on team communication was used pre- and postintervention and interval audits were conducted to evaluate adherence to the new model, review its effect on communication as well as facilitate ongoing areas for improvement. Other outcomes measured included the number of pages placed to residents and documentation of estimated discharge dates (EDD) on the care boards. Interventions that were piloted included designated meeting times throughout the day between nurses and residents, creating a systematic method of communicating nonurgent concerns and drafting guidelines for paging. The project continues to evolve with modifications to include other allied health care. Paging data notes decreased frequency of pages since the pilot project started. Documentation of EDD has increased from 0% to approximately 60% though deficiencies still exists requiring further fine-tuning. Qualitative results indicate increased satisfaction and knowledge of patient care plan from nurses. For example, 23% of surveyed nurses feel very satisfied with the quality of collaboration with physicians compared with 7% prepilot. A systematic provider-driven model for communication has the potential to enhance teamwork and improve knowledge and delivery of patient care, particularly among frontline nurses. A significant improvement in the ward culture and efficiency of care delivery has already been shown through various measured parameters, proving this model of communication to be effective.

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A prospective interim analysis of microbiological gene expression profile of *Staphyloccocus aureus* bacteremia and its clinical implications. ***D.L. Pepe, R.V. Anantha, J. Delport, K.K. McCormick, T. Mele.*** **From Western University, London, Ont.**

Staphylococcus aureus bacteremia is an important cause of morbidity and mortality in hospitalized patients. Efforts to recognize early infection with *S. aureus* remain paramount as the virulence of *S. aureus*–related infections is variable and depends on a number of both patient factors and the microbiological profile of the bacteria. In this study we have sought to prospectively evaluate the incidence of *S. aureus*–related bacteremia in a large tertiary care centre in Southwestern Ontario. Our study focuses on assessing superantigens produced by each strain of *S. aureus* and clinical outcomes associated with each infection. Between June 1, 2014, and Apr. 1, 2015, 171 blood culture samples positive for *S. aureus* were prospectively collected and underwent genetic analysis for a panel of virulence factors and superantigens. In addition, clinical data associated with each sample including demographics, comorbidities, last admission to hospital, and overall mortality were assessed. Fifty-seven samples underwent full genotyping analysis and prospective clinical data were collected for approximately 171 patients. Data analyzed for the first 100 patients revealed a mean age of 59 (range 21–98) years, and 40% of patients were male. Bacterial cultures demonstrated an MRSA infection rate of 28%. Genetic analysis of the first 100 samples also demonstrated that all 6 superantigens being studied are represented among the blood culture samples drawn to date. The presence of these antigens is associated with an 8% mortality. Future work will involve further data collection and gene expression profile analysis.

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Outcomes of selective nonoperative management of civilian abdominal gunshot wounds: a systematic review and meta-analysis. ***A.N. Al-Rawahi, F.A. Al-Hinai, A.W. Kirkpatrick, C.J. Doig, J.B. Kortbeek, D.J. Roberts.*** **From the University of Calgary, Calgary, Alta.**

Although mandatory laparotomy for patients with abdominal gunshot wounds (GSW) has long been the standard of care, this approach is associated with high incidence of nontherapeutic operations and increased morbidity and hospital length of stay. This systematic review and meta-analysis sought to determine the associated outcomes of patients treated with selective nonoperative management (SNOM) for abdominal GSWs. We searched Medline, PubMed, Embase, and the Cochrane Database (March 1966–October 2014). Two investigators extracted data from included studies in duplicate. Studies evaluating SNOM among patients with civilian abdominal GSWs who were hemodynamically stable, without signs of peritonitis, were included in the systematic review. Outcomes (failure of SNOM, defined as need for laparotomy for abdominal GSW-related reasons during hospitalization or follow up; mortality; and morbidity) were combined across studies using random-effects models. Heterogeneity was estimated using I^2 statistics and by conducting tests of homogeneity. Weighted means were calculated to quantify hospital length of stay (LOS). Among 6581 citations identified, we included 37 studies (n = 5721 patients treated with SNOM). The pooled failure of SNOM was 7% (95% CI 2%–11%, I^2 = 96%, p = 0.001) while the pooled mortality associated with SNOM was 0.4% (95% CI 0.2%- 0.6%). The pooled failure in patients with isolated liver injury was 10% (95% CI 3%–17%, I^2 = 45%, p = 0.13) while it was 3% (95% CI 0%–7%, I^2 = 84%, p = 0.001) in those with isolated renal injury. The pooled estimate of failure was 4% in patients who underwent mandatory CT versus 8% in those who underwent selective CT (p = 0.051). The hospital LOS varied from 2 to 15 days (weighted average, 6 d). Despite heterogeneity across the included studies, SNOM appears to be safe and feasible. Use of mandatory abdominal CT scans is associated with a lower failure rate after SNOM.

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Does rater training improve the reliability of surgical skill assessments? A randomized control trial. ***R.L. Maniar, A. Vergis, L. Gillman, K. Hardy, J. Park.*** **From the University of Manitoba, Winnipeg, Man.**

Surgical training programs require reliable forms of assessment to evaluate surgical skills and measure technical competence. Rater

training (RT) has been shown to improve the psychometric properties of assessment tools in other disciplines, but has not been previously studied in relation to surgical skills. This study evaluated whether RT improved the reliability of surgical skill assessments. Royal College–certified surgeons from multiple specialties, including general surgery, urology, orthopedics, otolaryngology, neurosurgery, thoracic, cardiac, and plastic surgery (n = 47) were randomized to either RT or no training groups. Frame of reference RT was administered using a brief 5-minute training video. All participants then assessed 10 videos of junior trainees performing a suturing and knot-tying task using a previously validated global rating scale (GRS). Interrater reliability was measured using interclass correlation coefficient (ICC). Mixed-effects modelling was used to assess mean GRS scores. The ICC was 0.71 (95% CI 0.51–0.89) for the RT group and 0.61 (95% CI 0.41–0.84) for the untrained group. Mean GRS scores were not significantly different between the 2 groups (mean difference 0.02, p = 0.51). For education purposes, the reliabilities demonstrated in this study would be considered "good" for the RT group but only "moderate" for the nontrained group. However, the CIs did overlap and the reliability coefficients for both groups were below the threshold of 0.8, which is considered the minimum desirable level for high-stakes testing. These results suggest that surgical skill assessments may still be improved. RT may represent a way to improve reliability, but further study is needed to identify the most effective methods of training.

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Parallel or divergent? The evolution of emergency general surgery service delivery at 3 Canadian teaching hospitals. ***B. Anderson, S. Khorasani, J.M. Sutherland, S.M. Hameed, C.J. de Gara*. From the University of Alberta, Edmonton, Alta.; and the University of British Columbia, Vancouver, BC**

Emergency general surgery (EGS) has evolved from a system of individual surgeon responsibility to one of collective responsibility provided by call groups and dedicated EGS teams. This is one of the first multicentre studies to compare the way emerging EGS services in Canada have evolved to confront modern challenges in emergency surgical care. The delivery structure of EGS services in 3 major teaching hospitals (A, B and C) was characterized through structured interviews with surgical residents and attending surgeons. Next, the process of care with respect to timing of operations, for acute cholecystitis and appendicitis was compared using retrospective analysis of prospectively collected institutional databases over a 12-month period. ICD-10-CA coding was used to match diagnoses. Outcomes included admission-to-operating room (OR) time interval, daytime (0700h-1500h), evening (1500h-2300h) or nighttime (2300h-0700h) procedure, and hospital length of stay (LOS). Marked variability in structure and patterns of resource utilization were observed. Centre A had access to a dedicated daytime OR only (0730h-1700h), Centre B had a consultant-led team only, and Centre C had both dedicated daytime OR availability (0730h-1500h) and a consultant-led team. Admission-to-OR interval (hh:mm) was not different for appendectomies (A: 05:51, B: 07:42, C: 06:18, p = 0.07); it was significantly longer for cholecystectomies at Centre C (A: 30:37, B: 24:52, C: 41:22, p < 0.01). Centre B surgeons were operating more during nighttime for appendectomies (A: 7.7%, B: 34.1%, C: 9.0%, p < 0.01) and cholecystectomies (A: 3.4%, B: 26.7%, C: 0%, p < 0.01). However, for both procedures, there was no significant difference with respect to LOS (days) (appendectomy A: 2.6, B: 2.3, C: 2.6, p < 0.01; cholecystectomy A: 3.5, B: 3.8, C: 5.7, p < 0.01). Potential differences in admission-to-OR time, secondary to less nighttime operating when dedicated daytime ORs were available, did not affect LOS. As the future of general surgery, EGS services will continue to evolve optimally to suit local environments. Focus should be on structure and process reforms directed at improved patient care.

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Surgeon satisfaction in the era of dedicated emergency general surgery services: a multicentre study. ***S. Khorasani, B. Anderson, N. Switzer, J.M. Sutherland, S.M. Hameed, C.J. de Gara*. From the University of British Columbia, Vancouver, BC; and the University of Alberta, Edmonton, Alta.**

Emergency general surgery (EGS) services are transforming the delivery of general surgery care in Canada. Interestingly, the specific structure and function of EGS services are dependent on local contexts, and a spectrum of models has evolved in hospitals across the country. While all EGS services are designed to optimize the care of patients with acute and often complex surgical conditions, little is known about how such services are perceived by surgeons. Surgeon satisfaction with current EGS models in 2 large academic centres (A and B) in 2 Canadian cities was compared using a survey tool supplemented by in-person interviews where necessary. Centre A had dedicated daytime operating room (OR) access used by 11 surgeons on 24-hour conventional call schedule, whereas Centre B had an established EGS team led by 12 surgeons with limited dedicated OR access. Questions were designed to capture surgeon practice patterns, call volumes, schedule disruptions, and perceptions of quality and timeliness of care. Overall personal satisfaction with EGS services was also assessed. Survey response rates were 100% in both centres. Compared with Centre A, surgeons in Centre B were more likely to perform operations, including cholecystectomies, after midnight while on call. They were also more likely to be unsatisfied with OR availability and report perceived patient care compromise as a result of inadequate daytime OR access. Surgeons in both centres were found to be more satisfied with their call experience after the establishment of EGS services. Surgeon satisfaction with EGS models appears to be influenced by timely daytime access to the OR. Limited OR accessibility is associated with lower surgeon satisfaction and perceived negative effects on patient care. Further studies to analyze the interplay between EGS service structures, surgeon satisfaction and patient care are needed to better characterize the sustainability and workforce needs of EGS services.

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Withdrawn

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Timing of cholecystectomy after gallstone pancreatitis: Are we meeting the standards? ***A. Banmann, J. Shum*. From Northern Ontario School of Medicine, Sudbury, Ont.**

Gallstone pancreatitis (GP) accounts for 35 to 40 percent of worldwide cases. In patients with mild GP, the standard of care is also to perform laparoscopic cholecystectomy (LC) within

7 days of the acute event and during the index hospitalization. Reports have suggested that there is a 25–30% risk of developing recurrent pancreatitis, cholecystitis and cholangitis within 6–18 weeks if LC is not completed. Our study aimed to review compliance with these recommendations at a community academic hospital and if failure to meet these recommendations resulted in an increase in adverse events. All admissions for GP from January 2012 to September 2013 in a single community hospital were collected retrospectively. Patient comorbidities, pancreatitis severity, interventions, readmissions, and postoperative outcomes were collected for a year since initial diagnosis. In total 114 admissions for GP were identified; 94 were mild (no organ failure or local or systemic complications). Of those with mild GP, 69 (74%) underwent LC within a year; 29 (42%) were completed during the same admission. The average time to surgery for same-admission LC was 4.4 days (95% CI 2.9–5.8) with 11 readmissions (0 pancreatitis). Outpatient LC occurred 109 days after diagnosis (95% CI 70–157) with 23 readmissions (7 for pancreatitis). Despite recommendations in the literature to perform LC for mild GP during index admission, compliance at this hospital was low. Outpatient LC was associated with significant increase in time to surgery and readmissions for pancreatitis.

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Management of traumatic occult hemothorax, a survey of trauma providers in Canada. ***R. Rae, J. Lampron*. From University of Ottawa, Ottawa, Ont.**

Thoracic injuries are responsible for approximately 25% of all trauma deaths, even in modern Level 1 trauma centres. Hemothorax caused by blunt trauma contributes to morbidity and mortality, and chest tube insertion remains the first line therapy for these. With increasing access to computed tomography (CT) in trauma, it is possible to identify occult hemothoraces; hemothoraces seen on CT scan, but not visible on chest x-ray (CXR). These pose a management problem. There are no guidelines in the literature for managing occult hemothorax (OH) in adults due to blunt trauma. The objective of this study was to survey the current practice of Canadian trauma providers in management of traumatic occult hemothorax. An electronic survey using SurveyMonkey was distributed to the Trauma Association of Canada members email list. An electronic reminder sent after 2 weeks, to increase response rate. Participants' demographics, awareness of OH, and management of OH were solicited. Response rate was 16% (42; $n = 261$). About 98% of participants were physicians and 88% worked in academic hospitals. About 48% of providers would observe all, 45% observe some, and 2% drain all OH; 5% consult a specialist. The top 3 factors influencing decision-making were size of hemothorax (84%), hemodynamic instability (56%) and mechanism of injury (35%). No agreement was found on what size of hemothorax should prompt drainage, although no one drained OH less than 1.5cm. About 29% of participants would not drain OH regardless of size; 20% did not know what size to drain. The top 3 factors triggering drainage of OH were clinical deterioration (93%), progression on CXR (83%) and shortness of breath (63%). Current OH management practices vary widely among Canadian trauma providers. There is no agreement on when to drain them. Further research is necessary to provide guidelines for management of traumatic OH.

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Withdrawn

CANADIAN ASSOCIATION OF THORACIC SURGEONS

ASSOCIATION CANADIENNE DES CHIRURGIENS THORACIQUES

01

Extent of lymph node involvement after esophagectomy with extended lymphadenectomy for esophageal adenocarcinoma predicts recurrence: a large North American cohort study. ***S. Najmeh, H. Jiang, M.L. Leimanis, P. Mossallanejad, J. Cools-Lartigue, L.E. Ferri.* From McGill University, Montréal, Que.**

Esophagectomy remains the cornerstone of curative treatment for esophageal adenocarcinoma; however, recurrence remains high. Although previous studies have examined the rate of recurrence related to lymph node (LN) involvement, there are little data on these patterns after extended D2 lymphadenectomy. We sought to identify factors associated with disease recurrence after en-bloc esophagectomy and extended lymphadenectomy for esophageal adenocarcinoma. Patients undergoing complete resection of esophageal or EGJ adenocarcinoma between 2005 and 2014 in a university-affiliated North American hospital were identified from a prospectively collected database. Survival data were compared based on extent of LN involvement. A χ^2 test was used to test independence and colinearity within predictors of recurrence and survival. Disease-free (DFS) and overall (OS) survival were analyzed using the Kaplan–Meier method. A total of 216 patients who underwent curative resection for esophageal and EGJ cancers were identified; 123 patients (58%) received neoadjuvant chemotherapy and 168 patients (79.2%) underwent a D2 lymphadenectomy. The median total number of LNs resected was 31 (5–84) and median number of positive lymph nodes was 2 (0–34). Eighty patients (37%) recurred at a median follow up of 13.6 (1.5–72.7) months; with 65 patients (81.25%) having distant and 15 patients (18.75%) having locoregional recurrences. Having a positive LN number (+LN) > 4 and a positive:total lymph node ratio (LNR) > 0.2 were associated with decreased OS and DFS. T stage > 2, poor grade, lymphovascular invasion, perineural invasion, > 4 +LNs and LNR > 0.2 were predictors of recurrence. Higher number of positive LNs and higher LNR were associated with lower OS and DFS in patients undergoing en bloc esophagectomy with D2 lymphadenectomy for esophageal adenocarcinoma. Irrespective of extent of LN involvement, the majority of recurrences were distant, implying efforts to improve outcomes should be directed toward enhancing systemic, rather than local, control.

02

A randomized comparison of electronic versus handwritten daily notes in thoracic surgery. ***D. French, C. Anstee, S. Gilbert, D. Maziak, F. Shamji, S. Sundarean, J. Villeneuve, A. Seely.* From the University of Ottawa, Ottawa, Ont.**

Daily progress notes communicate a patient's clinical status and plan to other health care professionals. The objective of this study is to compare the quality of synoptic digitally recorded notes to handwritten daily progress notes. For 20 consecutive weekdays, patients were randomized to have a daily progress note produced using a synoptic electronic note created on a portable computer or a traditional handwritten note. On the same day, note readers were asked to evaluate the overall quality of the note on a scale of 1–10, and specific aspects of the note on a scale of 1–5. Note writers were asked to evaluate the ease and effectiveness of creating their own notes using a similar scale. Outcomes were compared using a Mann–Whitney *U* test. Note readers evaluated 57 electronic notes and 59 handwritten notes. There was a statistical significant difference in the median score of the overall quality of the notes (electronic = 8; handwritten = 6; $p < 0.001$). The median scores for quality of the documentation of the subjective and physical exam findings, and anticipated discharge information, and the clarity, completeness, and legibility of the note all showed a statistical significant difference favouring the electronic notes. There was no difference in the median score for the documentation of the clinical plan (both groups = 4; $p = 0.309$). Note writers evaluated 36 electronic notes and 38 handwritten notes. The median scores for the overall quality, completeness and legibility showed a significant difference favouring electronic notes. There was no difference in the other categories, including the time required to create each type of note. This is the first randomized controlled trial comparing the quality of electronic daily surgical progress notes to traditional handwritten notes. Higher quality progress notes are created using a synoptic electronic daily note without increasing the time required to create the note.

03

Is tissue still the issue? Lobectomy for suspected lung nodules without preoperative or intraoperative confirmation of malignancy. ***S. Kaaki, S. Srinathan, L. Tan, G. Buduhan.* From the University of Manitoba, Winnipeg, Man.**

While preoperative or intraoperative histologic confirmation of malignancy has traditionally been indicated for a suspicious lung nodule before anatomic lung resection (lobectomy), invasive diagnostic procedures are expensive, time consuming, potentially morbid and not always diagnostic. The purpose of this study was to determine whether or not foregoing routine preoperative and intraoperative tissue biopsy for suspected malignant lung nodules increased the incidence of lobectomy for benign lesions. Retrospective cohort of 256 consecutive adult patients who underwent thoracoscopic or open lobectomy for a confirmed or suspected pulmonary malignancy, with or without tissue diagnosis. Clinical, radiographic and pathologic data were compared. Among 256 patients who underwent lobectomy for confirmed/suspected lung malignancy, 127 had attempted preoperative or intraoperative tissue biopsy (group A) and 129 had no biopsy procedure (group B). There was no significant difference in the incidence of benign resections

between the groups (Group A = 4 patients [3.2%] benign pathology v. group B = 9 patients [7.0%], $p = 0.16$). Clinical and radiographic characteristics were similar in both groups. Compared with group A, group B had significantly shorter operative time (127.1 v. 112.3 min, $p = 0.004$) and fewer intraoperative complications (23 v. 37 patients, $p = 0.03$). Multivariate regression analysis failed to demonstrate significant preoperative predictive variables for malignancy. There was trend toward longer hospital stay and surgical waiting time in group A than B (6.6 v. 5.2 d, $p = 0.24$; 92.4 v. 66.2 d, $p = 0.14$). Foregoing routine invasive preoperative/intraaoperative biopsy and proceeding directly to lobectomy in selected patients with suspicious lung nodules is safe, did not increase the incidence of resected benign pathology, and may decrease surgical wait time. Patients should be carefully evaluated and counseled after review of all clinical and imaging characteristics.

04

Incidence of pulmonary embolism and deep vein thrombosis following major lung resection: a prospective multicentre incidence study. ***J. Agzarian, L. Schneider, W.C. Hanna, C. Finley, C. Schieman, L.A. Linkins, M. Crowther, M. De Perrot, T. Waddell, Y. Shargall.*** **From McMaster University, Hamilton, Ont.**

The incidence of postoperative venous thromboembolism (VTE) in patients undergoing oncologic lung resections is unspecified. Currently, post-thoracic surgery VTE prophylaxis guidelines demonstrate considerable variation. This multicentre incidence study is the first prospective trial assessing the incidence of VTE events following lung resection. Between June 2013 and December 2014, patients undergoing lung resection for primary or secondary lung malignancies in 2 tertiary care centres were recruited to prospectively undergo postoperative chest CT (PE protocol) and bilateral lower extremity Doppler ultrasonography at 30 ± 5 days after surgery. The primary outcome of interest was the incidence of postoperative VTE. Postoperative complications and VTE-related outcomes were recorded up to 3 months. A total of 157 patients were included in this analysis. All patients received unfractionated Heparin and mechanical prophylaxis perioperatively and until hospital discharge. Study participants consisted of 54% females, had a mean age of 71 years, and 81.8% had primary lung cancer, as compared with 15.9% with metastatic cancer. There were 19 VTE events (12.1% incidence), including 14 PE (8.9%), 3 DVT (1.9%), 1 combined PE/DVT, and 1 massive LA thrombus originating from the pulmonary vein stump postlobectomy. In total, 64% of PEs occurred in the operated lung. Only 4 patients (2.5%) were symptomatic at diagnosis. One patient died secondary to massive in situ ipsilateral PE, for an overall 30-day mortality of 0.64%. A univariate analysis did not demonstrate significant differences between the VTE and non-VTE groups. The incidence of postoperative VTE (and de novo PE) after lung resections is significant despite the current standard of care for in-hospital VTE prophylaxis. There are no specific risk factors associated with the development of post-discharge VTE, and most patients do not demonstrate specific symptomatology. Related morbidity and mortality from these events may be substantial. More research into the role of post-discharge extended VTE prophylaxis is therefore warranted.

05

Venous thromboembolism (VTE) prophylaxis in thoracic surgery: a Canadian national delphi consensus survey. ***J. Agzarian, L. Schneider, W.C. Hanna, C. Finley, C. Schieman, L.A. Linkins, M. Crowther, M. De Perrot, Y. Shargall.*** **From McMaster University, Hamilton, Ont.**

The incidence of venous thromboembolism (VTE) after surgical resection of thoracic malignancies is reported to be as high as 15%, but the evidence required to support prophylaxis guidelines does not exist. We conducted a modified Delphi consensus process to survey thoracic surgeons, thoracic anesthesiologists and thrombosis experts across Canada. The questions addressed perioperative risk factors for VTE, impact of those factors on selecting the type (medical and/or mechanical), duration of chemical prophylaxis (extended v. in-hospital only), and timing of treatment initiation. Three survey rounds were conducted. Participants were asked to rate each parameter on a 10-point scale. Consensus was defined a priori as an item demonstrating a coefficient of variation of ≤ 30% (0.3), and the item was then discontinued from future rounds. A total of 72, 57 and 50 respondents participated in the 3 rounds, respectively, with good distribution between specialties. Consensus was reached on associated risk factors such as previous VTE, age, cancer diagnosis, thrombophilia, poor mobilization, extended resection, and preoperative chemotherapy treatment. Consensus on risk factors impacting extended prophylaxis decisions was achieved on cancer diagnosis, obesity, previous VTE and poor mobilization. Almost no consensus was reached on the approach to perioperative prophylaxis, with only daily low molecular-weight heparin usage reaching consensus. No consensus was achieved regarding the roles of mechanical prophylaxis and unfractionated heparin, or the timing of initiation of perioperative treatment. VTE prophylaxis until discharge reached consensus. There was, however, no consensus concerning the role of extended prophylaxis. There is no standard consensus on VTE prophylaxis after thoracic surgery in Canada. While consensus exists between clinicians regarding predisposing risk factors for VTE events, there is no agreement on timing of initiation of treatment, agents used, and factors potentially mandating extended duration of VTE prophylaxis.

06

Preoperative chemoradiation therapy v. chemotherapy in patients undergoing modified en bloc esophagectomy for locally advanced esohageal adenocarcinoma: Does radiation add value? ***J. Spicer, B. Stiles, M. Sudarshan, A. Correa, L. Ferri, N. Altorki, W. Hofstetter.*** **From McGill University, Montréal, Que.**

Preoperative chemotherapy (CT) or chemoradiation (CRT) are associated with improved outcomes compared with up-front surgery in patients with locally advanced esophageal adenocarcinoma (EAC). We hypothesized that additional regional therapy (radiation) does not benefit patients undergoing en bloc resection. We performed a multi-institutional study using 3 prospectively entered databases from high-volume esophageal centres. Inclusion criteria were patients with esophageal adenocarcinoma treated with either preoperative CT or CRT followed by modified en bloc esophagectomy. Survival was assessed by Kaplan–Meier method and stepwise multivariable analyses were used to

explore variables independently associated with survival outcomes. A total of 214 patients with cT3N1 disease were identified, of which 114 underwent preoperative CT v. 100 who underwent CRT. A majority of patients had esophagogastric junction (51%, n = 110) or distal third lesions (45%, n = 96). There was a preponderance of poorly differentiated carcinomas (57%, n = 122) versus moderate (29%, n = 62). Median survival was 31.2 (95% CI 20.7–41.7) months for the CT group and 39.2 (95% CI 27.3–51.0) for CRT (p = 0.665). Mortality at 90 days was 5.3% for CT and 4% for CRT (p = 0.754). There were no significant differences in major postoperative morbidity between the groups. Multivariate analysis identified 3-field lymphadenectomy (HR 1.52, 95% CI 1.004–2.337) and number of positive lymph nodes (HR 1.064, 95%CI 1.034–1.094) as negative independent predictors of overall and disease-free survival. Given a modified en bloc esophagectomy, type of preoperative therapy was not a significant determinant of overall survival or disease-free survival. Although preoperative CRT did not add perioperative risk, it also did not prolong survival. The role of preoperative radiation in the setting of a planned radical resection should be further evaluated.

07

Comparative outcomes following tracheal resection for benign versus malignant conditions. ***J. Spicer, R. Rice, J. Shewale, B. Sepesi, M. Antonoff, G. Walsh, S. Swisher, T. Estrera, H. Safi, K. Khalil.*** **From McGill University, Montréal, Que.**

Benign and malignant diseases of the trachea are relatively rare and continue to be a formidable challenge. The aims of our study were to describe perioperative outcomes following tracheal resection from a diverse cohort of patients and to compare results for benign versus malignant surgical indications. Prospectively maintained departmental databases from 2 institutions were used to identify patients having undergone tracheal resection between January 2000 and June 2014. Patient factors and perioperative outcomes were collected. Univariate and multivariate logistic regression were performed to identify predictors for perioperative complications. We identified 43 patients who met inclusion criteria. Median age was 52 (range 18–78) years, 46% (n = 20) of participants were men. The operative indication was malignant disease in 49% (n = 21). The operative approach was cervical in 77% (n = 33), sternotomy in 9% (n = 4) and right thoracotomy in 14% (n = 6). Mean tracheal resection length was 3.1 ± 1.44 cm. Hyoid release and hilar release manoeuvres were used in 16% of cases (n = 7). Major complications occurred in 33% of patients (n = 14) and included 6 reoperations, 8 endoscopic interventions, 2 strictures, 4 infectious complications and 4 recurrent nerve injuries. There were no anastomotic dehiscences or tracheo-esophageal fistulas and perioperative mortality was 2% (n = 1). At univariate analysis age, female sex, concomitant esophageal resection and prior tracheal surgery were found to be significantly associated with the occurrence of perioperative complications. Multivariate logistic regression identified age as the only independent predictor of perioperative complications (OR 1.06, 95% CI 1.01–1.12, p = 0.023). Tracheal resection carries a low operative mortality. Many previously identified factors, such as length of resection and previous tracheal surgery, were not identified as independent predictors of perioperative complications. Complex malignant resections are not associated with worse outcomes as compared with those for benign indications.

08

Combined clinical staging for resectable lung cancer: clinicopathological correlations and the role of brain MRI. ***J. Vernon, N. Andruszkiewicz, L. Schneider, C. Schieman, C.J. Finley, Y. Shargall, C. Fahim, F. Farrokhyar, W.C. Hanna.*** **From McMaster University, Hamilton, Ont.**

In our model of combined clinical staging (CCS) for lung cancer, patients with a CT scan of the chest that does not show distant metastases will then routinely undergo whole body PET/CT and MRI of the brain before any therapeutic decision. We aim to determine the accuracy of CCS and the value of brain MRI in this population. A prospective database was queried for all patients who underwent resection of lung cancer between January 2012 and June 2014. Demographics, wait times, clinical and pathological stage (7th edition AJCC/UICC), and costs of staging were collected. Krippendorff's α was used to determine correlation between clinical and pathological stage. Of 315 patients with primary lung cancer, 55.6% were female and the median age was 70 (27–87) years. The mean time from initial CT scan to surgical treatment was 9.12 ± 6.0 weeks. Krippendorff's α between CCS and pathological stage was 0.193 (95% CI 0.125–0.260). When correlation was analyzed without consideration for substages A and B, 50.2% (158/315) of patients were staged accurately, 39.7% (125/315) were overstaged, and 10.2% (32/315) were understaged. Only 4.7% (15/315) of patients underwent surgery without appropriate neoadjuvant systemic treatment. Preoperative brain MRI detected asymptomatic metastases in 4/315 patients (1.1%). At a median postoperative follow-up of 16 months (1–40), 7 additional patients developed symptomatic brain metastases, all of whom had normal brain MRIs preoperatively. The total cost of CCS was $416 924 over the study period, with $131 824 (31.6%) going toward brain MRI. CCS is effective for patients with resectable lung cancer, with less than 5% of patients being understaged in a way that denied them appropriate systemic treatment before surgery. Brain MRI is a low yield and high cost intervention in this population, and its routine use should be questioned.

10

A retrospective cohort evaluation of non–small cell lung cancer recurrence detection. ***I.C. Yeung, H. Yakubu, R. Addas, S. Gilbert, D.E. Maziak, P.J. Villeneuve, S. Sundaresan, F. Shamji, A. Seely.*** **From the University of Ottawa, Ottawa, Ont.**

While surgical resection offers the best chance of cure in early stage non–small cell lung cancer (NSCLC), recurrence rates can be as high as 52%. Recurrence tends to occur within the first 2 years postresection. Early detection maximizes treatment options and attempts for cure. Debate exists regarding the best method of surveillance, especially the frequency of CT scanning. No guidelines exist for NSCLC recurrence detection following lung cancer resection. The purpose of this study is to document whether conventional screening (history, physical, CXR) or radiographic (CT scan) means detected the initial signs of recurrence. Retrospective chart review was conducted on a cohort of patients who developed NSCLC recurrence after complete resection while enrolled in a clinical trial assessing adjuvant melatonin. Patients received regular follow-up intervals with CXR, as well as

CT annually. Two authors independently extracted data including demographics, stage, and conventional or radiological detection. Disagreements were resolved by discussions with the treating surgeon. Between 2007 and 2015, 34 patients (16 male, 18 female) developed recurrence; initial stage was stage I in 56%, 29% stage II, and 15% stage III. About 47% of recurrences were detected conventionally, including 41% by symptoms and 6% by CXR abnormality. About 53% of recurrences were detected through CT in otherwise asymptomatic patients. About 14% recurred locally at surgical margins, 57% regionally (hilar adenopathy and lung), and 29% had distant metastasis (brain and bone). The majority of recurrence occurred within the first year; 32% recurred by 6 months, with 32%, 24%, 9% and 3% appearing by 1 year, 1.5 years, 2 years and 4 years, respectively. Among first-year recurrences, 64% were detected through conventional means. NSCLC recurrence is detected through both conventional and radiological means. As guidelines are established, effort should be made to optimize early detection, while minimizing radiation exposure and unnecessary testing.

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Health-related quality of life measure distinguishes between low and high T stages in esophageal cancer. ***B. Kidane, J. Sulman, W. Xu, Q.Q. Kong, R. Wong, J.J. Knox, G.E. Darling.* From the University of Toronto, Toronto, Ont.**

Functional Assessment of Cancer Therapy-Esophageal (FACT-E) is a health-related quality of life (HRQOL) instrument validated in esophageal cancer patients. It comprises a general component (FACT-G) and a disease-specific esophageal cancer subscale (ECS). Lower scores suggest reduced HRQOL. Our objective was to explore the relationship between baseline FACT-E, ECS and clinically determined T-stage in patients with stage II–IV cancer of the gastroesophageal junction or thoracic esophagus. A retrospective cohort study was performed using prospectively collected data from 2 Canadian tertiary centres. We included all consecutive patients treated between 1996 and 2014 with clinical stage II-IV cancer of the gastroesophageal junction or thoracic esophagus who completed FACT-E at baseline. Clinical T-stage was determined by a combination of endoscopic ultrasound and computed tomography. Fisher's exact test and ANOVA with post hoc Tukey's b tests were used. There were 135 patients. Mean age was 61.0 ± 11.0 years. Approximately 68.1% (n = 92) had adenocarcinoma. T-stage distribution was 10 (7.4%) T1, 33 (24.4%) T2, 79 (58.5%) T3 and 13 (9.6%) T4. Mean FACT-E scores stratified by T-stage were not significantly different: T1 = 81.7 ± 18.0; T2 = 78.1 ± 19.0; T3 = 75.3 ± 16.3; T4 = 78.4 ± 21.0 (p = 0.65). Mean ECS scores stratified by T-stage were significantly different: T1 = 58.7 ± 9.1; T2 = 45.6 ± 12.3; T3 = 42.3 ± 12.6; T4 = 44.5 ± 15.4 (p = 0.002). Post hoc tests showed that ECS scores for T1 were significantly different from the higher T-stages (p < 0.01). In patients with stage II–IV esophageal cancer, baseline ECS and FACT-E appear to decrease as clinical T-stage increases from T1 to T3. Baseline ECS appears to be significantly different for T1 patients compared with higher T-stage patients. Since EUS has lower sensitivity in the T1 to T2 range, baseline ECS may serve as a useful adjunct to clinical staging, especially in low-resource healthcare settings.

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Transition from multiport to single-port anatomic lung resection is feasible. ***D. French, C. Thompson, S. Gilbert.* From the University of Ottawa, Ottawa, Ont.**

Single-port thoracoscopy is a minimally invasive technique aimed at minimizing trauma to the chest wall during lung resection. The objective of this study was to compare perioperative outcomes of the single-port approach (S-VATS) to multiport VATS lobectomy (VATS). Consecutive anatomic lung resections through a single, non–rib spreading incision were reviewed and compared with a historical, prospective cohort of multiport VATS cases. Outcomes analysis was focused on the use of operating room resources and postoperative recovery. Over a 6-month period, 29 S-VATS procedures were completed by 1 surgeon and compared with an equal number of VATS patients. The groups were similar in age, sex, BMI, comorbidity, tumour size, pulmonary function, operative time and stapler usage. All tumours were completely resected (R0). All patient underwent an anatomic resection. All patients had lobectomies except 2 VATS (7%) and 6 S-VATS (21%) patients who underwent segmenectomies (p = 0.126). There was no difference in conversion rate (S-VATS = 0%; VATS = 3.4%; p = NS). One S-VATS patient with morbid obesity required insertion of an extra port. Median 1-hour postoperative visual analogue pain scale was lower in S-VATS patients (S-VATS = 2; VATS = 3.5; p = 0.02), but similar at 24 hours (S-VATS = 2; VATS = 2; p = 0.31). There was no significant difference in the median duration of chest tube drainage (S-VATS = 3 d; VATS = 3 d, p = 0.07) and the median length of stay (S-VATS = 4 d; VATS = 5 d, p = 0.07). Mortality was 0% and the complication rate was similar between groups (S-VATS = 5/29 [17%]; VATS = 5/29 [17%], p = 1.0). Early experience suggests that transition to S-VATS anatomic lung resection, without specific patient selection, is feasible and associated with perioperative outcomes that are comparable to multiport VATS. The S-VATS approach did not prolong operative time or increase complications. Ongoing investigation of postoperative, outpatient recovery and oncologic outcomes is required.

13

Survival rates in patients with N3 esophageal adenocarcinoma treated with neoadjuvant chemotherapy and esophagectomy with en-bloc lymphadenectomy. ***J. Cools-Lartigue, H. Jiang, L. Baker, J. Spicer, S. Najmeh, L. Ferri.* From McGill University, Montréal, Que.**

Patients with esophageal adenocarcinoma (EAC) frequently present with locally advanced disease. Significant lymph node (LN) burden (N3 disease, > 7 LN positive), has traditionally been associated with poor overall survival (OS) following esophagectomy, leading some clinicians to bias such patients as palliative. We sought to determine if a curative intent approach with multimodal therapy comprising neoadjuvant chemotherapy (NACT) and esophagectomy is associated with acceptable survival in patients with N3 disease. Patients subject to resection of stage IIIC EAC (pN3; > 7LN +) from 2005 to 2014 were identified from a prospectively collected database. Patient demographics, NACT, pathologic, and follow-up data were reviewed. A χ^2 test was used to test independence among predictors of survival. Disease-free survival (DFS) and OS were analyzed using the

Kaplan–Meier method and Cox proportional hazards model. Data are expressed as medians (ranges), with results significant at $p < 0.05$. Of 300 patients with EAC undergoing esophagectomy, 56 had stage IIIC (pN3) disease. R0 resection was achieved in 88% (49/56). Male preponderance (39M:10F) with median age of 66 (30–84) years was observed. About 61% (30/49) of patients received NACT with TCF (28/30), ECF (1/30) or FLOT (1/30). Tumour differentiation was moderate in 32% (16/49) and poor in 68% (33/49) of patients. A total of 37 (10–72) LNs were retrieved, with 13 (7–44) positive LNs per patient. DFS and OS were 469 (0–2399) and 605 (97–2399) days respectively. DFS and OS at 1, 3 and 5 years were 78%, 25%, and 20%, and 81%, 35%, and 25%, respectively. On univariate analysis, NACT (OS 817 v. 491 d) and a positive:total LN ratio < 30% (OS 965 v. 605 days) were significantly associated with improved survival. On multivariate analysis, only positive:total LN ratio predicted OS (HR 2.07). Multimodal treatment with effective chemotherapy, esophagectomy and complete resection is associated with long-term survival in a subset of patients with N3 EAC.

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Impact of a dedicated outpatient clinic on the management of malignant pleural effusions. ***R. El-Safty, A. Behzadi.* From the University of Toronto, Toronto, Ont.**

Malignant pleural effusion can cause breathlessness and may require hospitalization for invasive pleural drainage. A dedicated malignant pleural effusion clinic (MPE clinic) is a strategy to manage malignant pleural effusion that may reduce hospital admission days, allow patients to spend more of their last days at home, reduce costs and save health care resources. A retrospective cohort study was designed comparing the period from April 2008 to March 2011 (Group A; before MPE clinic) to the period from April 2011 to March 2014 (Group B; after MPE clinic establishment). Groups A and B comprised 116 and 168 patients, respectively. The number of hospital admissions was lower in the group B (44.0% v. 74.1%, $p < 0.001$). The pleural effusion control was higher in group B (65.4% v. 50%, $p = 0.012$). Median survival time in group A was 2.1 (95% CI 0.58–3.62) months, while in group B it was 3.6 (95% CI 3.1–4.1) months (log-rank $p = 0.785$). Outpatient MPE clinic may be of particular importance in the setting of the Canadian health care system and the overcrowded hospitals. The ability to avoid hospitalization for a palliative intervention and replace it with a simple and effective outpatient management process should appeal to patients and administrators alike.

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Has the quality of reporting of randomized controlled trials in thoracic surgery improved? ***N. Dharampal, J.P. Edwards, W. Chung, M.S. Brar, C.G. Ball, J. Seto, S.C. Grondin.* From the University of Calgary, Calgary, Alta.**

We evaluated the quality of reporting of randomized controlled trials (RCTs) in the thoracic surgery literature according to CONSORT and to determine predictors of quality. All RCTs published in 4 principal journals between 1998 and 2013 were identified in PubMed. Two independent reviewers assessed each trial using the CONSORT checklist (1996) with discrepancies resolved by a third reviewer. Mean checklist score were compared between trials published from 1998 to 2005 and 2006 to 2013. The κ statistic for interrater agreement was calculated. Univariable and multivariable linear regression were then performed to identify independent predictors of quality. After 2 rounds of review, 203 of the 2838 identified articles met inclusion criteria. The overall κ coefficient was 0.95 indicating very good agreement between reviewers. The mean CONSORT score was significantly higher in 2006–2013 (mean 10.8, 95% CI 10.3–11.2) than 1998–2005 (mean 9.3, 95% CI 8.7–9.6). On multivariable analysis there was strong evidence of an increased mean CONSORT score in studies comparing nonsurgical interventions, multicentre trials, publications after 2006, studies with increased number of authors, and studies funded by industry. Our study suggests that the quality of reporting in the thoracic surgery literature is improving with time and is predicted by factors including number of authors, multicentre trials, type of comparison, time period of publication, and industry sponsorship. Ongoing efforts should be made to improve quality of reporting in thoracic surgery.

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Clinical features distinguishing malignant from benign esophageal diagnoses in patients referred to an esophageal diagnostic assessment program. ***C.K. Wen, L. Schneider, F. Farrokhyar, C.J. Finley, C. Schieman, W.C. Hanna, S. Demay, E. Reynolds, J. Morton, Y. Shargall.* From McMaster University, Hamilton, Ont.**

Esophageal cancer is associated with a very poor prognosis. Diagnosis is difficult and often delayed, resulting in presentation with more advanced disease. In this study, we identified clinical features that could distinguish malignant from benign esophageal diagnoses in patients referred for possible malignancy. Standardized intake surveys for not yet diagnosed symptomatic patients referred to a regional esophageal diagnostic assessment program between May 2013 and December 2014 were completed before their first clinic visit. Patient characteristics and clinical symptoms predictive for eventual malignant esophageal diagnoses were explored using stepwise logistic regression analysis. In total 240 patients were diagnosed with malignant (164, 68%) or benign (76, 32%) diseases. Patients ultimately found to have malignant diagnoses were more likely to be male (74.2% v. 53.9%, $p = 0.002$, OR 2.4), possess a hiatus hernia (22.0% v. 8.0%, $p = 0.010$, OR 3.2), or have melena stools (11.6% v. 2.6%, $p = 0.026$, OR 4.8). Patients with a benign diagnosis were more likely to have GERD (47.4% v. 32.5%, $p = 0.031$) and cough (40.8% v. 25.0%, $p = 0.016$). Dysphagia was the most common presenting symptom. While dysphagia alone could not differentiate between malignant and benign diagnoses (59.8% v. 64.5%, $p = 0.569$), dysphagia with concomitant weight loss was more likely to be found in patients with malignant rather than benign disease (16.5% v. 5.3%, $p = 0.021$, OR 3.5). Advanced age, obesity, history of Barrett's esophagus, odynophagia, smoking and alcohol consumption were not found to be significant predictors of malignancy. Clinical features such as male sex, the presence of a hiatus hernia, melena stools and dysphagia with concurrent weight loss were more likely to be found in patients with an ultimate diagnosis of malignancy within our referral patient population. These results may assist physicians in identifying patients who could benefit from more expedited diagnostic workup for esophageal cancer.

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Concordance with invasive mediastinal staging guidelines. ***A.M. Bendzsak, T.K. Waddell, K. Yasufuku, S. Keshavjee, M. De Perrot, M. Cypel, A. Pierre, G.E. Darling.*** **From the University of Toronto, Toronto, Ont.**

The application of invasive mediastinal staging (IMS) guidelines for non–small cell lung cancer (NSCLC) has not yet been studied. The objectives of this study are to determine reasons for noncompliance with Cancer Care Ontario (CCO) IMS guidelines for NSCLC, and to determine the frequency of N2 disease for cases that did not receive IMS. All primary NSCLC resections without IMS between June 1, 2010, and May 31, 2012, at the University Health Network were reviewed. CCO IMS guideline criteria were assessed and all pathology reports were reviewed to determine intraoperative nodal station sampling and nodal positivity. Of 241 resections for NSCLC, 143 (59%) received IMS. Of the 98 (41%) who did not receive IMS, 65 were concordant with guidelines, and 33 were not. Guideline nonconcordance was related to tumour size and location in 2/3 of cases, with tumours greater than 3 cm comprising 9 (27%) cases, 5 (15%) cases due to tumours located centrally, and 6 (18%) cases with both central location and size greater than 3 cm. The remainder were related to imaging: 6 (18%) had no PET scan, 6 (18%) had CT scans older than 3 months, and 1(3%) case was node-positive on CT scan. Of guideline concordant cases, only 43 (66%) had intraoperative nodal sampling, with 34 of these (79% of sampled) sampling 2 or more N2 stations. Two cases (5%) had N2 positive nodes. Of guideline nonconcordant cases, 26 (79%) had intraoperative nodal sampling with 22 (85%) of these sampling 2 or more N2 stations. Three of these cases (12%) had N2 positive nodes. CCO IMS guidelines were followed in 86% of patients. Following IMS guidelines resulted in acceptable N2 positivity, lending support to the application of IMS guidelines. Improvement in the use of intraoperative mediastinal staging; however, in the absence of preoperative IMS, is required to prevent understaging of patients with NSCLC.

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Current lung-protective ventilation strategies may not be protective during one-lung ventilation surgery. ***D. Cornejo-Palma, B. Kidane, M. Hamilton, D. Fortin, E. Frechette, R. Inculet, N. Badner, R. Malthaner.*** **From Western University, London, Ont.**

High-level evidence is lacking regarding the role of lung-protective ventilation (LPV) during one-lung ventilation surgeries. Our objective was to compare outcomes after elective lung resection between matched patients that received protocolized LPV and patients that did not. A matched-control retrospective cohort study was performed using data from a tertiary Canadian centre. Surgical care was the same for all patients. Our experimental group comprised patients who received LPV (tidal volumes ≤ 6 mL/kg) with intermittent use of positive end-expiratory pressure (PEEP) and continuous positive airway pressure (CPAP) both at 5 cmH20 for 20 minutes. Recruitment manoeuvers of 5-second Valsalva to 25 cmH20 were used. Each patient was matched 1:1 with a control who did not receive protocolized LPV. Matching was based on demographics, comorbidity index, preoperative lung function, procedure, diagnosis, year of surgery and smoking status. Fisher exact and independent t tests were used for independent-sample analysis. McNemar and paired t tests were used for paired-sample analysis. The 50 cases and 50 controls were well-matched with no significant within-pair and between-group differences. There were no significant differences in rates of respiratory failure and ARDS (6/50 v. 5/50, p = 1.0) or prolonged air leak (11/50 v. 10/50, p = 1.0) between LPV and non-LPV groups on both independent (p > 0.99) and paired-sample analysis (p > 0.99). There were more deaths (4/50 v. 0/50) in the LPV group but this was not statistically significant on independent or paired-sample testing (p = 0.12). Three of 4 deaths were due to respiratory failure, of which 1 was secondary to ARDS and 2 were secondary to pneumonia/empyema. Our study did not find any significant difference in outcomes for those receiving protocolized LPV. There was a trend toward higher mortality in those receiving this protocolized LPV. This may be related to fluctuations in intraoperative airway pressures. Thoracic surgeons should be closely involved in planning and evaluating intraoperative ventilation studies on their patients.

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National practice variation in pneumonectomy perioperative care — results from a survey of the Canadian Association of Thoracic Surgeons. ***B. Kidane, A. Seely, R.A. Malthaner, S. Srinathan, G. Darling.*** **From the University of Toronto, Toronto, Ont.**

Our objective was to assess perioperative pneumonectomy practices among Canadian thoracic surgeons as part of a quality-improvement initiative to determine practice variation and identify areas for study/improvement. After several rounds of survey development (including item generation/reduction, validity testing) and piloting, a 29-item survey was distributed using the Dillman method to all practising members of the Canadian Association of Thoracic Surgeons. Seventy-three surveys were sent and 64 were returned. Two surgeons reported being retired. Response rate was 87% (62/71). Nonresponse to questions was 0%–8% (n = 0–5). Median number of pneumonectomies performed annually was 3.5 (IQR 2.75–5.00). Routine preoperative workup commonly included qualitative ventilation-perfusion scans (100%, n = 62) and spirometry (87%, n = 54) in addition to staging scans. Reported routine use of epidurals (84%, n = 52) was more prevalent than paravertebral blocks (16%, n = 10). While 16% (n = 10) do not pursue intraoperative fluid restriction, 69% reported intraoperative restriction < 2 L. Postoperatively, however, 98% (n = 61) practised fluid restriction and 84% reported daily fluid restriction < 2 L. Regarding intraoperative protective ventilation strategies, respondents appeared more focused on minimizing peak airway pressures (55%, n = 34) rather than tidal volumes (18%, n = 11). Twenty-four percent (n = 15) reported using intraoperative steroids to decrease postoperative complications. Thirty-two percent (n = 20) do not routinely insert chest tubes while (44%, n = 27) insert chest tubes attached to conventional drainage systems without suction. Sixteen respondents (26%) gave no postoperative antibiotics, whereas 44% (n = 27) gave 24 hours of postoperative antibiotics; the remaining 15 respondents gave > 24 hours of antibiotics. Fifty-two respondents (82%) reported willingness to participate in multicentre trials regarding perioperative pneumonectomy practices. Our findings suggest significant variation in reported preoperative, intraoperative and postoperative care practices for

pneumonectomy across Canada. This rigorously developed survey had a high response rate and represents the Canadian experience. This national survey highlights areas for study and quality improvement and willingness to participate in multicentre initiatives.

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Outcomes after multimodal treatment of esophagogastric neuroendocrine carcinoma: Is there a role for resection? ***S. Gowing, S. Najmeh, D. Jones, C. Mueller, M. Leimanis, J. Spicer, L. Ferri.* From McGill University, Montréal, Que.**

Gastroesophageal (GE) neuroendocrine carcinomas (NECs) are relatively recently described and highly aggressive tumours. The optimal treatment of these rare malignancies is controversial. We therefore sought to review our experience with this complex cancer with respect to treatment and outcomes. A prospectively entered database of esophageal and esophagogastric malignancies managed at a high volume North American upper GI cancer service from 2005 to 2014 was accessed to identify NEC patients. Type I/II (carcinoid) neuroendocrine tumours were excluded. Patient demographics, staging, treatment, and oncologic outcomes were reviewed. Overall (OS) and disease-free survival (DFS) were determined. Data are presented as medians with interquartile ranges. Of 462 database patients we identified 15 with NEC. Median age was 66.5 (IQR 64.25–73.5) years, and most were male (12/15). Tumours were located at the GE junction (8,75%) and stomach (4,25%) with a median tumour size of 6.5 (IQR 3.75–8.7) cm. Curative-intent treatment was attempted in 9 patients and a palliative approach was adopted in 6 (3 chemotherapy alone; 3 palliative resection). Of multimodal-treated patients, 8 (67%) patients received neoadjuvant chemotherapy (cisplatin-based doublets or triplets), 2 (16.7%) patients received adjuvant chemotherapy and radiation (5FU/leucovorin/45 Gy), and 1 (8.3%) patient received adjuvant chemotherapy only (etoposide/cisplatin). Esophagogastrectomy was performed for all resections, with left thoracoabdominal incision in 6 (50%), transabdominal esophagogastrectomy in 4 (33%), and Ivor Lewis in 2 (17%). Surgical in-hospital mortality was 0%. Pathologic staging was pT1/T2/T3/T4 in 0/2/8/2, complete resection (R0) was achieved in 8/9 (88.9%). A median of 22.5 (IQR 8.5–32.5) lymph nodes were resected with a median of 4 (IQR 0–9.25) positive. OS of the entire cohort was 53.3% at 1 year and 6.7% at 3 years. Of patients undergoing resection, DFS was 11.1% at 1 year with no patient living more than 2 years. DFS and OS for surgically treated esophagogastric neuroendocrine carcinoma remain poor with a high rate of recurrence following surgery. A collaborative multicentre registry is needed to identify the optimal treatment and to assess the role of surgery, if any, for this rare and aggressive malignancy.

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Clinical results of treatment for isolated axillary and plantar hyperhidrosis: a single centre experience. ***L. Donahoe, K. Wanzel, B. Lychacz, C. Compeau.* From the University of Toronto, Toronto, Ont.**

Primary hyperhidrosis is a debilitating condition that classically involves excessive sweating from the palms, axillae and feet. Some patients present with isolated symptoms. Thoracoscopic bilateral sympathectomy is well recognized as an excellent therapy for isolated palmar sweating. We sought to review the outcomes of our institutional approach to the management of isolated axillary and plantar hyperhidrosis. All patients who underwent axillary adenectomy (the "Skoog" procedure, $n = 20$) and CT-guided lumbar sympathectomy with 5–10 mL of phenol 6% ($n = 40$) at a single institution were included. Patients completed a short telephone survey. A 10-point scale was used to measure severity of symptoms (0 nonexistent, 10 debilitating). Thirteen (65%) patients who underwent the Skoog procedure (SP) and 8 (20%) patients who underwent lumbar sympathectomy (LS) participated. Family history was positive for hyperhidrosis in 6 SP (46%) and 6 LS (75%) patients. One year post-SP, the average symptom severity score was 5.6. The average preprocedure score for symptom severity was 9.0 for SP and 9.8 for LS. Postprocedure, the average symptom severity for LS patients was 2.1 (right) and 1.5 (left). Compensatory hyperhidrosis was experienced by 6 SP (46%) and 4 (50%) LS patients, but only 1 (13%) patient found it more bothersome. Four (31%) SP patients developed infections. One (13%) LS patient had temporary retrograde ejaculation. Three (38%) LS patients required more than 1 procedure. Twelve (92%) SP and 4 (50%) LS would have the procedure again. All patients were same-day discharges. Axillary and plantar hyperhidrosis can be effectively managed with SP and CT-guided lumbar sympathectomy. These procedures should be considered for patients with isolated hyperhidrosis or resistant hyperhidrosis post thoracic sympathectomy.

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The role of pneumonectomy after neoadjuvant chemotherapy for N2 non–small cell lung cancer. ***J. Spicer, J. Shewale, B. Sepesi, M. Antonoff, A. Correa, W. Hofstetter, D. Rice, A. Vaporciyan, R. Mehran, G. Walsh, J. Roth, S. Swisher.* From McGill University, Montréal, Que.**

The optimal management of patients with N2 non–small cell lung cancer (NSCLC) remains controversial. The role of pneumonectomy for these patients has come under question due to the high rates of perioperative complications and early recurrence. We examined the perioperative and long-term outcomes of patients undergoing pneumonectomy for N2 disease after neoadjuvant chemotherapy. A prospectively entered institutional database was accessed to identify all patients with N2 disease treated by neoadjuvant chemotherapy followed by surgery. Propensity matching was used to compare outcomes between patients who underwent pneumonectomy versus lobectomy. We identified 151 patients who underwent neoadjuvant chemotherapy followed by surgery for N2 NSCLC. Of these, 17 underwent pneumonectomy and these patients were the focus of our study. Median age was 61.5 (range 46–76) years, and 83.3% were males. Median survival for the pneumonectomy cohort was 318 (range 78–1994) days. There were no deaths at 30 days and 90-day survival was 88.9%. At 3 years, patients who underwent pneumonectomy had 45% survival as compared with 69% for the lobectomy cohort and 15% versus 53% at 5 years. In a highly selected cohort of patients with N2 disease, it is possible to achieve long-term survival with minimal perioperative risk. Nevertheless, recurrence rates remain high and until we develop more effective systemic therapy, surgeons should remain cautious about operating on N2 NSCLC when a pneumonectomy would be required to achieve complete resection.

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Time delays in the management of non–small cell lung cancer: a comparison between high-volume designated and low-volume community hospitals. ***P. Dibajnia, J. Lee, A. Behzadi.* From the University of Toronto, Toronto, Ont.**

Thoracic surgery in high-volume centres is associated with better outcomes; however, the impact of these centres on time delays in management is poorly understood. This study compared time delays in management of non–small cell lung cancer (NSCLC) between a high-volume and a low-volume hospital in Ontario. A retrospective chart review of patients at the 2 hospitals who underwent staging for NSCLC by 1 surgeon was conducted. Data was collected over 28-month periods at each hospital in a noncontemporary fashion. Time delays in management were calculated using a 6-point timeline. Comparisons between the hospitals were drawn for each interval as well as the total management time. Subsequently, a path analysis was performed to identify referral patterns that contribute to time delay. Ninety patients from the high-volume hospital, and 102 patients from the low-volume hospital were identified. The median total management time was 33 days longer at the high-volume hospital (155 d v. 122 d, $p = 0.010$). Comparison of subintervals revealed that the time from the first visit to thoracic surgeon to completion of staging accounted for 11.5 of the observed 33 day-delay ($p < 0.001$). Delays to PET scans were found to be the most significant contributor. Path analysis revealed that at both hospitals, patients who were referred directly to the surgeon after suspicious imaging had a shorter total management time than those who completed additional tests before referral. Direct referrals from the community to thoracic oncologist may significantly contribute to expediting diagnosis and management of NSCLC. Furthermore, improved access to advanced staging technologies may reduce time delays. Ongoing evaluation of time delays in diagnosis and management of lung cancer is needed to identify other factors that lead to delays.

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Regionalization and outcomes of lung cancer surgery in Ontario, Canada. ***A. Bendzsak, N. Baxter, G. Darling, P. Austin, D.R. Urbach.* From the University of Toronto, Toronto, Ont.**

Many health systems are moving toward regionalizing specialized care, including thoracic surgery; the consequences of regionalization have not yet been established. We tested whether the Cancer Care Ontario (CCO) policy to regionalize lung cancer surgery in Ontario influenced patterns of lung cancer surgery delivery and surgical outcomes. We examined all lung resections in Ontario between 2004 and 2012. Outcomes included surgery done in a designated hospital (DH), operative mortality (OM), length of stay (LOS), readmission to any Ontario hospital (RA), return to any emergency department (ED), and distance travelled. We calculated adjusted outcome rates between regionalization periods (2004–2007 v. 2008–2012) and used adjusted interrupted time series regression models to test the specific effect of the implementation of the CCO policy. The policy directed surgery to DHs both immediately (OR 1.40, 95% CI 1.2–1.6) and after policy implementation (OR 1.3, 95% CI 1.2–1.4). OM was significantly lower after regionalization (2.9% v. 4.08%, OR 0.68, 95% CI 0.58–0.81). Similarly, LOS decreased from a mean of 9.1 days to 7.9 days (RR 0.87, 95% CI 0.85–0.89). Interrupted time series models, however, showed no immediate effect of the policy on OM, and OM did not improve above baseline trends after the policy was implemented (OR 0.98, 95% CI 0.95–1.01). LOS increased immediately after regionalization (RR 1.07, 95% CI 1.02–1.13), but decreased significantly afterwards (RR 0.93, 95% CI 0.91–0.95); this occurred without changes to RA or return to ED. The mean distance travelled for surgery increased after regionalization (36.0 km v. 40.6 km, OR 1.0, 95% CI 1.00–1.08, $p = 0.03$). This is the first study to control for the effects of time on surgical outcomes when analyzing regionalization. As a result, we showed that although mortality improved after regionalization of thoracic surgery, this improvement was not due to regionalization per se. Instead, the benefits of regionalization were found in other measures of health care delivery, such as LOS. Thus, the effects of regionalization as not as simple to predict as previous studies based on volume–outcome relationships would suggest.

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Robotic pulmonary resection for lung cancer: the first Canadian series. ***W.C. Hanna, C. Fahim, P. Patel, Y. Shargall, T.K. Waddell, K. Yasufuku.* From McMaster University, Hamilton, Ont.; and the University of Toronto, Toronto, Ont.**

We present the first Canadian series of robotic pulmonary resection for lung cancer, examining the effects of new technology and learning curves on perioperative outcomes. Prospective databases at 2 institutions were queried for patients who underwent robotic pulmonary resection for lung cancer between October 2011 and February 2015. Data were collected on demographics, comorbidities, perioperative variables and complications. Results are presented as medians and ranges. The learning curve effect was evaluated in temporal tertiles, stratified by surgeon. Differences in perioperative outcomes were evaluated using the Mantel–Cox log-rank test. Of 116 patients included, 48% were males and median age was 67 (28–88) years. The majority (88%, 102/116) underwent a robotic lobectomy, 9% (11/116) a segmentectomy, and 3% (3/116) a wedge resection. Five patients (4%) were converted to thoracotomy. Median operative time was 281 (134–650) minutes and length of stay was 4 (1–19) days. Total operative time decreased significantly ($p < 0.01$) over the learning curve: tertile 1 (326 [range 290–362] min), tertile 2 (275 [range 261–289] min) and tertile 3 (235 [range 210–260] min). Median time spent on the robotic console also decreased significantly ($p < 0.01$) over tertiles: 195 (range 144–246), 148 (range 136–160), and 116 (range 100–132) minutes, respectively. Across tertiles, there were no differences in the median number of lymph node stations harvested (6, 5, 6; $p = 0.33$), length of stay (4, 4, 4; $p = 0.25$, or the rate of major complications (Clavien–Dindo class ≥ III, 5, 1, 4, respectively; $p = 0.26$). There were no deaths. The early Canadian experience with robotic lung cancer resection demonstrates excellent results that are comparable to those of experienced centres in operative times, length of stay and conversion rates. Further improvement was demonstrated by the learning curve effect. A prospective study to examine the outcomes and cost of robotic pulmonary resection compared with video-assisted thoracoscopic surgery should be done in the context of the Canadian health care system.

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01

The effect of early postoperative nonsteroidal anti-inflammatory drugs on pancreatic fistula following pancreaticoduodenectomy. ***R. Behman, P.J. Karanicolas, M. Lemke, S.S. Hanna, N.G. Coburn, C.H.L. Law, J. Hallet.* From the University of Toronto, Toronto, Ont.**

Nonsteroidal anti-inflammatory drugs (NSAIDs) are used commonly for postoperative analgesia, but can potentially impair healing. Their effect on pancreaticoduodenectomy (PD) outcomes is unknown. We sought to examine the impact of early postoperative NSAIDs on pancreatic fistula (PF) after PD. We reviewed our prospective pancreatectomy database supplemented by medication administration records, including all PDs from 2002 to 2012. Primary outcome was occurrence of clinically significant (grade B–C) PF. Secondary outcomes included major morbidity (Clavien grade III–V) and 90-day mortality. Patients were compared based on early postoperative NSAIDs use (first 3 days following surgery) using univariate and multivariate analyses. Subgroup analyses were conducted based on NSAIDs type (COX-2 inhibitors and nonselective inhibitors). We included 251 PDs, of whom 127 (50.6%) patients received NSAIDs postoperatively (35.5% COX-2 inhibitors, 18.3% nonselective inhibitors, and 4.4% both). Use of any NSAIDs was associated with a nonsignificant increase in PF (16.5% v. 11.3%, $p = 0.23$), and no difference in major morbidity and mortality. Use of ketorolac was not associated with an increase in PF (8.7% v. 15.1%, $p = 0.256$). COX-2 inhibitors were associated with increased PF (20.2% v. 10.5%, $p = 0.033$), but no difference in major morbidity or mortality. After adjusting for Charlson comorbidity and estimated blood loss, use of COX-2 inhibitors was independently associated with PF (OR 2.12, $p = 0.044$). COX-2 inhibitors are associated with PF in the early postoperative period. While ketorolac appears safe in this setting, caution is warranted with the use of COX-2 inhibitors.

02

Laparoscopic ultrasound still has a role in the staging of pancreatic cancer: a systematic review of the literature. ***J. Levy, M. Tabiri, T. Vanounou, G. Maimon, S. Bergman.* From McGill University, Montréal, Que.**

The reported incidence of noncurative laparotomies for pancreatic cancer, using standard imaging (SI) techniques for preoperative staging, remains high. The objectives of this study are 1) to determine the diagnostic accuracy of laparoscopic ultrasound (LUS) in assessing resectability of pancreatic tumours, 2) to compare the reported resectability rates of LUS to standard preoperative imaging, and 3) to determine how the accuracy of these modalities has evolved over time. We systematically searched the Embase and Medline databases through September 2014. Inclusion criteria were prospective studies investigating the accuracy of LUS in determining resectability of pancreatic tumours in patients who had undergone SI procedures. To account for recent technological advances in imaging techniques, a comparison between modalities was carried out for studies published in the last 5 years, those enrolling patients after the year 2000 and those exclusively using multidimensional CT. In total 104 studies were initially identified and 19 prospective studies (1573 patients) were included. LUS correctly predicted resectability in 79% (41%–100%) compared with 55% (29%–85%) for SI. Overall, in patients deemed resectable by SI, LUS prevented noncurative laparotomies in 33%. Of those, the most frequent LUS findings precluding resection were liver metastases, vascular involvement and peritoneal metastases. Between 2009 and 2014, the diagnostic accuracy of LUS and SI was 100% and 81% (78%–85%), respectively. In those studies enrolling patients only after the year 2000, the resection rates were 74% (54%–100%) and 58% (29%–85%) for LUS and SI, respectively. In the only prospective study comparing LUS to multidimensional CT, the accuracy was 100% versus 78%, respectively. LUS seems to still have a role in the preoperative staging of pancreatic cancer alongside standard imaging techniques. With its ability to detect liver metastases, vascular involvement and peritoneal metastases, the use of LUS may lead to less noncurative laparotomies.

03

Impact of portal vein embolization on morbidity and mortality of major liver resection in patients with colorectal metastases: experience of a small single tertiary care centre. ***P. Cyr, V. Falk, P. Collingwood, M. Hogan, A. Mathieson.* From Memorial University, St. John's, Nfld.**

Surgical resection remains the gold standard for cure of colorectal liver metastases. Feasibility of resection is based on patients' functional remaining liver (FRL) and may be improved by portal vein embolization (PVE). Based on clinical observation at our institution, we hypothesize that all patients undergoing major liver resections should be considered for preoperative PVE regardless of FRL volume. A retrospective chart review of all patients who underwent hepatic resection at a single centre by 2 surgeons between January 2008 and December 2013 was carried out. Patient demographics, PVE status, indication for surgery, neoadjuvant chemotherapy, postoperative INR and bilirubin levels, length of stay (LOS), 30-day complication rates, and mortality were recorded. A comparative analysis was performed between patients who did and those who did not undergo preoperative PVE. Of 120 patients who underwent hepatic resection, 93 (77.5%) had colorectal cancer liver metastases. Twenty-two patients underwent preoperative PVE. Average FLR volume was 49% (26%–56%). The mean age was 61.6 (34–80) years, 63.4% male, and 83.9% had received neoadjuvant chemotherapy. There was no difference in mean postoperative INR (non-PVE = 1.38, PVE = 1.39, $p = 0.84$), mean bilirubin level (non-PVE = 45.5, PVE = 28.6, $p = 0.33$), LOS ($p = 0.46$), complication rates (non-PVE = 27.3%, PVE = 25.4%, $p = 0.53$). A single death (0.2%) occurred during the study period. Both groups were homogenous

for patient characteristics. No significant difference was found with regards to postoperative outcomes. This study is limited by its retrospective nature and small size. Overall, no significant difference could be detected between patients who had undergone previous PVE and those who did not. This study does not support universal use of preoperative PVE.

04

A decision model and cost analysis of intraoperative cell salvage during hepatic resection. ***M. Lemke, G. Eeson, Y. Lin, J. Tarshis, J. Hallet, N. Coburn, S. Hanna, C. Law, P. Karanicolas.*** **From the University of Toronto, Toronto, Ont.**

Hepatic resection is associated with significant perioperative blood loss and blood transfusion. Intraoperative cell salvage (ICS) can reduce the need for allogeneic transfusions, but is associated with notable direct costs. We aimed to determine if routine use of ICS is cost-minimizing for patients based on individualized transfusion risk. We developed a decision-analytic model to compare the incremental costs from a provider perspective of adoption and nonadoption of routine ICS use for hepatectomy. A prospectively maintained database of patients undergoing liver resection from 2003 to 2012 at a high-volume hepatobiliary centre provided data to populate the model along with purchasing records and literature reported values where required. We performed probabilistic sensitivity analysis to determine the probability of ICS being cost-minimizing at specified transfusion risks. One-way sensitivity analysis was used to test the robustness of our assumptions and to identify factors most relevant to institutions considering adoption of ICS practice for hepatectomies. In the base case analysis (transfusion risk of 28.8%) the probability that routine utilization of ICS is cost-minimizing is 64%. The average incremental cost savings from use of ICS at this transfusion risk was $45.54 USD (95% CI $43.23–$47.85) per patient. The probability that ICS is cost-minimizing exceeds 50% if the preoperative transfusion risk exceeds 25%. The model was most sensitive to variation in personnel costs and costs of allogeneic transfusions. ICS shows potential to be a cost-minimizing strategy in hepactectomy, particularly when used for patients with a transfusion risk of 25% or greater.

05

The impact of portal pedicle clamping on survival from colorectal liver metastases in the contemporary era of liver resection: a matched cohort study. ***M.E. Tsang, P.J. Karanicolas, R. Habashi, E. Cheng, S.S. Hanna, N.G. Coburn, C.H.L. Law, J. Hallet.*** **From the University of Toronto and Sunnybrook Health Sciences Centre — Odette Cancer Centre, Toronto, Ont.**

Portal pedicle clamping (PPC) reduces bleeding during hepatectomy, but may impact micro-metastases' growth through ischemia-reperfusion injury. We sought to examine the association between PPC and long-term survival following hepatectomy for colorectal liver metastases (CRLM). A matched cohort study was conducted using our prospective hepatectomy database to identify all patients undergoing hepatectomy for CRLM from 2003 to 2013. Cohorts were selected based on use of PPC, with 1:1 matching for age (5-yr increments), time period (2003–2007 v. 2007–2013), and clinical risk score (0 to 5 scale). Outcomes were overall (OS) and recurrence-free survival (RFS). Results of multivariate Cox regression performed to assess the association between PPC and survival were reported as hazard ratios (HR). Of 481 hepatectomies for CRLM, 187 (39%) patients underwent PPC. In total 110 pairs of patients were matched in the cohorts, and the remainder excluded. Preoperative chemotherapy (p = 0.217), major hepatectomy (≥ 3 segments, p = 0.715) or resection status (R0 v. R1–2, p = 0.366) did not differ. Thirty-day major morbidity (p = 0.429) and 90-day mortality (p = 0.404) were not significantly associated with PPC. Median follow-up was 33 (IQR 20.1–54.8) months. When adjusting for extent of resection, perioperative transfusion, operative time, and surgeon, no significant difference was observed in OS (HR 0.91, 95% CI 0.52–1.60 for PPC), with 5-year OS of 57.8% (95% CI 52.4%–63.2%) for PPC and 62.3% (95% CI 57.1%–67.5%) without PPC. Five-year RFS did not differ (HR 0.86, 95% CI 0.57–1.30) with 29.7% (95% CI 24.9%–34.5%) for PPC v. 28.0% (95% CI 23.2%–32.8%) for no PPC. Excluding 90-day deaths did not substantially alter the results for OS (log-rank p = 0.774) or RFS (log-rank p = 0.837). PPC was not associated with a significant difference in OS or RFS in patients undergoing hepatectomy for CRLM. It does not appear to adversely affect oncologic outcomes. PPC remains a safe strategy to limit blood loss during hepatectomy.

06

Clinical and pathological features of intraductal papillary neoplasms of the biliary tract and gallbladder. ***S. Bennett, E.C. Marginean, M. Paquin-Gobeil, J. Wasserman, J. Weaver, R. Mimeault, F.K. Balaa, G. Martel.*** **From the University of Ottawa, Ottawa, Ont.**

Intraductal papillary neoplasms of the biliary tract (IPNB) and intracholecystic papillary neoplasms (ICPN) are rare tumours characterized by intraluminal papillary growth that can be associated with invasive carcinoma. Their natural history remains poorly understood. The current North American literature contains 2 series, comprising 62 patients. This study examines clinicopathological features and outcomes. Patients who underwent surgery for IPNB/ICPN between 2008 and 2014 at The Ottawa Hospital were identified through retrospective pathology review of all resected biliary tract tumours. Descriptive clinical and pathological statistics and survival data were generated. Of 23 patients with IPNB/ICPN, 10 were male, with a mean age of 68 years. Most common presentations were abdominal pain (10) and jaundice (9). Tumour locations were 5 intrahepatic, 3 hilar, 8 extrahepatic bile duct, and 7 gallbladder. Invasive cancer was found in 20 patients. Epithelial subtypes included pancreatobiliary (15), intestinal (7) and gastric (1). Median follow-up was 30 months. The 3-year overall (OS) and disease-free survival (DFS) were 71% and 57%, respectively. The 5-year OS and DFS were 51% and 57%, respectively. Decreased OS and DFS was seen in patients with tumours expressing MUC1 on immunohistochemistry (IHC). Trends toward decreased survival were seen with increasing depth of invasion and in R1 resections. IPNB/ICPN are rare precursor lesions of biliary tract cancer that have a high rate of invasion at the time of resection. Therefore, radical surgical resection is warranted. Compared with typical cholangiocarcinoma and gall bladder carcinoma, they seem to demonstrate a more favourable prognosis. Patients with tumours expressing MUC1 on IHC demonstrate worse OS and DFS.

07

International practice patterns among ALPPS surgeons: Do we need a consensus? ***S. Buac, E. Schadde, A.A. Schnitzbauer,***

K. Vogt, K. Pineda-Solis, R. Hernandez-Alejandro. **From Western University, London, Ont.**

The associating liver partition and portal vein ligation for staged hepatectomy (ALPPS) procedure is the newest technique developed to induce accelerated future liver remnant (FLR) hypertrophy in order to increase hepatic tumour resectability and limit postoperative liver failure. While early studies indicated an unacceptable morbidity and mortality, recent reports have demonstrated more favourable outcomes. We hypothesized that this inconsistency in published results may be due to variability in how the procedure is being performed, and our study aimed to determine whether there was an international consensus among ALPPS surgeons. Using the ALPPS registry, a web-based survey was sent via e-mail to all attending surgeons performing the procedure worldwide. The survey included questions regarding surgeon demographics, indications for ALPPS, patient selection, perioperative decision-making, and details of surgical technique. Fifty-six ALPPS surgeons responded to our survey. Approximately half of the respondents had training in liver transplantation. The majority of respondents (89%) have performed less than 12 ALPPS procedures. Only 16% responded that ALPPS is reserved solely for colorectal liver metastases. Over half (54%) of the respondents would consider performing ALPPS for an FLR greater than 30%. Neoadjuvant chemotherapy is routinely recommended by only 66% of respondents. Moreover, 25% of respondents would consider performing ALPPS even in the context of tumour progression during chemotherapy. Thirty percent of surgeons do not preserve the outflow to the middle hepatic vein and 39% believe it is necessary to skeletonize the structures of the hepatoduodenal ligament. Approximately 45% of surgeons surveyed have observed some evidence of Segment IV necrosis. Our study demonstrated that there is no consensus on ALPPS with respect to indications, patient selection, perioperative decision-making, or surgical technique. This may explain the incongruity in published outcomes, and it opens the door for the future creation of evidence-based safe recommendations regarding ALPPS.

08

Omental flaps to protect pancreaticojejunostomy in pancreatoduodenectomy. ***V.K. Kapoor, A. Behari, N. Gupta, R.K. Singh.*** **From Sanjay Gandhi Postgraduate Institute of Medical Sciences (SGPGIMS), Lucknow, India**

Pancreaticojejunostomy (PJ) leak is a major complication of pancreatoduodenectomy (PD). PJ leak leads to an abscess which can erode into the gastroduodenal artery (GDA) stump to cause delayed intra-abdominal bleed. We have used an omental flap to protect the GDA stump from PJ leak in PD. A vascularized flap of greater omentum, based on the epiploic branches of right gastroepiploic vessels was placed anterior to the GDA stump and wrapped around the PJ so as to separate it from the GDA stump. Delayed intra-abdominal bleed was defined as that occurring 7 days after surgery. Between 2002 and 2014, omental flap was used in 122 patients who underwent PD; mean pancreatic duct diameter was 3.5 mm, pancreas was soft in 72 (59%) patients and an internal stent was placed in 34 (28%) patients. PJ leak occurred in 32 (26%) patients; in addition, 6 (5%) patients had hepaticojejunostomy leak and 5 (4%) had gastro/duodenojejunostomy leak. Other complications included delayed gastric emptying in 20 (16%), intra-abdominal abscess in 14 (12%) and septicemia in 5 (4%) patients. Post PD bleed occurred in 17 (14%) patients — it was intra-abdominal in 12 (10%) patients. Six of the intra-abdominal bleeds were delayed bleeds; 4 settled with conservative measures and 2 required reexploration; sites of bleeding were found to be mesocolic window and superior mesenteric vein (SMV), respectively. Five of 122 (4%) patients died, only 1 due to delayed intra-abdominal bleed (from SMV); other causes of death included PJ leak with septicemia (2), colonic gangrene and cardiac arrest. No patient with PJ leak had delayed intra-abdominal bleed. PEA leak after PD can result in delayed intra-abdominal bleed with high mortality. A vascularized omental flap wrapped around the PJ protects the GDA stump from the complications of PEA leak and reduces the risk of delayed abdominal bleed after PD.

11

Preoperative diagnostic angiogram and endovascular aortic stent placement for appleby resection candidates: a novel surgical technique in the management of locally advanced pancreatic cancer. ***N. Trabulsi, J.S. Pelletier, C. Abraham, T. Vanounou.*** **From McGill University, Jewish General Hospital, Montréal, Que.**

Despite recent advances in neoadjuvant and adjuvant treatment modalities of pancreatic adenocarcinoma, the prognosis is still dismal. Tumours that arise in the body and tail usually present late and are typically unresectable. Lyon Appleby first described the feasibility of celiac axis (CA) resection for locally advanced gastric cancer. This technique was further modified to be applied in the surgical treatment of locally advanced pancreatic body carcinoma with celiac axis invasion, known as the "modified Appleby resection." Given that the feasibility of this technique is entirely based on the presence of collateral circulation, it is crucial to objectively confirm the presence of an anatomic and functional collateral system. We here describe a novel technique used in 2 patients with pancreatic cancer at our institution who were candidates for Appleby resection. Both patients had a preoperative angiogram for assessment of anatomic circulation and placement of an endovascular stent to cover the CA. We hypothesize that this new technique allows enhancement of collateral circulation and helps minimize intraoperative blood loss when transecting the CA at its takeoff. Moreover, extra length on the CA margin may be gained, as the artery can be transected at its origin without the need for vascular clamp placement. Preoperative CA obstruction also allows improvement of collateral flow preoperatively and a potential decrease in the risk of postoperative ischemic complications. We present the clinical scenario of both patients, including preoperative workup, imaging, angiograms, operative findings, and postoperative course. We propose this novel technique in the preoperative management of patients who are undergoing a modified Appleby procedure. While further experience with this technique is required, we believe that it confers significant advantages to the current standard of care.

12

Recurrence following initial hepatectomy for colorectal liver metastases: a multi-institutional analysis of patterns, prognostic factors and impact on survival. ***J. Hallet, A. Sa Cunha, R. Adam, D. Goére, P. Bachelier, D. Azoulay, A. Ayav, E. Grégoire, F. Navarro, P. Pessaux.*** **From Institut de Recherche sur les Cancers de l'Appareil Digestif (IRCAD), Strasbourg, France; Sunnybrook Health Sciences Centre — Odette Cancer Centre, Toronto, Ont.; Hôpital Paul Brousse,**

Université Paris-Sud, Villejuif, France; Institut Gustave Roussy, Villejuif, France; Hôpital Hautepierre, Strasbourg, France; Hôpital Henri Mondor, Créteil, France; Hôpital de Brabois, Nancy, France; Hôpital de la Timone, Marseilles, France; and Hôpital Saint-Eloi, Montpellier, France

Curative intent treatment of colorectal liver metastases (CRLM) is now widely accepted. Less is known about recurrence patterns following hepatectomy and their impact on long-term outcomes with modern multimodal CRLM management. We sought to characterize the patterns of, factors associated with, and survival impact of recurrence following initial hepatectomy for CRLM. We conducted a retrospective cohort study of patients undergoing initial hepatectomy for CRLM in 39 institutions (2006–2013). Kaplan–Meier methods were used for survival analyses. Overall survival (OS) landmark analysis at 12 months posthepatectomy was performed to compare groups based on recurrence (intervening event during follow-up). Multivariate Cox and logistic regression models were used to determine factors associated with all recurrence and recurrence within 3 years. In total 2320 patients were included, of which 47.4% recurred at median time of 10.1 (IQR 5.4–18.4) months, with 67.3% of recurrence occurring within 3 years. Distribution of recurrence was intrahepatic only in 46.6%, extrahepatic only in 31%, and combined intra/extrahepatic in 22%. Five-year OS differed according to recurrence status, with 57.5% (95% CI 55.0%–60.0%) with recurrence versus 74.3% (95% CI 72.2%–76.4%) without (adjusted HR 3.08, 95% CI 2.31–4.09). OS varied by site of recurrence (log-rank $p = 0.002$), and was lower for combined intra-/extrahepatic recurrence. Patients with node positive primary (HR 0.78, 95% CI 0.68–0.89), > 3 liver metastases (HR 0.82, 95% CI 0.68–0.93), and > 4 cm largest metastasis (HR 0.82, 95% CI 0.69–0.97) were at increased risk of recurrence, after adjusting for clinicopathologic variables. Recurrence within 3 years was associated with disease free interval < 12 months, extrahepatic disease at primary tumour diagnosis, and node positive primary. Recurrence after CRLM resection remains a frequent issue associated with inferior OS. Most recurrences occur within 3 years of hepatectomy. This information on recurrence patterns and predictors should inform decision to resect CRLM, follow-up plans, and patient counselling.

13

The influence of the multidisciplinary cancer conference era on the management of colorectal liver metastases. ***M.E. Tun-Abraham, K. Pineda-Solis, D. Paskar, H.A. Cano, D. Quan, R. Hernandez-Alejandro.*** **From Western University, London, Ont.**

Multidisciplinary cancer conferences (MCC) have evolved as a means to maximize communication and coordination between specialties to facilitate treatment planning and ultimately improve patient outcomes. The aim of this study was to assess how the management of colorectal liver metastases (CRLM) has evolved since inception of structured MCC. A retrospective review of patients undergoing CRLM resection between January 2008 and December 2014 was performed. At our tertiary centre, MCC were initiated in September 2012, with CRLM patients being referred from 9 referral hospitals. Comparisons between the pre- and post-MCC eras were performed. The pre-MCC cohort included 95 patients and the post-MCC cohort 112 patients. Demographics, chemotherapy use, resection margin status, perioperative and postoperative outcomes were evaluated. A total of 207 CRLM resections were performed (46% pre-MCC, 54% post-MCC): 136 (65%) for synchronous lesions and 71 (35%) for metachronous lesions. There were 59 (28%) major hepatectomies in the pre-MCC era and 76 (37%) post-MCC. By era, synchronous lesions were approached by conventional (colorectal resection first), reverse (liver first) or simultaneous resection: pre-MCC 57 (42%), 3 (2%) and 4 (3%), respectively, versus post-MCC 40 (29%), 5(4%) and 27 (20%), respectively. Chemotherapy use was comparable in both groups (91% v. 90%), with increased use of neoadjuvant treatment in the post-MCC era (76% v. 90%). There were no statistically significant differences in RO margin achievement (90% v. 94%), Clavien–Dindo total and severe (≥ IIIb) complications or 90-day mortality between eras. The advent of structured MCC promotes communication and cooperation between disciplines, such as oncology, colorectal and liver surgeons, may help facilitate the increased use of more coordinated and complex treatments, such as simultaneous resections, major hepatectomies and neoadjuvant chemotherapy.

14

Monosegment ALPPS hepatectomy: extending resectability by rapid hypertrophy. ***M.E. Tun-Abraham, E. Schadde, E. De-Santibañez, R. Hernandez-Alejandro.*** **From Western University, London, Ont.**

Liver remnant function limits major liver resections to generally leave patients with ≥ 2 Couinaud segments. Associating Liver Partition and Portal vein ligation for Staged hepatectomy (ALPPS) induces extensive hypertrophy and allows surgeons to perform extreme liver resections. The international ALPPS registry (2011–2014) was screened for novel resection type with only 1 segment remnant. The anatomy of lesions and indications for ALPPS, operative technique, complications, survival, and recurrence were evaluated. The objective of this study was to review explore the safety of this novel, monosegmental liver resection in the international ALPPS registry. Among 333 patients, 12 underwent monosegment ALPPS hepatectomies in 6 centres, all for extensive bilobar colorectal liver metastases. All patients were considered unresectable by conventional means, and all had a response to or no progression after chemotherapy before surgery. In 2 patients, the liver remnant consisted of segment 2, in 2 of segment 3, in 6 of segment 4, and in 2 of segment 6. Median time to proceed to stage 2 was 13 days and median hypertrophy of the liver remnant was 160%. There was no 90-day mortality. Four patients experienced liver failure, but all recovered. Complications higher than Dindo–Clavien IIIa occurred in 4 patients with no long-term sequelae. At a median follow-up of 14 months all patients are alive, 6 patients are tumour-free and 6 patients have developed recurrent metastatic disease. ALPPS allows systematic liver resections with monosegment remnants, a novelty in liver surgery.

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How does simultaneous resection of colorectal liver metastases impact chemotherapy administration? ***K. Pineda-Solis, M. Tun-Abraham, D. Mirsattari, H.A. Cano-Gonzalez,***

D. Paskar, R. Hernandez-Alejandro. **From London Health Sciences Center, London, Ont.**

The optimal sequence of surgical management of colorectal liver metastases (CRLM) synchronous with primary tumours remains controversial. The conventional approach is resection of the primary followed by liver resection. Other options include reverse approach and simultaneous (SIM) resection. In any case, complete surgical resection is the best strategy for long-term survival. However, few studies have explored how these different strategies impact other treatment modalities, namely chemotherapy. The aim of this study is to analyze the potential outcome differences of SIM versus non-SIM strategies: in particular; complications, total time off chemotherapy (TOC) and time between completed resection and return to chemotherapy (TRC). All liver resections for synchronous CRLM from January 2008 to December 2014 at our institution were identified and classified as SIM or non-SIM. Patients undergoing emergency surgery for their colorectal primary were excluded. Clinical data were collected, and statistically analyzed. A total of 91 eligible patients were identified; 31 were SIM and 60 non-SIM. Major hepatectomies were performed in 48% of SIM and 70% in non-SIM. Overall, complications occurred in 48% of SIM and 23% in non-SIM ($p = 0.03$); severe complications (> IIIB, Clavien–Dindo) were 3% and 2%, respectively (NS). The 90-day mortality was 0% in both groups. The SIM group had a mean TRC of 92 days versus 86 days in the non-SIM group (NS). TOC in the SIM group was 157 days and 164 days in non-SIM (NS). The SIM approach had a comparable impact on chemotherapy schedules, relative to conventional non-SIM strategies, despite higher overall morbidity, likely because the incidence of severe complications that might delay chemotherapy was similar. Although there is a lack of evidence demonstrating earlier resumption and shorter disruption of chemotherapy result in oncological benefit, chemotherapy remains a cornerstone in CRLM management, and as such, the SIM strategy does not seem to negatively impact chemotherapy schedules.

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Preoperative liver volumetry for surgical planning: a systematic review and evaluation of current modalities. ***K.M. Eltawil, G. Martel.*** **From the University of Ottawa, Ottawa, Ont.**

The volume of the future liver remnant (FLR) is fundamental when planning for major hepatic resection and living donor liver transplantation. A small FLR is considered a major risk factor for postoperative liver insufficiency, which is associated with increased morbidity and mortality rates. Preoperative hepatic volumetry has therefore become fundamental for liver surgery. A Medline, Embase, PubMed, as well as Cochrane Database of Systematic Reviews search was undertaken to address the following subtopics: imaging-based volumetry, formula-based volumetry, and computer-based software volumetry. The technical applications as well as the strengths, limitations and existing controversies regarding the usefulness of those modalities were analyzed. To date, CT volumetry using manual tracing on the liver boundaries is the most widely used modality to determine the safety of hepatectomy. This method seems to be time consuming and have a certain degree of error tending to overestimate the actual hepatic volume. Computer softwares have been developed to provide rapid and efficacious measures that could be accomplished by the surgeon without radiologist support. However, few studies have provided validation of those methods. Others have proposed the use of conversion factors and formulas based on body weight and body surface area aiming to standardize volumetric assessments in different ethnic groups. In conclusion, there is no uniform consensus about the modality that should be chosen for evaluation of the FLR. The need for utilization of combined functional and morphologic assessments seems to be essential for more accurate prediction of postoperative hepatic dysfunction especially in the cirrhotic population.

17

Surgical planning of hepatic metastasectomy using radiologist performed intraoperative ultrasound. ***L. O'Malley, A. Menard, S. Wong, D. Jalink, S. Nanji.*** **From Queen's University, Kingston, Ont.**

Intraoperative ultrasound (IOUS) of the liver is often performed to ensure that there are no occult metastases or local invasion which would compromise the curative intent of resection for hepatic metastases. IOUS performed by a radiologist represents theoretical best practice for both identifying lesions and the use of adjuncts such as ablation. A retrospective analysis of liver resections done at our institution (2011–2013) showed a rate of change in the operative plan of about 40% with radiologist performed IOUS. Here, we report an interim analysis of a prospective study examining the frequency and details of any change in operative plan as a result of radiologist performed IOUS. Patients undergoing liver resection for colorectal or neuroendocrine cancer metastases as of January 2014 were recruited. All patients underwent an MRI and CT scan within 2 months of surgery. The preoperative plan was stated before the procedure and re-assessed in the operating room based on intraoperative findings/IOUS results. The frequency with which the operative plan was changed based on the use of IOUS was reported. Thus far, 20 liver resections have been completed on 18 patients. Mean age was 63 years. There were 18 resections for CRC metastases and 2 for NET metastases. The mean time from most recent imaging to surgery was 19.8 (range 1–59) days. Of the 20 procedures, 3 had a change in plan based on IOUS: 2 had a more extensive resection and in 1 case the operation was aborted. Three of 20 patients had a change in operative plan based on findings on IOUS (15%). In the current series many more patients had preoperative MRI than in our retrospective series, which may account for the reduction in change in operative plan. Data collection is ongoing.

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Surgical resection and perioperative chemotherapy for colorectal cancer liver metastases: a population-based study. ***S. Nanji, W.J. Mackillop, X. Wei, C.M. Booth.*** **From Queen's University, Kingston, Ont.**

Most literature describing surgery for colorectal cancer (CRC) liver metastases (LM) comes from high volume centres. Here we report management and outcomes achieved in routine clinical practice. All cases of CRC in Ontario who underwent resection of LM in 1994–2009 were identified using the population-based Ontario Cancer Registry. Electronic treatment records identified chemotherapy delivery. Temporal trends are described for 3 periods: 1994–1999, 2000–2004, and 2005–2009. We describe volume of resected CRCLM as a ratio of incident cases per

CRCLM resection. Overall (OS) and cancer-specific survival (CSS) are measured from time of LM resection. In total 2717 patients underwent resection of CRCLM. Between 1994 and 2009 there was a 78% increase in case volume; from 1 resection for every 48 incident cases to 1 resection for every 27 incident cases ($p < 0.001$). Use of perioperative chemotherapy increased over study periods from 44% (306/700) to 52% (429/830) to 65% (777/1187, $p < 0.001$). Chemotherapy utilization rates varied across geographic regions (range 43%–69%, $p < 0.001$). Postoperative mortality rates at 30 and 90 days were 2.5% and 4.3% respectively. Five-year OS during the study periods was 36% (95% CI 32%–39%), 40% (95% CI 36%–43%), and 46% (95% CI 43%–49%, $p < 0.001$); CSS was 38% (95% CI 35%–42%), 42% (95% CI 38%–45%), 49% (95% CI 44%–53%, $p < 0.001$). The temporal improvement in OS/CSS persisted on adjusted analyses. Outcomes of patients with resected CRCLM in routine practice is comparable to those reported from high volume centres. Survival improved over the study period despite a greater proportion of patients with CRC undergoing liver resection.

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Management and outcome of colorectal cancer (CRC) liver metastases in the elderly: a population-based study. ***S. Nanji, W.J. Mackillop, X. Wei, C.M. Booth*. From Queen's University, Kingston, Ont.**

Surgical resection and perioperative chemotherapy is the standard treatment for patients with CRC liver metastases. There is limited data to describe practice and outcomes among elderly patients. We report utilization of chemotherapy, surgical management and outcomes of surgical resection of CRC liver metastases in the elderly in routine clinical practice. All cases of CRC in Ontario who underwent surgical resection of LM from 2002–2009 were identified using the population-based Ontario Cancer Registry. We linked electronic records of treatment to the registry to identify surgical procedures and utilization of chemotherapy. Pathology reports provided details regarding extent of disease and surgical procedure. Patients were classified as < 65, 65–74, and ≥ 75 years of age. We identified 1310 patients: 710 (54%) < 65; 414 (32%) 65–74; and 186 (14%) ≥ 75 years of age. Mean number of lesions (2.3, 2.0, 1.6, $p < 0.001$) and mean size of the largest lesion (4.0, 4.4, 4.5 cm, $p = 0.042$) varied across age groups. Older patients were less likely to undergo a major liver resection (≥ 3 segments): 65%, 65%, 42% ($p = 0.041$). Perioperative chemotherapy was used less frequently in the elderly (71%, 57%, 41%, $p < 0.001$). Ninety-day mortality (2%, 5%, 8%, $p < 0.001$) increased with age. Cancer-specific survival at 5 years across the age groups was 49%, 47%, 35% ($p < 0.001$); overall survival was 49%, 44%, 28% ($p < 0.001$). Resection of CRC liver metastases is associated with greater risk of postoperative mortality despite less aggressive surgery in elderly patients treated in routine clinical practice. Use of perioperative chemotherapy is lower among the elderly. Although the long-term outcomes are inferior to younger patients, a substantial proportion of elderly patients will have long-term survival.

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Outcomes following repeat hepatic resection for recurrent metastatic colorectal cancer: a population-based study. ***S. Nanji, X. Wei, M.E. Tsang, C.M. Booth*. From Queen's University, Kingston, Ont.**

Despite improved outcomes in patients undergoing liver resection for colorectal cancer (CRC) metastases, more than half of patients develop recurrent hepatic disease. We report management and outcomes of patients undergoing repeat liver resections in the general population of Ontario. All cases of CRC in Ontario who underwent surgical resection of liver metastases with subsequent reresection from 2002–2009 were identified using the population-based Ontario Cancer Registry. Cases with a second surgery within 6 months ($n = 23$) were classified as staged resections rather than repeat surgery. We linked electronic records of treatment to the registry to identify surgical procedures and utilization of chemotherapy. Pathology reports provided details regarding extent of disease and surgical procedure. Of the 1310 cases of liver resection for CRC metastases from 2002–2009, 78 (6.0%) underwent a repeat liver resection for recurrent metastatic disease. The mean age was 56 years and the mean time between the first and second resection was 23 (range 7–94) months. Compared with the first resection, second resections were associated with fewer lesions (2.7 v. 1.5; $p = 0.001$), fewer major resections (≥ 3 segments 58% v. 28%, $p = 0.008$) and more perioperative chemotherapy (72% v. 81%, $p = 0.076$). The size of largest lesion (3.2 cm in both groups, $p = 0.179$) and positive margin rate (13% v. 11%, $p = 0.480$) were similar. First and second resections had comparable length of stay (8 v. 9 d) and 30-day mortality (0% v. 4%, $p = 0.245$). Median overall survival from time of first resection was 86 months. Unadjusted cancer-specific survival of cases with repeat resection at 5 years was 62% (95% CI 48–76); overall survival was 60% (95% CI 48–72). Repeat liver resections for metastatic CRC is associated with fewer lesions and less extensive surgery. Postoperative outcomes for first and second resections are comparable. A substantial proportion of cases undergoing repeat liver resection will have long-term survival.

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A clinical pathway after pancreaticoduodenectomy standardizes postoperative care and may decrease postoperative complications. ***S. Tung, A.T. St-Germain, D.J. Kagedan, K.S. Devitt, S. Gallinger, A.C. Wei*. From the University Health Network, University of Toronto, Toronto, Ont.**

Clinical pathways (CPW) are structured, standardized tools that have been shown to safely reduce hospital length of stay (LOS). Our group has developed a perioperative CPW for patients undergoing pancreaticoduodenectomy (PD). The study objective is to describe the CPW implementation process, assess patient adherence to CPW, and to evaluate the implications on postoperative course. An evidence-based CPW was implemented in a single high-volume hepato-pancreato-biliary centre in 2012. Perioperative demographic and clinical data was collected prospectively. Primary outcomes included LOS, 30 and 90-day readmission rate, and complication rate. Secondary outcomes included the rate of adherence to elements of the CPW, and the association between adherence, LOS, and complications. The CPW group ($n = 83$) was compared with a historic pre-CPW control group ($n = 49$). Bivariate tests were performed with non-parametric tests with a significance level of 0.05 (2-tailed). Over 15 months, 83 patients were initiated on the CPW with a median

LOS of 8 days. The 30-day readmission rate was 9.6% and there were no postoperative deaths, similar to the pre-CPW group. Notably, there was a significant reduction in total complication rate (85.7% pre-CPW v. 67.5% CPW, $p = 0.02$) and minor complication rate (61.2% pre-CPW v. 38.6% CPW, $p = 0.01$) in the CPW group. Certain CPW elements, including solid food intake and Foley catheter removal, were reached more frequently and quickly in the CPW group compared with the pre-CPW group. When CPW elements were not met, LOS was significantly prolonged (> 8 d, $p = 0.005$). A CPW for PD patients appears safe and standardization of care may be able to reduce perioperative complications. Moreover, failure to achieve CPW milestones may predict a complex perioperative course; CPWs may potentially identify patients in need of clinical rescue. Further studies are needed to evaluate the role of the CPW in predicting perioperative patient morbidity.

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Significance of regional lymph node involvement in patients undergoing liver resection and lymphadenectomy for colorectal cancer metastases. ***S. Nanji, X. Wei, M.E. Tsang, C.M. Booth*. From Queen's University, Kingston, Ont.**

The indications for curative intent surgery among patients with colorectal cancer (CRC) liver metastases are expanding. One indication that remains highly controversial is the role of resection among patients with presumed hepatic lymph node (LN) involvement. We report on the outcomes of patients with resected regional lymph nodes in the general population of Ontario. All cases of CRC who underwent surgical resection of liver metastases between 2002 and 2009 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 chemotherapy. Pathology reports were used to identify which patients underwent simultaneous regional lymphadenectomy with liver resection. These reports also provided details regarding extent of disease and surgical procedure. Of the 1310 cases of liver resection for CRC metastases from 2002 to 2009, 103 (7.9%) underwent simultaneous regional lymphadenectomy. The majority (71%) had a major liver resection (≥ 3 segments). The mean number of lesions removed was 2.4 (1–13) and mean size of the largest lesion was 4.7 (0.4–17) cm with a positive margin rate of 10%. Of the 103 lymphadenectomy cases, 80 (78%) were periportal, 16 (16%) were celiac and 7 (7%) were para-aortic. The mean number of LNs removed was 2.2 (1–15). Ninety-day mortality was 6%. Twenty-nine percent (30/103) of cases had positive lymph nodes. Median survival for patients with positive nodes compared with negative nodes was 25 months versus 46 months, respectively ($p < 0.001$). Unadjusted cancer-specific survival at 5 years for positive vs negative nodes was 10% versus 43% ($p < 0.001$); overall survival was 21% versus 42% ($p = 0.003$). Patients with resected CRC liver metastases with regional lymph node involvement have inferior survival compared with patients with negative lymph nodes. Despite this poor prognostic factor, a proportion of cases with involved lymph nodes will have long-term survival.

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NSAID use and risk of postoperative pancreatic fistulas following pancreaticoduodenectomy: a retrospective cohort study. ***M.S. Rashid, D. Dath, Y. Essaji, H. Kaka, M.J. Marcaccio, V. Tandan, T. Tang, F. Yuan, L. Ruo, P. Serrano*. From McMaster University, Hamilton, Ont.**

Nonsteroidal anti-inflammatory drugs (NSAIDs) are commonly used for pain control following pancreaticoduodenectomy and are increasingly being used as part of enhanced recovery pathways. They are, however, thought to increase postoperative leak rate after certain types of intra-abdominal operations like colorectal surgery. This study aims to evaluate the association between perioperative NSAIDs use and postoperative pancreatic fistula (POPF) following pancreaticoduodenectomy. This is a retrospective review of patients undergoing pancreaticoduodenectomy from January 2009 to March 2014. POPF was classified according to the International Study Group on Pancreatic Fistula (ISGPF) definition. Risks factors for POPF, including use of NSAIDS, were evaluated using univariable and multivariable methods. There were 190 patients analyzed during the study period (100/190, 53% of which had a diagnosis of pancreatic adenocarcinoma). At least 1 dose of NSAIDs was administered in 48 (25%) patients. Ketorolac was the most common type of NSAIDs used (39/48, 81%). There were 28/190 (15%) POPF events in the cohort, 13/190 (7%) of which were clinically relevant pancreatic fistulas (ISGPF type B or C). NSAIDs use was not associated with a significant increase in the risk of POPF (OR 0.99, 95% CI 0.39–2.51, $p = 0.986$). There was also no correlation found between the type, the number of days or the postoperative day NSAIDs were used and the risk of POPF. The most important factor associated with POPF was disease pathologies other than pancreatic adenocarcinoma or chronic pancreatitis. This study suggests that there is no association between the use of postoperative NSAIDs and the risk of POPF. Further studies are needed to better understand the implications of NSAIDs use and postoperative complications.

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Minimally invasive HPB surgery in Canada: What are we doing and do we want to do more? ***R. Jrearz*. From the University of Toronto, Toronto, Ont.**

Laparoscopic hepatopancreatobiliary (HPB) surgery has been shown to be safe and effective. The purpose of this study was to determine the extent to which laparoscopy is used in performing HPB resections in Canada. Likewise, we aimed to assess HPB surgeons' attitudes toward the use of laparoscopy and if there are any barriers to its incorporation. We surveyed 68 Canadian HPB surgeons through an electronic questionnaire distributed to the membership of the Canadian Hepatopancreatobiliary Association (CHPBA). The survey consisted of 12 questions regarding demographics, the use and limitations of laparoscopy in their current practice, and interest in increasing the use of minimally invasive techniques. Our survey had a response rate of 75%. Most responders (76%) have been in practice for over 5 years. The majority (80.4%) worked in an academic setting. Most surgeons (84.3%) were trained in HPB with or without transplant, 14 (27.5%) were trained in surgical oncology and 4 (7.9%) had training in minimally invasive or robotic surgery. The majority of surgeons used laparoscopy in minor resections such as liver wedge resections (86.4%) or distal pancreatectomy with or without splenectomy (80.4%). A minority of the respondents used laparoscopy for liver lobectomies (23.5%), extended liver resections

(9.8%) and pancreaticoduodenectomy (7.8%). Most surgeons (82.4%) wanted to increase the use of laparoscopy in their HPB practice. Major barriers identified include institutional factors such as lack of equipment (41.2%) and surgeon factors such as lack of adequate training (43.1%). OR time constraints (60.8%) was another limitation that can be considered a mixed institutional and surgeon factor. This study demonstrates that laparoscopy is commonly used for minor HPB resections; however, there is a strong desire to increase the use of minimally invasive techniques among Canadian HPB surgeons. Training centred on addressing the limitations and barriers to the uptake of minimally invasive techniques in HPB surgery are needed.

28 ***2015 CJS Editor's Choice Award Recipient***

Predictors of actual survival in resected pancreatic adenocarcinoma: a population-level analysis. ***D.J. Kagedan, R. Raju, M.E. Dixon, E. Shin, Q. Li, N. Liu, M. Elmi, A. El-Sedfy, C. Earle, N. Mittmann, N.G. Coburn.*** **From the University of Toronto, Toronto, Ont.**

Among patients diagnosed with pancreatic adenocarcinoma, numerous clinicopathologic factors have prognostic value following curative-intent resection. Controversy persists regarding the benefits of adjuvant treatment (chemotherapy, CT or chemoradiation therapy, CRT) following surgery. We sought to assess overall survival (OS) following resection, and to identify predictors of survival on a population level, with an emphasis on adjuvant treatment. Patients undergoing pancreatic adenocarcinoma resection between 2005 and 2010 were identified within the provincial cancer registry and linked to administrative databases that include actual survival for all patients in the province. Pathology reports of resection specimens were abstracted using the College of American Pathologists protocol. Landmark survival analysis excluding patients dying < 6 months following surgery was performed using the Kaplan–Meier method, and predictors of OS were identified by log-rank test. Cox proportional hazards multivariate regression was used to identify independent predictors of OS. A total of 473 patients were analyzed. The 1-, 3-, and 5-year survival rates were 65%, 23%, and 15%, respectively, with a median survival of 1.48 years. Follow-up ranged from 2.1 to 7.2 years; 20% of patients were censored. Among patients surviving > 6 months after surgery (n = 397), univariate analysis found no survival difference between patients receiving CT, CRT, or no adjuvant treatment (p = 0.89); this finding persisted on multivariate analysis (p = 0.26). Multivariate analysis demonstrated a survival benefit associated with undergoing surgery at a high-volume centre (HR 0.57, p = 0.004), but socioeconomic status, extent of operative resection, and resection margin positivity were not associated with OS (p > 0.2). Experiencing a Clavien grade 4 postoperative complication was associated with decreased OS (HR 1.49, p = 0.04) but grade 2 and 3 complications were not (p > 0.05). Following resection for pancreatic adenocarcinoma, median OS was 1.48 years, and 5-year survival was 15%. The benefits of adjuvant therapy demonstrated in randomized controlled trials may not translate into improved survival at the population level, when early postoperative deaths are excluded.

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Predictors of receipt of adjuvant therapy following pancreatic adenocarcinoma resection: a population-based analysis. ***D.J. Kagedan, M.E. Dixon, R. Raju, E. Shin, Q. Li, N. Liu, M. Elmi, A. El-Sedfy, C. Earle, N. Mittmann, N.G. Coburn.*** **From the University of Toronto, Toronto, Ont.**

Following curative-intent resection of pancreatic adenocarcinoma, adjuvant treatment (AT) with chemotherapy (CT) or chemoradiation therapy (CRT) is recommended. In spite of this, many patients do not receive AT. We sought to evaluate rates of receipt of AT following pancreatic resection at the population level, and to identify independent predictors of receipt of AT. Patients undergoing resection for pancreatic adenocarcinoma between 2005 and 2010 were identified within the provincial cancer registry and linked to administrative databases. Patients receiving neoadjuvant therapy and patients dying within 6 months of surgery were excluded from analysis. Receipt of AT was defined using physician billing codes for CT or CT plus radiation initiated within 4 months of surgery. Pathology reports of resection specimens were abstracted using the College of American Pathologists protocol. Clinicopathologic and sociodemographic patient characteristics predictive of receipt of AT were identified using multivariate logistic regression. A total of 397 patients were analyzed. Of these, 308 (77.6%) received AT and 89 (22.4%) received no adjuvant treatment. Multivariate regression analysis revealed positive lymph nodes to independently predict receipt of AT (p = 0.005), and increasing age to be a negative predictor of receipt of AT (p < 0.0001). Among patients receiving AT, 219 (71.1%) received CT, 88 (28.6%) received CRT, and 1 was excluded from analysis. Multivariate analysis demonstrated ACG comorbidity score > 10 (p = 0.0002) and treatment at a high-volume hepatopancreatobiliary centre (p < 0.0001) to predict receipt of CT over CRT. Positive resection margins were associated with increased likelihood of receiving CRT versus CT (p = 0.0002). In spite of recommendations to receive AT, nearly one-quarter of eligible patients did not receive any following surgery. Receipt of AT was not associated with socioeconomic status, extent of resection, or postoperative complications. Treatment at a high-volume hepatopancreatobiliary centre may bias patients in favour of receiving adjuvant CT over CRT.

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Effect of surgical wait time on oncological outcomes in periampullary cancer. ***E. Lau, K. Bertens, J. Hawel, M. Meschino, K. Leslie, R. Hernandez-Alejandro.*** **From Western University, London, Ont.**

Surgery provides the only potential cure for periampullary adenocarcinoma (PA). This study aims to evaluate the impact of surgical wait time on oncological outcomes of patients diagnosed with periampullary cancer. We performed a retrospective review of patients who were scheduled to have a pancreaticoduodenectomy (PD) for PA at a single institution from January 2007 to September 2014. Data collected included surgical wait time (defined as time between date of decision to treat and date of operation), whether resection was possible, pathological staging, and the Charlson Comorbidity Index. Multivariate logistic regression was performed to determine if wait time significantly impacted resectibility and T stage. All tests were 2-tailed and p < 0.05 was considered statistically significant. Two hundred and 60 patients were identified. The average surgical wait time was 25.5 (range 1–140) days. Sixty-two percent of patients had a wait time less than 28 days, which is the current provincial target for PD. Ninety-two percent of patients underwent PD within 56 days. At the time of operation, 24% of patients were found to

have unresectable disease (n = 62), of which 46% had local invasion and 54% had distant disease. Surgical wait time greater than 28 days was not predictive of whether patients would have resectable or unresectable disease at time of operation (p = 0.62). Furthermore, wait time greater than 28 days was not predictive of advanced T stage (p = 0.47). This study did not identify a significant impact of wait time greater than 28 days on oncological outcomes in PA. However, this study was limited by its small sample size and a multicentre study will be important to better determine if there is an effect of surgical wait time on oncologic outcomes in PA and to inform policy decisions.

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Does surgical assist expertise affect resectability in periampullary malignancies? ***M. Meschino, J. Hawel, E. Lau, S. Knowles, K. Leslie, R. Hernandez-Alejandro.* From Western University, London, Ont.**

Surgical resection provides the only chance for cure in periampullary malignancies. Despite advances in preoperative imaging, resectability is still often only determined intraoperatively. We examined variation in surgical assist level of training and its effect on resectability and complete pathologic resection. We conducted a retrospective review of all patients scheduled for pancreaticoduodenectomy (Whipple) from January 2007 to September 2014. Surgical outcomes were compared among 3 groups: hepatobiliary (HPB) surgeon assistant (HPB-A), non-HPB surgeon assistant (NHPB-A), and trainee assistant (T-A). Data analyzed included rate of resectability, rate of R0 resection, length of postoperative recovery, complication rate, and preoperative risk assessment using the Charleston Comorbidity Index. All statistics were computed using IBM SPSS Statistics version 21. Analysis of variance (ANOVA) was used for the continuous variables and the χ^2 or Fisher exact tests were used for the categorical variables. In total, 320 patients were brought to the OR for an attempted Whipple resection; 248 were resected and 72 were deemed unresectable. Resectability rates were significantly higher in the HPB-A group (88%) and NHPB-A group (85%) than the T-A group (72%, p = 0.022). No significant difference in R0 resection rate was observed between groups (78%, 73%, and 75%). The HPB-A group showed a trend of shorter length of stay (12.5, 30, and 22 days) that approached significance (p = 0.106). Similar trends were observed for complication rates (54%, 62%, and 72%), including anastomotic leak rates (6%, 11%, and 21%), again not significant (p = 0.388). Preoperative risk assessment was similar across all groups. This study suggests that the degree of surgical assist expertise correlates with higher rates of resectability for periampullary malignancy, without compromising margin status or complication rates. Identified trends that failed to reach statistical significance were likely limited by the study's small sample size.

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The impact of tranexamic acid on fibrinolytic activity during major liver resection. ***P.J. Karanicolas, Y. Lin, J. Tarshis, N.G. Coburn, C.H.L. Law, J. Hallet, B. Buck, M. Hamel-Smith, S. McCluskey.* From Sunnybrook Health Sciences Centre, University of Toronto, Toronto, Ont.**

Hyperfibrinolysis may occur as a result of the systemic inflammatory effect of surgery or due to hepatic injury that occurs during liver resection. Tranexamic acid (TXA) is an antifibrinolytic agent that decreases bleeding in various settings but has not been well studied in patients undergoing liver resection. Our objective was to examine the extent of fibrinolysis during liver resection and to explore the impact of TXA on fibrinolysis. We conducted a prospective, open label, phase II trial examining the impact of TXA at 2 doses on fibrinolysis during major liver resection (> 2 segments). We enrolled 18 patients sequentially to 1 of the 3 cohorts: 1) control (no TXA), 2) TXA dose I (1 g bolus followed by 1 g infusion over 8 hours), and 3) TXA dose II (1 g bolus followed by 10 mg/kg/hr until the end of surgery). We collected serial blood samples intra- and postoperatively to assess the extent of fibrinolysis and the serum concentration of TXA. No abnormalities in hemostatic function were identified on rotational thromboelastometry (ROTEM). Plasmin-antiplasmin (PAP) complex levels increased steadily to peak at 1106 ug/L (normal 0–512 ug/L) following parenchymal transection then decreased to baseline by the morning following surgery. There were no differences noted in any of these measurements in patients treated with TXA. In summary, significant hyperfibrinolysis occurs in patients during major liver resection. TXA does not appear to reduce the extent of fibrinolysis; further research is needed to determine if TXA is effective at reducing bleeding and whether it acts through an alternative mechanism.

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Colorectal cancer with synchronous hepatic metastases: a national survey of opinions on treatment sequencing and multidisciplinary cooperation. ***T.W. Clements, J.P. Edwards, W.D. Buie, E. Dixon, A.R. MacLean, S.C. Grondin, A. Gomes, S. Jayaraman, S.P. Cleary, C.G. Ball.* From the University of Calgary, Calgary, Alta.**

The management of patients with colorectal cancer and synchronous hepatic metastases has evolved significantly over the past 15 years. Changes include improved chemotherapy, advances in hepatic surgery, colonic stenting, and surgical consultation synergies. We sought to better understand surgeon viewpoints on both the optimal and realistic delivery of surgical cancer care for these patients. An online survey was distributed to members of CSCRS, CHPBA and CSSO. The survey used 40 questions to determine surgeon opinions. Statistical analysis was summative. A total of 41 colorectal surgeons (CRS) responded. Most had access to and a good working relationship with regional HPB surgeons (86%) and medical oncologists (100%). The majority (92%) believed there was a role for concurrent resection of primary colorectal cancer and hepatic metastases, with 69% having first hand experience. Most CRS (62%) discussed all cases of known hepatic metastases with an HPB surgeon before any resection. When a lesion was asymptomatic or minimally symptomatic, most CRS (92%) discussed these cases with medical oncology/HPB surgery before resection (8%). Bilobar metastases (58%), patient comorbidities (35%), portal lymphandenopathy (35%), and patient age (15%) restricted CRS from obtaining HPB consultation. Many CRS (46%) did not believe that resecting hepatic metastases before the primary might be of benefit. Most CRS (60%) reported they could not accurately predict hepatic resectability, with 27% having familiarity with evidence-based guidelines directing the care of synchronous disease. The definition of standard resection sequencing varied across subspecialties

($p < 0.05$). Despite working in smaller hospitals with less access to HPB surgeons and minimal experience with concurrent resections, non-CR general surgeons more often believed a liver-first approach may have merit. In summary, there was general agreement between CRS, HPB and general surgeons on numerous topics, but additional education is required with regard to HPB surgical capabilities and biology-based operative sequencing.

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Outcomes associated with a matched series of patients undergoing sequential resections of colorectal cancer and hepatic metastases compared with synchronous surgical therapy of the primary and hepatic metastases. ***C. Howard, A.R. MacLean, E. Dixon, W.D. Buie, C.G. Ball.* From the University of Calgary, Calgary, Alta.**

Concurrent surgical resection of a colorectal primary with partial or complete hepatic metastatic resection(s) has the potential advantage of shortening overall treatment intervals. Risks associated with this larger surgery must be considered, however. We sought to define outcomes associated with synchronous resections in a matched analysis with sequential resections. A single centre series was employed to evaluate outcomes and treatment intervals for patients who underwent synchronous resections of colorectal primaries and hepatic metastases who were subsequently matched to patients undergoing sequential/separate colorectal and hepatic resections. Standard statistical methodology was used ($p < 0.05$ = significant). A total of 14 patients underwent synchronous resection of a de novo colorectal primary and hepatic metastasis tumours. All patients received neoadjuvant systemic therapy, as well as combined colorectal and HPB subspecialty surgeon collaboration. All survivors (13/14) underwent adjuvant systemic therapy following either a combined procedure or a combined procedure with the addition of a second stage liver resection. When matched to sequential patients who received a colorectal resection followed by an interval hepatic procedure, perioperative morbidity (43% v. 26%) and mortality (7% v. 0%) were higher ($p < 0.05$). Postoperative complications were most commonly (83%) intraperitoneal abscesses requiring subsequent percutaneous drainage. Overall estimated blood loss was similar (378 mL v. 44 mL, $p > 0.05$). The median length of hospital stay was lower for synchronous resections compared with the additive length of stay for sequential resections (14 v. 21 days, $p < 0.05$). The overall duration of treatment (surgery and chemotherapy) was also significantly lower in the synchronous group (30 v. 48 weeks, $p < 0.05$). Median survival was comparable in both cohorts ($p > 0.05$). Although synchronous resections of de novo colorectal cancers with hepatic metastases result in higher morbidity, the total length of hospital stay, as well as the overall duration of treatment is significantly lower. Synchronous surgical resections must be carefully selected.

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The impact of anesthetic inhalational agent on short-term outcomes after liver resection. ***R. Habashi, J. Khan, J. Hallet, Y. LeManach, C. Law, N. Coburn, S. Hanna and P. Karanicolas.* From the University of Toronto, Toronto, Ont.**

Posthepatectomy liver failure (PHLF) represents a significant complication of hepatectomy. Previous studies suggested that the type of anesthetic inhalational agent (AIA) used during liver resection may influence the development of PHLF and other morbidities. We sought to compare the association of 2 commonly used AIA, desflurane and sevoflurane, during liver resection on posthepatectomy outcomes. We conducted a comparative cohort study analysis on a prospectively maintained hepatectomy database. Data were supplemented by manual chart review. Primary outcome was PHLF defined as derangements in both INR and bilirubin. Secondary outcomes included reoperation, readmission, 30-day overall morbidity (Clavien grade I–V), major morbidity (Clavien grade III–V), and mortality. The impact of AIA on outcomes was assessed using propensity score (PS) matched analysis. The probability (i.e., propensity score) to receive sevoflurane was estimated by logistic regression on baseline comorbidities, preoperative biomarkers, and intraoperative factors. We performed 1:1 matching with a nearest neighbour strategy. We used t tests or χ^2 tests to examine the association between AIA and outcomes. Of 749 patients who underwent hepatectomy during the study period, 616 (82%) received desflurane or sevoflurane. After PS matching, 474 patients were included (237 patients in each group). There was no difference in postoperative bilirubin, INR, or hemoglobin within 5 days of surgery. Perioperative blood loss and transfusion did not differ. PHLF was not different with sevoflurane compared with desflurane (50.9% v 49.1%, OR 1.07, 95% CI 0.71–1.59). No difference was observed in major morbidity between sevoflurane and desflurane (50.0% for both, OR 1.01, 95% CI 0.64–1.61). Thirty-day reoperation, readmission, mortality, and length of stay did not differ by AIA. In summary, the choice of AIA has little impact on short-term outcomes following hepatectomy, including PHLF, major morbidity, and mortality. The selection of AIA should rather be based on patient co-morbidities, AIA availability and costs.

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The impact of perioperative blood transfusions on post-hepatectomy short-term outcomes: an analysis from the American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP). ***J. Hallet, A.L. Mahar, M.E. Tsang, Y. Lin, J. Callum, N.G. Coburn, C.H.L. Law, P.J. Karanicolas.* From the Sunnybrook Health Sciences Centre — Odette Cancer Centre and the University of Toronto, Toronto, Ont.; Queen's University, Kingston, Ont.**

Blood loss and need for perioperative red blood cell transfusions (RBCT) remain a significant concern in liver surgery. RBCT carry risk of transfusion-related immunodulation that may impact postoperative recovery. This study examined the association between RBCT and posthepatectomy morbidity. Using the American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP) registry, we identified patients undergoing elective hepatectomy based on CPT codes (2007–2012). Primary outcomes were 30-day postoperative major morbidity, mortality, and length of stay. Unadjusted and adjusted relative risks (RR) with 95% CIs were computed using modified Poisson, logistic, or negative binomial regression, to estimate the association between RBCT and outcomes. To understand how the increased level of missing data over time impacted the results, a sensitivity analysis was restricted to the timeframe with complete data (2007–2010). A total of 12 180 patients underwent a hepatectomy in the ACS-NSQIP registry during the study period. Of those, 11 712 were included, including 2951 (25.2%) who received RBCT. Major morbidity occurred in 14.9% of patients, more commonly with RBCT

(25.3%) than without (11.3%, $p < 0.0001$). This held true for system-specific morbidity, including postoperative infectious, respiratory failure, venous thromboembolic, and cardiac events (all $p < 0.0001$). Patients receiving RBCT were more likely to suffer 30-day mortality (5.6% v. 1.0%, $p < 0.0001$). After adjustment for baseline and clinical characteristics, including comorbidities, malignant diagnosis, procedure, and operative time, RBCT was independently associated with increased major morbidity (RR 1.80, 95% CI 1.61–1.99), mortality (RR 3.62, 95%CI 2.68–4.89), and length of stay (RR 1.29, 95%CI 1.25–1.32). The sensitivity analysis did not significantly alter the results. Perioperative RBCT for hepatectomy was independently associated with worse short-term outcomes and prolonged length of stay. These findings further the rationale to focus on reducing RBCT for hepatectomy, which could be achieved by the implementation of blood management initiatives.

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Associations between pancreatic cancer quality indicators and outcomes in Nova Scotia. ***S. Hurton, G. Porter, A. Levy, M. Molinari.* From Dalhousie University, Halifax, NS**

There is heterogeneity in the quality of care provided to patients affected by pancreatic cancer (PC). However, clear associations between quality indicators (QIs) and outcomes have not been clearly established. The aim of this study was to explore if satisfaction of established QIs was associated with complication rates and improved overall survival (OS) in patients undergoing curative PC resections. Established QIs specific for PC were identified from the literature and used to assess the quality of care provided to patients with surgically resected PC in a single province from 2001 to 2011. Associations were examined between preoperative imaging, time from diagnosis to surgery < 2 months, and > 10 lymph node retrieved and outcomes (OS and perioperative morbidity). Data of all patients were extracted from administrative databases and a chart review. Analyses were carried out using logistic regression and Cox proportional hazards models. A total of 94 patients satisfied the inclusion criteria. Mean age of all patients was 68.1 years. Pancreaticoduoedenectomy was performed in 82 patients and distal pancreatectomy in 12 patients. Overall 63.7% (58 patients) had positive lymph node disease and 25.5% experienced Clavien–Dindo grade III–IV complications. Perioperative mortality was 5.3% (95% CI 0.7%–9.9%), and 5-year OS was 9.0% (95% CI 1.9%–16.1%). When adjusting for patient and tumour characteristics, cross-sectional imaging performed earlier than 8 weeks from the date of surgery was the only QI associated with lower OS (HR 0.437, 95% CI 0.166–0.981). Time from diagnosis to surgery within 2 months and the total number of lymph nodes harvested were not associated with improved survival. With the exception of preoperative imaging within the recommended interval, established process-based PC QI did not predict superior outcomes in PC patients undergoing resection in our study. Strategies aimed at improving process-based QI should ensure such indicators are associated with outcomes.

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Developing a national quality agenda in hepato-pancreato-biliary surgery: key priority areas for study. ***A.C. Wei, K. Devitt, P.J. Karanicolas, S.P. Cleary.* From the University of Toronto, Toronto, Ont.**

Cancer is the leading cause of death in Canada, responsible for > 75 000 deaths annually. HPB cancers are among those with the worst prognosis. Surgery is the optimal treatment for HPB cancers but it is often complex, with significant potential for perioperative morbidity and mortality. Complications may have a negative effect on quality of life and survival. We hypothesize that optimizing the structures and processes of surgical care will improve the quality of HPB surgery outcomes. We held a Canadian expert panel workshop to establish and rank quality improvement priorities for a quality agenda in HPB surgery; and identify areas for future study. Modified nominal group methods were used to achieve consensus recommendations. Twenty-two HPB surgeons participated in the workshop. The majority of the surgeons were Canadian from Ontario (11, 50%), Western Canada (4, 18%), Quebec (3, 14%), Atlantic Canada (3, 14%) and international (1, 5%). The expert panel recommended that the top priority structure of care that should be addressed was regionalization of HPB to high volume centres. The top priority process of care that should be tackled was standardization of care with surgical quality improvement tools, such as enhanced recovery after surgery protocols and/or clinical pathways. Cancer related outcomes (i.e., survival, recurrence) were identified as the most important outcomes of care that can to be impacted by quality initiatives. The development of a national quality agenda in HPB surgery requires identification of priority areas that will benefit from quality improvement. We report the recommendations of a national expert panel on the key structures, processes and outcomes of care that need future study and/or intervention. These results will be used to guide strategies which will aim at improve quality of care for this patient population.

CANADIAN HERNIA SOCIETY

SOCIÉTÉ CANADIENNE DE CHIRUGIE HERNIAIRE

02
Withdrawn

03
Histological features and clinical implications of polypropylene degradation. ***V.V. Iakovlev, S.A. Guelcher, R. Bendavid.*** **From St. Michael's Hospital, University of Toronto, Toronto, Ont., and the Shouldice Hospital, Thornhill, Ont.**

Estimated annual volume of implanted polypropylene meshes is in the range of several million devices worldwide. Up to 10% will be excised to treat complications; however, the excised specimens have remained underutilized over the last decades. Only a fraction of excised specimens are examined microscopically while the mechanisms of complications remain understudied. The fundamental question as to whether polypropylene degrades in vivo is still debated. Examination of over 150 excised meshes using conventional and transmission electron microscopy showed features of polypropylene degradation. The degraded material, detected by its ability to absorb dyes, formed a continuous outer layer at the surface of the mesh filaments. It retained light polarization properties and inclusions of nondegraded polypropylene. It also melded with the nondegraded filament core when heated by the surgical cautery. The following findings confirmed that degradation occurred in vivo: inflammatory cells trapped within fissures, melting caused by cautery of excision surgery, and growth of the degradation layer dependent on the duration of the mesh in the body. Cracking of the degraded material indicated changes contributing to clinically important mesh stiffening and deformation. Additionally, chemical products of degradation are released in the tissue and contribute to the mesh-body interactions.

04
A rare case of primary hernia of the perineum. ***R. Krouchev, J. Labrecque, G. Brochu.*** **From Université Laval, Québec, Que.**

Primary hernias of the perineum are rare. They result from weakness in the pelvic diaphragm and increased intraabdominal pressure. Repair can be achieved through an abdominal, a perineal or a combined access. There are 3 methods of repair: mesh repair, autogenous flap or primary repair. A 77-year-old female presented with a mass below the lower border of the gluteus maximus muscle. Physical examination and CT scan showed an upper posterior perineal hernia with small bowel content. The perineal approach was chosen and the hernia sac content was reduced and the sac excised. The pelvic floor defect was repaired with nonabsorbable sutures. Repair through a perineal approach without prosthesis is feasible and associated with minimal morbidity. Long-term follow up is needed to make sure this approach provides a durable repair.

05
Migration of polypropylene mesh in the development of late complications. ***V. Iakovlev, A. Koch, R. Bendavid.*** **From St. Michael's Hospital, University of Toronto, Toronto, Ont.; and the Shouldice Hospital, Thornhill, Ont.**

Knitted synthetic meshes have been used in millions of surgeries worldwide since their introduction over 5 decades ago. Depending on a device, up to 10% are excised for complications, which can occur years after implantation. One of the late complications, mesh migration, has been reported in cases of obvious displacement of the mesh through anatomic structures and into adjacent organs. Presently, the mechanisms of mesh migration are unclear and the degree of subclinical mesh displacement in the body is not known. Using a pool of over 180 pathology specimens of polypropylene meshes excised from the anterior abdominal wall and transvaginal locations we searched for features of mesh migration. The findings showed mesh migration in the tissue ranging from microscopic movement to gross migration into the bladder, vas deferens, fallopian tube or transmigration through the mucosa. The features, their incidence and possible mechanisms of mesh migration have been examined. While gross displacement of the mesh can be recognized clinically as obvious complications, movements on a smaller scale can contribute to other complications and need to be considered in treatment strategies.

06
Laparoscopic hernia repair — Has this procedure run its course? ***J.A. Morrison.*** **From Chatham Kent Health Alliance, Chatham, Ont.**

In the 25 years since the introduction of laparoscopic inguinal hernia repair by Shultz, the procedure has failed to fulfil its initial promise to become the gold standard for inguinal hernia repair. There are multiple reasons for this, including the lack of training, available preceptorships, long personal learning curve, lack of surgeon interest and perceived equivocal long-term advantages over open repairs. The laparoscopic approach has also been reserved by many surgeons for repair of recurrent or bilateral hernias while using the open approach for unilateral primary hernia repair. All endoscopic techniques (TAPP), (TEPP), and single port approaches, have been included under the overall term "laparoscopy," while both pure tissue repair, and mesh repairs are combined as "open." A computerized literature search was carried out to obtain statistical figures. The average general surgeon performs about 30–50 cases per annum. Performance of 50–200 laparoscopic cases is considered to be a reasonable personal learning curve. If current guidelines are adhered to, then the average surgeon might perform 4–5 laparoscopic cases per annum. There is also questionable evidence regarding the long-term results, especially in the area of unilateral primary repair. Most surgeons have ignored the laparoscopic approach to inguinal hernia repair. Case volume is drastically reduced if the current international guidelines recommendations

are adhered to. Case times are longer laparoscopically, costs are higher for primary repair. The long-term results of both laparoscopic and open repairs are very similar. Because of the prolonged learning curve, and the reduction of case numbers to a mere handful per annum, laparoscopic inguinal hernia repair may become a procedure reserved for large institutions, where training, preceptorship, and adequate case loads are available.

07

Mesh materials used for hernia repair: Why do they shrink? *R. Guidoin, L. Miao, L. Wang, G. Brochu.* From Laval University, Québec, Que.; and Donghua University, Shanghai, China

Twelve hernia repair meshes implanted for up to 4 years were harvested at recurrence (11) and infection and metulae (1). They were made of polypropylene and/or expanded polytetrafluoroethylene. The devices shrank considerably from 12% to 53% with heavy fibrotic reactions due to the contraction of the scar tissue. The level of inflammation was acceptable. Regretfully, the collagen bundles did not show any waviness, and thus could be considered as responsible for the lack of elasticity of the abdominal wall. In addition, the most outer layers of the polypropylene fibres were frequently uplifted and the nodes of the expanded polytetrafluoroethylene structure dispersed into the surrounding tissues. Despite the plethora of devices available, there is still no consensus about the way to go. Devices that will guarantee the waviness of the collagen fibres and thus the elasticity of the structures should be developed.

08

The role of pure tissue repairs in a tailored concept for inguinal hernia repair. *A. Koch, R. Lorenz, V. Iakovlev, R. Bendavid.* From the International Working Group on Pure Tissue Repairs (Cottbus, Berlin, Toronto)

The Guidelines of the European Hernia Society (EHS) set a clear recommendation that a mesh should be used in every male patient above the age of 18 years. But is there a strong evidence for that? A Cochrane review shows that the use of mesh is associated with a lower rate of recurrence but the quality of included studies, assessed with jaded scale, were low. In clinical praxis it is necessary to include the hernia size in to the decision process for an individualized concept in inguinal hernia repair. The critical analysis of the available studies and the results of a prospective study of 1500 consecutive cases with a minimal follow up of to 12 months will discuss the role of suture repairs yet. The current study shows the results of 1500 inguinal hernia repairs from 2006 to 2013. The median age was 48 years; 30% were suture repairs and 70% mesh repairs. There is an minimum 1-year follow up. Recurrence rates were overall 0.8%, suture repair 0.6% and mesh repair 0.8%. There were no major complications. The infection rate was 0.4% in the mesh and 0.3% in the suture group. A multivariate analysis of more than 40 000 primary inguinal hernias from the Herniamed Registry shows other independent risk factors than the choice of procedure. Contrary to the EHS guidelines we can show the place for suture repair in an tailored concept. For EHS I hernias the suture repair is a good choice with low recurrence rates, especially in young males. The failure of the guidelines is that they don´t discriminate between the different hernia sizes and not respecting individual risk factors.

09

Recurrent inguinal hernias a persistent problem in hernia surgery: analysis of 14 640 recurrent cases in the German hernia database, Herniamed. *R. Lorenz, A. Koch, F. Köckerling.* From Hernia Center 3+Chirurgen, Berlin, Cottbus, Berlin, Germany

We analyzed the results of the German hernia database, Herniamed. We are presenting the statistics comparing all inguinal and recurrent inguinal hernias registered since 2009. Additionally, we use a multivariate analysis to answer the following questions: What types of hernia recur most? What are the most frequent comorbidities? Which risk profiles are related to recurrences? How long after primary repair does recurrence occur? Which operation techniques are linked to most of the recurrences? We identified 133 029 inguinal hernias; 13% (14 640) of them are recurrent cases. All together 1359 (9.3%) of these had a second recurrence, 294 (2.0%) had a third recurrence and 144 (0.9%) cases had more than 3 hernia operations in the medical history. Every technique with or without mesh has multiple recurrences: 55.14% after an open non-mesh repair, 23.86% after open mesh repair and 20.91% after endoscopic repair. Early recurrences have similar frequencies as later recurrences (14.18% after 1 year, 20.89% after 10–20 years). Direct hernias are more often linked to recurrences than primary cases (55.18% v. 47.15%). Males are more affected then females in recurrent cases (91.37% v. 8.63% for recurrences and 87.97% v. 12.03% for primary cases). More than 50% of the recurrent inguinal hernias were in obese patients with a BMI > 25. Males older than 50 years are more affected than females of the same age (74.50% v. 64.07%). Recurrences are an ongoing problem in the repair of inguinal hernias. We count about 13% recurrences in our German hernia database. The recurrences are influenced by biological, technical and surgical factors.

10

Open circular intra-abdominal ventral herniorrhaphy: a new technique in ventral hernia repair. *S. Yeretsian.* From Université de Montréal, Montréal, Que.

We studied an alternative surgical procedure to component separation, diastasis, and bulging cases in moderate abdominal wall defect (10–15 cm) located above the arcuate line. We describea new biosynthetic mesh (patent pending). The old scar is not excised. No need for extensive bilateral external fascial dissection. The peritoneum is entered and the hernia sac is excised. A circular auto-graft biosynthetic composite mesh tailored upon the size of the hernia is developed. A continuous circular suturing is performed with polypropylene 2–0 by fixing the mesh to the parietal peritoneum and posterior rectus sheath. The first row of suture is used for anchoring the mesh as well as partial approximation of the rectus abdominis muscle to its normal anatomic position. The second continuous circular row of sutures delineated by a tinted circle is passed 3,5 cm from the first row of sutures. The second row of sutures will approximate the rectus abdominis muscle to its normal anatomic and physiologic position by re-establising the linea alba and creating an overlapping condition of both edges of the wound requiring an excision of both edges of the skin and subcutaneous tissue for cosmstic wound closure. The wound is drained. Centripetal forces excercised by circular suturing have been calculated based on physical and pathematical laws. Five cases were performed using this method, with 1 wound infection trated with IV antibiotics successfully. It is very efficacious and safe surgical peocedure with less major complications.

CANADIAN SOCIETY OF COLON AND RECTAL SURGEONS

SOCIÉTÉ CANADIENNE DES CHIRURGIENS DU CÔLON ET DU RECTUM

01

Misrepresentation or "spin" is common in robotic colorectal surgical studies. ***S.V. Patel, J.A. Van Koughnett, B. Howe, S.D. Wexner.* From Queens University, Kingston Ont.; Western University, London Ont.; and Cleveland Clinic Florida, Weston, Fla.**

Spin has previously been defined as "specific reporting that could distort the interpretation of results and mislead readers." The purpose of this study was to determine the frequency and extent of misrepresentation of results, or "spin," in studies assessing robotic techniques in colorectal surgery. Publications comparing assessing robotic surgery in colorectal patients were identified by searching Medline and Embase (1992–2014). Studies were included if a nonsignificant difference ($p > 0.05$) in the primary outcome(s) occurred. These studies were then assessed for the frequency, strategy and extent of "spin," or misrepresentation of results, as previously defined. Thirty-eight studies (24 303 patients) were identified. Despite the equivocal nature of these studies, 82% had evidence of spin in either the abstract or the conclusions. The most common form of spin was concluding equivalence between surgical techniques based on nonsignificant differences (76% of abstracts, 71% of conclusions). Claiming improved benefits despite nonsignificance was also commonly observed (26% of abstracts, 45% of conclusions). Due to the small sample size, we did not find evidence of an association between spin and study design, type of funding, publication year or study size. Less than half of studies acknowledged the equivocal nature of the study (47% study abstracts, 34% study conclusions). Only 24% of study abstracts called for further studies, compared with 63% of study conclusions. The absence of spin predicted whether authors acknowledged equivocal results in the study conclusions ($p = 0.02$). Misrepresentation of results was common in the majority of studies assessing robotic colorectal surgery. A large majority of the included studies concluded that robotic surgery was as safe as more traditional techniques, despite small sample sizes and limited follow up data. Readers of these articles need to be critical of authors' conclusions and publishers should ensure that conclusions correspond to the study methods and results.

02

Postoperative pelvic sepsis rates following complete pathologic response to neoadjuvant therapy in rectal cancer. ***D. Mihalicz, M.S. Brar, W.D. Buie, I. Datta, A.R. MacLean, C. MacPherson, H. Huang, B. O'Connor, S. Schmocker, H. Wang, E. Kennedy, J.A. Heine.* From the University of Calgary, Calgary, Alta.; and and Mount Sinai Hospital, Toronto, Ont.**

The objective of this study is to determine if complete pathologic response (pCR) after neoadjuvant chemoradiotherapy increases the risk of pelvic sepsis or results in delayed perineal wound healing following subsequent radical excision. A secondary outcome was to determine if extending the time to resection affects the risk of pelvic sepsis. Patients diagnosed with stage II to IV rectal cancer between Jan. 1, 2005, and Dec. 30, 2013, in 3 major urban centres were identified. Those treated with neoadjuvant chemoradiotherapy with curative intent, followed by surgery, were examined. Demographic, clinical and pathologic data were collected via retrospective chart review. Postoperative pelvic sepsis, confirmed by imaging or operative findings, was defined as either anastomotic dehiscence or pelvic abscess. Delayed perineal wound healing in patients undergoing APR was documented. In total 635 patients fulfilled the inclusion criteria (423 males; mean age 60.3 [range 27–90] yr). Ninety-nine patients (15.6%) had a pCR following neoadjuvant therapy. Of these, 93 (96.9%) completed the prescribed radiation compared with 484 (94.5%) of those who did not achieve a pCR ($p = 0.338$). There was no statistical difference between rates of pelvic sepsis in pCR versus non-pCR patients who underwent a LAR with primary anastomosis (22.8 v. 18.1%, $p = 0.406$) or delayed perineal wound healing in patients who underwent an APR (25.7% v. 29.4%, $p = 0.652$). Pelvic sepsis rates were significantly different in patients who underwent surgery within 8 weeks compared with more than 8 weeks from completion of chemoradiotherapy (19.3% v. 12.9%, $p = 0.028$). A pCR following neoadjuvant chemoradiotherapy for rectal cancer does not appear to be a risk factor for pelvic sepsis or delayed perineal wound healing following radical resection. A longer interval between completion of neoadjuvant therapy and surgery may decrease the rate of these complications.

03

Understanding the complexities of shared decision-making in cancer: a qualitative study of the perspectives of patients undergoing colorectal surgery. ***D.H. Hirpara, W.J. Choi, M.C. Cleghorn, S. Sockalingam, F.A. Quereshy.* From the University of Toronto, Toronto, Ont.**

The decisions leading up to cancer surgery are fraught with uncertainty for many patients, often due to the presence of significant trade-offs between treatment effectiveness and quality of life. Past studies on shared decision-making (SDM) have focused on the physician–patient encounter, with little to no emphasis on the interplay between familial and cultural factors and the decision-making process. The literature on this topic is especially scarce in the field of surgical oncology, with no studies using qualitative patient interviews. The objective of this study was to explore the complexities of the longitudinal and interactive process of SDM within the setting of colorectal cancer surgery (CRCS). An interdisciplinary team, consisting of a psychiatrist, surgical oncologist and nurse navigator, developed a semistructured questionnaire. Telephone interviews were conducted with a convenience sample of 20 CRCS patients. All interviews were audio-recorded and transcribed verbatim. Data saturation was achieved and a descriptive thematic analysis was performed. Three major themes emerged. First, the role of family was

considered a crucial adjunct to the patient–provider dyad. Second, patients identified a variety of facilitators in the decision-making process, including a robust social support system, and competent and caring surgical team. Although language was a perceived barrier for some patients, there was no difference in level of involvement in care between patients who spoke English fluently and those who spoke English as a secondary language. Finally, patients felt they lacked choice and control in making decisions about surgery, thus challenging the very notion of SDM. These commonalities among patients transcended differences in age, education, occupation, and ethnicity. Cultural factors may be less important than family engagement and social support for patients who require surgical treatment for colorectal cancer. Health care providers must be aware of the uniqueness of decision-making in this context in order to empower patients and their families.

04

Impact of hospital volume on quality indices for rectal cancer surgery in British Columbia, Canada. ***R.J. McColl, C.E. McGahan, E. Cai, M.J. Raval, P.T. Phang, A.A. Karimuddin, C.J. Brown.*** **From the University of British Columbia, Vancouver, BC**

The relationship between hospital volume and patient outcomes is controversial in the treatment of patients with rectal cancer. The purpose of this study was to determine if surgery in a high-volume hospital (HVH) is associated with quality indicators known to influence patient outcomes. This is a population based study using 2 sets of data: the British Columbia (BC) Cancer Agency (BCCA) Gastrointestinal Cancer Outcomes Unit (GICOU) database, and the Discharge Abstract Database maintained by the BC Ministry of Health. We merged these databases and identified all patients ≥ 18 years old treated with surgery for a stage I–III rectal adenocarcinoma during the period 2003–2009. HVHs were defined as those centres performing ≥ 20 rectal cancer surgeries in a given year. The primary outcomes were operative and perioperative factors that have proven influence on patient outcomes. Between 2003 and 2009, 2081 patients had curative-intent surgery for rectal cancer in BC. Of these, 1690 patients had surgery in 1 of 17 HVHs whereas 391 had surgery in 1 of 28 low-volume hospitals. Patients were similar in age, sex, and cancer stage. In a multivariate analysis, patients who had surgery in an HVH were more likely to have sphincter-preserving surgery (OR 2.02, 95% CI 1.46–2.80), ≥ 12 lymph nodes removed with the tumour (OR 1.40, 95% CI 1.10–1.78), neoadjuvant radiation therapy (OR 1.57, 95% CI 1.10–2.25), and receive chemotherapy (OR 1.49, 95% CI 1.14–1.96). There was no impact of hospital volume on overall survival. For rectal cancer patients in BC, being treated at an HVH is associated with several quality indicators linked to better oncologic or quality of life outcomes.

07

The effect of laparoscopy on inpatient cost after elective colectomy for colon cancer. ***A.G. Doumouras, F. Saleh, J.-E. Tarride, D. Hong.*** **From McMaster University, Hamilton, Ont.**

Laparoscopy in colorectal cancer (CRC) has demonstrated similar oncologic outcomes and morbidity profiles to open surgery with added benefit of less pain and decreased hospital stay. Though laparoscopy can be initially expensive, we wanted to determine whether the benefits led to decreased inpatient cost utilization. We performed a population-based, retrospective cohort study including all patients, (age > 18 yr) who received an elective colectomy for CRC in Ontario from April 2008 until March 2012. Patient demographics, comorbidities, procedures and complications were derived from the Canadian Institute of Health Information's (CIHI) Discharge Abstract Database. The CIHI statistics of resource intensity weight and cost per weighted case were used to determine the costs of each patient's index admission. A multivariate generalized linear regression model using an inverse Gaussian distribution was developed to determine the effects of covariates on total inpatient cost per patient. Over 4 years, 8659 patients with CRC underwent colectomy. Unadjusted median costs were significantly different between open and laparoscopic procedures, ($9484 v. $7787, $p < 0.001$). Length of stay was also shorter for laparaoscopic procedures (9.24 d v. 6.88; $p < 0.001$). After adjustment for covariates, use of laparoscopy was predictive for a decreased inhospital resource utilization of $758 per patient (95%CI $666–$851, $p < 0.001$). For every complication experienced, costs increased by $1637 (95% CI $1536–$1739, $p < 0.001$) and leaks specifically increased costs by $16149 (95% CI $12 792–$19 507, $p < 0.001$) while reoperation added $8575 (95% CI $6092–$11 058, $p < 0.001$). Lastly, chronic kidney disease $752 (95% CI $249–$1256, $p = 0.003$) and increased patient age ($21/yr, 95% CI $17–$24, $p < 0.001$) predicted higher than expected resource utilization. Overall, elective laparoscopic colectomy for CRC in Ontario was more efficient on a per patient basis from 2008–2012 than open even after adjusting for comorbidities, total length of stay and ICU length of stay. Major drivers of resource utilization included reoperation, anastomotic leaks, kidney disease and patient age. The utilization of laparascopy had the potential savings of $3 million per year.

08

Predictors of variation in neighbourhood access to laparoscopic colectomy for colon cancer. ***A.G. Doumouras, F. Saleh, D. Hong.*** **From McMaster University, Hamilton, Ont.**

Rates of laparoscopic colectomy for colon cancer have steadily increased since its inception and currently accounts for a third of colectomy procedures compared with open in the United States. This study evaluated the variation in laparoscopy use for colon cancer in Ontario. We identified all patients aged > 18 years who received an elective colectomy for colon cancer from April 2008 until March 2012 in the province of Ontario. Patient demographics, comorbidities and procedures were derived from the Canadian Institute of Health Information's (CIHI) Discharge Abstract Database. Rates of laparoscopy were calculated for each neighbourhood and a cluster analysis was performed to determine spatial aggregation of neighbourhoods with significantly higher (hot spots) or lower (cold spots) rates than would be expected with random variation. Ordinal logistic regression was used to identify independent predictors of access. Overall, 8609 patients underwent colectomy with 3699 done laparoscopically. Rates of laparoscopy were 18% in cold spots and 67% in hot spots ($p < 0.001$). Overall, 54 cold spot neighbouhoods were identified, representing 1.3 million people of whom 965 underwent colectomy. In the multivariate analysis, patients from rural neighbourhoods were less than half as likely to be in a hot spot,

OR 0.47 (95% CI 0.24–0.92, $p = 0.03$). Additionally, having a minimally invasive surgery (MIS) fellowship training facility within the same administrative health region as the neighbourhood made it more than 22 times as likely to be a hot spot, OR 22.43 (95% CI 10.14–49.62, $p < 0.01$). Neighbourhood socioeconomic status was not associated significant spatial aggregation. This study identified significant variation in the utilization of laparoscopy for colon cancer within Ontario. Rural neighbourhoods were more likely to be in cold spots for while neighbourhoods near MIS training centres were more likely to be in hot spots. Further study into the causes of this variation is needed to identify ways to address it.

09

Predictors of 30-day readmission after elective colectomy for colon cancer. ***A.G. Doumouras, F. Saleh, D. Hong.*** **From McMaster University, Hamilton, Ont.**

Avoidable readmission after surgery is a major burden on health care resources and is common after CRC surgery. However, strategies for prevention must first identify actual risk factors. Our objective, then, was to evaluate for independent predictors of 30-day readmission after elective colectomy for CRC in Ontario. We performed a population-based cohort study that included all patients who received an elective colectomy for CRC in Ontario from April 2008 until March 2012. Patient comorbidities, procedures and demographics were derived from the Canadian Institute for Health Information Discharge Abstract Database and Hospital Morbidity Database. Neighbourhood socioeconomic status was derived the Ontario Marginalization Index. Thirty-day readmission rates was calculated from index procedure. Multivariable logistic regression was used to examine independent predictors of readmission. Over 4 years, 8659 procedures were performed with an overall 30-day readmission rate of 8.5%. After multivariate regression, patients having a complication during initial admission were 1.37 times as likely to be readmitted (95% CI 1.17–1.60, $p < 0.001$) and patients from rural neighbourhoods were also more likely to be readmitted OR 1.24 (95% CI 1.03–1.50, $p = 0.025$). In addition, when compared with patients from the lowest socioeconomic quintile, all other patient quintiles were less likely to be readmitted. Age, sex, laparoscopy, comorbidities and distance had no effect likelihood of readmission. The readmission rate after elective CRC surgery in Ontario is similar to other major population-based cohorts. Complications on initial admission, rural patients and patients in the lowest socioeconomic quintile were more likely to be readmitted. Considering a large proportion of the readmissions were short-term, future research into potential measures to prevent these readmissions is essential.

10

Neutrophil-to-lymphocyte ratio predicts major perioperative complications in patients with colorectal cancer. ***J.M. Josse, M.C. Cleghorn, K.M. Ramji, H. Jiang, T.D. Jackson, A. Okrainec, F.A. Quereshy.*** **From the University of Toronto; the University Health Network, and the Princess Margaret Cancer Centre, Toronto, Ontario.**

Neutrophil:lymphocyte (NLR) and platelet:lymphocyte (PLR) ratios are well-studied biomarkers for systemic inflammation. It has been hypothesized that an increased systemic inflammatory response can negatively impact surgical outcomes in cancer patients. The objective of this study was to evaluate the association of NLR and PLR with the occurrence of major perioperative complications in patients undergoing colorectal surgery. A retrospective cohort study of patients who underwent resection for suspected colorectal cancer (CRC) from 2004 to 2012 was conducted. NLR and PLR scores were calculated from preoperative and postoperative blood work. High- versus low-value cohorts were defined via ROC curve analysis. Univariate and multivariable logistic regression was used to determine if patients with elevated NLR/PLR were more likely to suffer major perioperative complications. In total 583 patients were included; 362 (62%) colon surgeries and 221 (38%) rectal surgeries were performed. A total of 281 (48%) cases were laparoscopic and 302 (52%) were open. Fifty-two (9%) major complications were observed. NLR ≥ 2.3 was significantly associated with a major perioperative complication (OR 2.52, 95% CI 1.26–5.01). PLR was not associated with major complications. Other factors associated with major complications included Charlson Comorbidity Index ≥ 3 (OR 4.83, 95% CI 2.31–10.11) and male sex (OR 2.06, 95% CI 1.09–3.89). On multivariable analysis, high NLR (OR 2.25, 95% CI 1.12–4.52) and Charlson score (OR 4.55, 95% CI 2.17–9.56) retained significant. No relationships were found among complication type, although risk of anastomotic leak approached statistical significance (OR 2.96, 95% CI 0.99–8.91). NLR ≥ 2.3 is an independent risk factor for major surgical complications following resection for CRC. Using the preoperative NLR may provide clinicians with a tool for identifying potential high-risk surgical patients. The risk for anastomotic leak may be associated with an elevated NLR. Further study is needed to validate this threshold and evaluate the clinical implications of these findings.

12

Sessile serrated adenoma (SSA) detection-predictive factors. ***R. Daigle, A.R. MacLean, W.D. Buie, J. Heine, M. Brar, I. Datta, R.J. Hilsden.*** **From the University of Calgary, Calgary, Alta.**

The purpose of this study was to determine the incidence and predictors of SSA detection in patients undergoing average risk screening colonoscopy. All average risk patients who underwent screening at the Colon Cancer Screening Center from 2008 to 2013 were included. Patients with an SSA were identified. Patients with incomplete colonoscopy were excluded. Factors potentially predictive of SSA detection included standard endoscopic quality indicators (annual colonoscopy volume, cecal intubation rate and average withdrawal time), time of procedure, specialty of the endoscopist, patient age and sex. Univariate and multivariate analyses were used to determine if there was an association between these parameters and SSA detection rate. In total 35 031 patients underwent screening colonoscopy (52% female; average age 58 [range 50–74] yr); 1808 (5.2%) patients had at least 1 SSA. Most endoscopists performed more than 200 colonoscopies/year (4% < 200) and had an average withdrawal time ≥ 6 minutes (73%). The mean adenoma detection rate was 29.7% (range 11%–45%) and the mean SSA detection rate was 4.9% (range 0.4%–13%). On multivariate analyses patient age > 65 years (OR 1.2, $p < 0.001$), high cecal intubation rate (≥ 95%; OR 5.2, $p < 0.001$), colonoscopy average of > 200 (201–400 colonoscopies per year; OR 1.6, $p < 0.001$), > 400, (OR 2.1, $p < 0.001$), an average withdrawal time of ≥ 8 minutes (OR 2.3, $p < 0.001$) and afternoon procedure (OR 1.2, $p = 0.01$), were predictive of SSA detection. There was no difference in SSA detection between gastroenterologists and colorectal surgeons. Five percent of patients

undergoing average risk colorectal cancer screening were found to have a SSA. Factors predictive of SSA detection included patient age > 65 years, moderate to high volume endoscopists, high cecal intubation rate (≥ 95%), withdrawal time ≥ 8 minutes and afternoon procedure. Validated quality indicators for adenoma detection also appear to be applicable to SSA detection rates.

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Diverticular abscess managed with long-term definitive nonoperative intent is safe. ***R. Garfinkle, A. Kugler, V. Pelsser, P.H. Gordon, N. Morin, C.A. Vasilevsky, J. Faria, G. Ghitulescu, L. Feldman, M. Boutros.*** **From the Jewish General Hospital and the McGill University Health Centre, Montréal, Que.**

Initial nonoperative management for diverticulitis complicated by abscess has become standard; however, the need for elective resection following this index episode is unclear. The purpose of this study is to assess the long-term outcomes of definitive expectant management following initial nonoperative treatment of diverticular abscess. All cases of computed tomography scan-documented acute sigmoid diverticulitis complicated by abscess ≥ 2.0 cm from 2000 to 2013 were identified; only those cases managed with nonoperative intent were further reviewed. All computed tomography scans were rereviewed by a blinded gastrointestinal radiologist. The primary outcome was emergency sigmoid resection for diverticulitis. Secondary outcomes were recurrent diverticulitis (uncomplicated and complicated) and elective sigmoid resection for diverticulitis. Of 104 patients with acute sigmoid diverticulitis with abscess, a total of 73 patients underwent nonoperative intent with long-term expectant management. Median abscess size was 5.0 (range 3.2–6.4) cm, and median follow-up was 62 (range 28–98) months. Following resolution of the index episode, 22 patients (30.1%) experienced a recurrent episode of diverticulitis at a median time to recurrence of 23 (range 9–40) months. Two patients (2.7%) had a recurrent episode with peritonitis that required a Hartmann procedure at 6 and 64 months, respectively. Seven (9.6%) patients experienced a complicated recurrence (4 pericolic abscess, 2 fistula, 1 hepatic abscess) for which an elective sigmoid colectomy was performed (median time-to-colectomy 33 [range 16–56] months). Thirteen (17.8%) patients experienced an uncomplicated recurrence, all of whom were managed with continued nonoperative intent (median follow-up 81 [range 34–115] months). Female sex (61% v. 35%, $p = 0.047$) and a prior episode of diverticulitis before the index diverticular abscess (44% v. 14%, $p = 0.0076$) were associated with an eventual recurrent episode. After the initial successful nonoperative treatment of diverticulitis with abscess, expectant management with nonoperative intent is a safe long-term option with low rates of surgery, especially in the emergency setting.

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Long-term outcomes of conservative management following successful nonoperative treatment of acute diverticulitis with abscess: a systematic review. ***A. Kugler, N. Trabulsi, A. Al-Khamis, N. Morin, P.H. Gordon, C. Vasilevsky, G. Ghitulescu, J. Faria, M. Demian, M. Boutros.*** **From the Jewish General Hospital, Montréal, Que.**

The aim of our systematic review is to assess the long-term outcomes of conservative management following successful nonoperative treatment of acute colonic diverticulitis complicated by abscess. A systematic search in PubMed, Medline, Embase, Cochrane and Northern Light on acute colonic diverticulitis complicated by abscess was performed without date or language restrictions. All randomized controlled trials, nonrandomized comparative studies and observational studies on nonoperative management of acute diverticulitis were included. Case reports, case series, technical reports and review articles were excluded. We included studies that clearly stated a diagnosis of diverticulitis with abscess, nonoperative treatment on index admission including laparoscopic lavage and drainage and no planned elective resection. Long-term outcomes assessed were recurrence, need for emergency or elective operation, mortality and quality of life. Abstracts, full manuscripts and data extractions were reviewed by 2 independent, blinded authors and arbitrated by a third author. Nine out of 1303 identified publications fulfilled the inclusion criteria. In these 9 studies, 388 of 2451 patients were managed with conservative intent following successful nonoperative treatment of acute diverticulitis with abscess at the index admission. These 388 patients comprised our study population. The overall recurrence rate was 22.4% (87 patients) for a follow-up period of 2–180 months. Of these, 107 (27.6%) patients underwent surgery during the follow-up period. Eleven (2.8%) patients required an emergency operation due to recurrence with free perforation and peritonitis ($n = 7$) or abscess ($n = 4$). Forty-eight (12.4%) patients underwent an elective resection for recurrent diverticulitis (7 fistula, 5 stenosis, 29 recurrent symptoms, 2 phlegmons, 5 indication not specified). One patient (0.3%) died due to a recurrence of acute diverticulitis. No studies reported quality of life. In this systematic review, conservative management following successful nonoperative treatment of acute colonic diverticulitis complicated by abscess is associated with a low rate of emergency operation and death.

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Incidence of ischemic colitis after abdominal aortic aneurysm repair: results from the national surgical quality improvement program database. ***M. Abou Khalil, J. Abou Khalil, P. Gordon, D. Obrand, M. Boutros.*** **From McGill University, Montréal, Que.**

Ischemic colitis (IC) is a recognized complication of abdominal aortic aneurysm (AAA) repairs. Although it occurs infrequently, IC is associated with a high morbidity and mortality. The aim of our study was to investigate the rates of IC after open and endovascular AAA repair. We obtained the vascular procedure specific participant user files for patients undergoing open and endovascular AAA repairs within the American College of Surgeons National Surgical Quality Improvement Program database for the year 2012. Data on demographics, indication for surgical intervention, medical comorbidities, aneurysm diameter, transfusion requirement and IC were analyzed. We excluded patients presenting with aortic ruptures from the analysis and treated endovascular-to-open conversion as open procedures. The primary outcome IC. We performed multivariate logistic regression to identify predictors of IC and adjust for possible confounders. In 2012, 672 patients underwent open abdominal aortic aneurysm repair and 2067 patients underwent endovascular AAA repair. Seventeen patients were converted from an endovascular to an open repair and they were included in the open group. Patients with ruptures were excluded (52 in the open repair, 67 in the

endovascular repair). Operating time was significantly shorter in the endovascular group (258 min and 151 minutes, $p < 0.001$). Patients undergoing an endovascular repair were older, had higher ASA scores and higher BMI scores. The rate of IC following endovascular and open endovascular AAA repairs was 1.5% and 5.7%, respectively. On multivariate analysis accounting for confounders such as age, sex, transfusion requirement, symptoms, hematocrit, embolization and aneurysm diameter, endovascular repair remained significantly associated with decreased odds of IC compared with an open repair (OR 0.36, 95% CI 0.184–0.709). In this large database, the rate of IC was 1.5% and 5.7% following endovascular and open AAA repairs, respectively. Endovascular AAA repair was associated with significantly decreased odds of IC compared with open AAA repair.

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Sigmoid colectomy for acute diverticulitis in immunosuppressed v. immunocompetent patients: outcomes from the ACS-NSQIP database. ***A. Al-Khamis, J. Abou Khalil, C.-A. Vasilevsky, N. Morin, G. Ghitulescu, P.H. Gordon, M. Demian, J. Faria, M. Boutros.*** **From the Jewish General Hospital, McGill University, Montréal, Que.**

To examine the impact of immunosuppression on mortality and morbidity following colectomies for acute diverticulitis in the emergency and elective settings. Patients with acute diverticulitis who underwent emergency or elective colectomy, between 2005–2012 were identified from the American College of Surgeons National Surgical Quality Improvement Program database. Immunosuppression was predefined in this database as chronic or high dose corticosteroid (2005–2010) or immunosuppressant (2011–2012) use. Multivariate regression was used to assess the impact of immunosuppression on mortality, serious morbidity, organ space infection, infectious outcomes and wound dehiscence. Of 26 987 patients, a total of 4271 (596 immunosuppressed and 3675 immunocompetent) patients had emergency and 22 716 (736 immunosuppressed and 21 980 immunocompetent) patients had elective colectomies. Immunosuppressed compared with immunocompetent patients had appeared to have more comorbidities. In both groups, mortality and serious morbidity were significantly higher in the emergency setting (immunosuppressed 16% and 45%, immunocompetent 4% and 28%) compared with the elective setting (immunosuppressed 2% and 17%, immunocompetent 0.4% and 8%, $p < 0.001$). On multivariate regression for the emergency setting, immunosuppression significantly increased risk of mortality (OR 1.82, 95%CI 1.01–3.28), and did not appear to increase risk of serious morbidity, organ space infection, overall infectious complications or wound complications compared with immunocompetent patients. On multivariate regression for the elective setting, mortality was similar in immunosuppressed and immunocompetent groups; however, major morbidity was increased in immunosuppressed compared with immunocompetent patients (OR 1.4, 95%CI 1.7–1.8). Emergency colectomy for diverticulitis is associated with higher mortality in immunosuppressed compared with immunocompetent patients, while elective colectomy is associated with comparable mortality. In the elective setting, immunosuppressed compared with immunocompetent patients are at increased risk of major morbidity; while in the emergency setting, the impact of immunosuppression on morbidity may not be observed due to increased mortality in this group.

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A cross-sectional survey of health and quality of life of patients awaiting colorectal surgery in Canada. ***A. Karimuddin, C. Brown, M. Raval, P. Phang, G. Liu, R. Crump, J. Sutherland.*** **From St. Paul's Hospital, University of British Columbia, Vancouver, BC**

Patient reported outcomes (PROs) are an integral part of providing patient care. In health care environments where patients wait for surgery, PROs at presentation and postoperatively may inform triage and booking practices. Within the context of a large prospective study of patients waiting for surgery, this study reports cross-sectional data on domains of patients' health waiting for colorectal surgery. The British Columbia surgical patient registry was queried to identify patients referred for colorectal surgery. Patients were recruited immediately after being placed on the registry. Data collection began in September 2012. Patients completed health status instruments to assess for overall health (EQ-5D), pain (PEG-3) and depression (PHQ-9). Surveys were filled at surgical booking. Patients awaiting colorectal surgery were separated into 3 domains: A) patients awaiting abdominal/cancer surgery, B) patients awaiting reversal of stomas, and C) patients awaiting proctological procedures. In total 983 patients were contacted to provide baseline data, with 479 (42.33%) participating. Group A had 277 patients, Group B 80, and Group C 122. Compared with abdominal/cancer and reversal of stoma, patients waiting for proctology were found to have more problems with mobility, self-care and pain. On the pain scale (PEG-3), patients awaiting proctology suffered from higher levels of pain (> 3.0), while younger patients had higher levels of pain on multivariate analysis. 17.5% of patients awaiting reversal of ostomy displayed signs of depression. Comorbidities were associated with lower health status, and higher pain and depression in a negative direction. Female patients were more likely to experience pain and depression. Patients presenting to colorectal surgeons for diagnosis and surgical planning, self-report significant problems with their quality of life. This extends across domains related to mobility, self-care and depression. Attention must be paid to this wider array of morbidity as well as to the need for nonsurgical interventions while patients wait for elective surgery.

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Self-expanding metal stents versus emergent surgery in acute malignant large bowel obstruction. ***I.L. Browne, S. Drolet, J. Heine, T. MacLean.*** **From the University of Calgary, Calgary, Alta.**

Patients presenting with acute malignant colonic obstruction continue to present a treatment dilemma. Options include self-expanding metal stent (SEMS) as a bridge to surgery, or emergency surgical intervention. While there was much enthusiasm about SEMS recent data have raised concerns about the safety and efficacy of the procedure. The objective of this study was to assess short and long-term outcomes of patients undergoing curative resection following SEMS insertion compared with patients undergoing emergent surgery (ES). All patients presenting with acute malignant colonic obstruction between April 2002 and March 2009 were identified. Electronic and conventional medical records were reviewed. Demographic data, tumour location, clinical outcomes of attempted stent insertion, and type of surgery performed were recorded. Patients who had an attempt at stent insertion were analyzed in the stent

group on an intention to treat basis. Long-term outcomes including overall survival (OS) and disease free survival (DFS) were determined using the Kaplan–Meier method. 114 patients were included, of which 62 underwent emergent surgery and 52 underwent SEMS insertion. Thirty-day mortality was 8.06% in the ES group versus 3.8% in the SEMS group ($p = 0.451$). Two-year OS was 76.9% in the SEMS group and 67.7% in the ES group ($p = 0.274$), while 5-year OS was 59.6% and 43.5%, respectively ($p = 0.054$). About 51.9% of SEMS patients were alive at 10 years compared with 31.7% of ES patients ($p = 0.050$). Ten-year DFS was similar between groups ($p = 0.33$). Patients with a failed SEMS had similar 10-year OS and DFS to the ES group. Our study demonstrates that SEMS as a bridge to surgery in patients presenting with acute large bowel obstruction is a safe and effective strategy compared with ES. Long-term oncologic outcomes are similar with a trend toward favouring the SEMS group. SEMS should be considered in patients presenting with malignant colonic obstruction.

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Combined laparoscopic and TAMIS LAR in a morbidly obese patient after open right hepatectomy. ***C. Morin*, *F. Letarte*, *A. Bouchard*, *S. Drolet*. From Laval University, Québec, Que.**

Laparoscopic low anterior resection (LAR) for rectal cancer is a challenging surgery in morbidly obese male patients. Transanal minimally invasive surgery (TAMIS) is a flexible access platform developed in 2009 to gain mobility over the transanal endoscopic microsurgery (TEM) platform. A new hybrid approach combines laparoscopic and TAMIS views to accomplish a down–up mesorectum dissection with enhanced visibility. TAMIS allows for rectal transection having the tumour under direct vision and ensures a negative distal margin. This video demonstrates a case of combined laparoscopic and TAMIS LAR in a morbidly obese male patients after open hepatectomy. Combined laparoscopic and TAMIS LAR was carried out in a 69-year-old morbidly obese man with a clinical T3N1M1 rectal adenocarcinoma with 4 liver metastases. The patient first underwent induction chemotherapy followed by right hepatectomy. Then he received neo-adjuvant long course chemoradiation. The surgery was initiated laparoscopically with mobilization of the splenic flexure, high ligation of the inferior mesenteric artery and TAMIS distal rectal transection and retrograde mesorectal dissection. The patient underwent a combined laparoscopic and TAMIS LAR with primary stapled anastomosis and diversion ileostomy. Tumour directed TEM was accomplished with 2 cm distal margin and an intact mesorectal fascia. Combined laparoscopic and TAMIS LAR is feasible and allows a good retrograde dissection for rectal cancer in morbidly obese male patients. This approach ensures distal transection under direct vision and offers the possibility for stapled anastomosis with a double purse-string suture technique. http://youtu.be/Vqf7Cek5Em4.

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Safety and feasibility of laparoscopic rectal cancer resection in morbidly obese patients. ***A. Brind'Amour*, *F. Letarte*, *A. Bouchard*, *P. Bouchard*, *C. Thibault*, *R.C. Grégoire*, *J. Gagné*, *S. Drolet*. From Laval University, Québec, Que.**

Rectal resection for cancer can be technically challenging, especially in the obese patient. While some have investigated the impact of laparoscopic surgery on rectal cancer, no specific study looked at the subgroup of morbidly obese patients. The goal of this study was to evaluate feasibility and safety of laparoscopic rectal resection for cancer in this population. All morbidly obese patients, defined as a BMI of 40 kg/m^2 or greater, undergoing laparoscopic rectal cancer resection for primary cancer between January 2006 and July 2013 were identified using medical records in a single academic hospital centre. Operative and postoperative outcomes, lymph node harvest, resection margins, total mesorectal excision (TME) grading and survival outcomes were evaluated. Thirteen patients underwent laparoscopic approach. There were 7 males (53.8%). The median BMI was 42.4. There were 5 low rectal tumours (38.5%). Six patients (46%) received neoadjuvant chemoradiation treatment. Median operative time was 315 minutes. Median estimated blood loss was 605 mL. There were 4 conversions (30%). Anastomotic leak occurred in 2 patients (15.4%). Median number of lymph node retrieved was 20.0. TME was complete in only 9 patients (69.2%), with 3 patients with incomplete TME being also in the conversion group. There was no mortality or morbidity. The median time of follow-up was 30.5 months. There was no local or distant recurrence. This study suggests that laparoscopic rectal resection for cancer in morbidly obese patients is challenging and associated with a higher rate of conversion compared with patients with lower BMI. Adequate TME resection can be achieved in most patients, although conversion is associated with worse specimen quality. Mortality, morbidity and readmission rates are similar to the literature showing the same benefit for laparoscopic procedure. Further studies are needed to identify patients at risk of conversion that may benefit from an open approach.

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Factors associated with morbidity following sacral neurostimulation for fecal incontinence: beware of the high risk groups. ***S.A. Chadi*, *A.J. Cracco*, *F.G. Rodrigues*, *M. Zutshi*, *B. Gurland*, *S.D. Wexner*, *G. da Silva*. Cleveland Clinic Florida, Weston, Fla.; Cleveland Clinic, Cleveland, Oh.**

Sacral neurostimulation (SNS) has become a preferred treatment for fecal incontinence (FI). The aim of this study was to identify the factors associated with morbidity following SNS for FI. An IRB-approved retrospective review of prospectively collected data of patients treated for FI with SNS was performed. Demographic variables, causes of FI and surgical details were correlated with the incidence of morbidity. Morbidity included pain, infection, noninfectious wound concerns, lead-related issues, loss and lack of efficacy. Categorical variables were analyzed with χ^2 analysis, whereas nonparametric variables were compared with the Mann–Whitney U test. Significance was defined as a $p < 0.05$. In total 115 patients (mean age 58.5 ± 15 yr, 85% females) underwent implantation of the device from 2010 to 2014 in 1 institution. The median follow-up was 8 (range 0.3–37) months. The most common morbidity was stimulation related pain (21.7%) whereas pain at the site of implantation occurred in 11.3% of patients. Furthermore a history of pain syndromes ($p = 0.03$) was found to be significantly associated with higher rates of stimulation-related pain whereas the only factor associated with pain at the site of implantation was male gsexender ($p = 0.01$). A loss of efficacy was observed in 16.5% of patients while other 7% of patients never derived significant benefit. A loss of efficacy was found to be significantly associated with a prior

spinal surgery (p = 0.03). Fifteen percent (17/115) underwent explantation after first surgery, and 8% (9/115) had surgical revision, with 33% (3/9) requiring further explantation. Thirteen percent (15/115) underwent reimplantation with 20% (3/15) requiring explantation. There is minimal information on the rates of morbidity in patients with SNS procedures performed for FI. This study suggests that male gender, prior spinal surgery, and a history of pain syndromes were correlated with postoperative morbidity.

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Hyperglycemia increases surgical site infections following colorectal resections for malignancy in a standardized patient cohort. ***S.A. Chadi, N.M. Saur, D. Bekele, H. Amer, E.G. Weiss, G. da Silva, S.D. Wexner*. From Cleveland Clinic Florida, Weston, Fla.**

The current evidence supporting increase postoperative morbidity and mortality in hyperglycemic patients is heterogeneous. We examined the effect of hyperglycemia on postoperative infections in patients with colorectal cancer resections (CCR). A retrospective review of an IRB-approved prospective database was performed for patients with a CCR from 2008 to 2014. All analyses, confounding variables and outcomes were proposed a priori. Primary outcome was evidence of a surgical site infection (SSI) defined by the CDC criteria. Main independent variable was postoperative day 1 (POD1) glucose level with hyperglycemia defined a priori as > 180mg/dL. Categorical variables were compared in univariate analyses with χ^2 tests. Multivariable logistic regression (MVR) was performed to adjust for confounding and identify the role of proposed variables on predicting the outcome of SSI. In total 349 patients underwent CCR (mean age 65.3 ±13.7 yr). All patients received preoperative antibiotics. Twenty percent had a stage 3 or 4 malignancy. Twenty-six patients had POD1 hyperglycemia (mean 128.6 ± 33.6 mg/dL), with 70 (20%) identified with a SSI. Mean operative time was 190 ± 111 minute. Neither POD1 glucose (p = 0.312) nor POD1 hyperglycemia (p = 0.054) were associated with the presence of SSI (p = 0.312). Active smokers and those with a laparotomy had higher rates of SSI (p = 0.015, p < 0.001, respectively). Higher cancer stages (3/4) was significantly associated with SSI (p = 0.03). MVR adjusting for known predictors (smoking status, surgical approach, diabetes diagnosis, cancer stage and POD1 hyperglycemia) was performed with the dependent variable of SSI (Hosmer–Lemeshow p = 0.45); operative time was excluded for concerns of colinearity with surgical technique. Smoking (OR 4.6, 95% CI 1.8–11.7, p = 0.002) and hyperglycemia (OR 3.3, 95% CI 1.2–9.1, p = 0.019) were predictors of SSI while laparoscopy (n = 209; 60%) was protective against SSI (OR 0.21, 95% CI 0.12–0.39, p < 0.001). POD1 hyperglycemia is associated with increased rates of SSI when controlling for confounders. This reiterates the need for stringent postoperative glycemic control regardless of history of diabetes to improve surgical outcomes.

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Implementing an enhanced recovery program after colorectal surgery in elderly patients: Is it feasible? ***C. Antczak, Y. Bendavid, M. Poirier, F. Heyen, J.F. Latulippe, M. Henri*. From Université de Montréal, Montréal, Que.**

We compared the outcomes following implementation of an enhanced recovery program (ERP) between elderly patients undergoing elective colorectal surgery and their younger counterparts. With the approval of our centre's ethics committee, implementation of the enhanced recovery after surgery (ERAS) protocol was studied prospectively in a consecutive series of patients undergoing colorectal surgery between September 2013 and August 2014. Patients were separated into 2 subgroups: ≤ 70 years and > 70 years. End points were compliance with ERP elements, length of stay, readmissions, emergency department visits, morbidity and mortality. A total of 201 colorectal surgery patients underwent ERAS, 110 (54.7%) were ≤ 70 years (YP) and 91 (45.3%) were > than 70 years (EP). Diagnosis, type of surgery and ASA grade were significantly different between the 2 groups. The most common diagnosis was cancer in both groups. The main type of surgery was anterior or low anterior resection in the YP (n = 46) and right colectomy in the EP (n = 33). EP showed no difference in terms of compliance with the ERP elements compared with YP. There was no difference in the rate of postoperative ileus, surgical site infection, and cardiac, and pulmonary complications between both groups. Median length of stay was 4 days in the YP and 5 days in the EP. There was no difference in median time to achieve discharge criteria (p = 0.450) and total length of stay (p = 0.106) between the 2 subgroups. There was no difference in the rate of emergency visit (p = 0.408), readmission (p = 0.577), reoperation (p = 0.525) and mortality (0% in both groups) between the younger patients and their elderly counterparts. The ERP program is feasible for elderly patients above the age of 70 years and can be safely implemented with comparable readmission, morbidity, and mortality rates.

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From laparoscopic-assisted to total laparoscopic right colectomy with intracorporeal anastomosis: Is the shift in technique justified? ***U. Hameed, K. Beyfuss, V.N. Palter, P.K. Stotland, A. Okrainec, L.V. Klein, M.A. Aarts, S. Ashamalla*. From the University of Toronto, Toronto, Ont.**

Total laparoscopic right colectomy (TLC) with intracorporeal anastomosis is gaining popularity over laparoscopic-assisted right colectomy (LAC), but requires advanced laparoscopic technique. This multicentre retrospective review compares the 2 techniques performed at 5 academic-affiliated hospitals. Patients undergoing laparoscopic right hemicolectomy for neoplasm between Jan. 1, 2009, and Jan. 1, 2014, were included. Those undergoing resection for non-neoplastic conditions or emergency cases were excluded. Patients were identified using operating room databases coding for laparoscopic right hemicolectomy. Data collection included patient demographics, perioperative outcomes, complications, and pathology. Analysis was performed using the χ^2 test for categorical variables and Mann–Whitney U test for continuous variables were used to test significance of differences between the groups. p < 0.05 was considered significant. In total 619 patients underwent laparoscopic right hemicolectomy between Jan. 1, 2009, and Jan. 1, 2014 (297 TLC, 322 LAC). The 2 groups were similar in terms of age, sex, and T stage. The TLC group had a longer operative time (164 v. 133 min, p < 0.001), but shorter return to bowel function (48h v. 71h, p < 0.001) and length of hospital stay (4d v. 5d, p < 0.001). Mean lymph node harvest (18 v. 18 p = 0.481) was equivalent. There was no difference in the rate of anastomotic leak (4.7% v. 6.2%,

$p = 0.414$) or wound infection (7.1% v. 7.5%, $p = 0.855$); however, the TLC group had a lower incidence of ileus (22.9% v. 31.7% $p = 0.014$), postoperative bleeding (7.1% v. 12.4%, $p = 0.026$), and urinary retention (10.1% v. 5.9%, $p = 0.05$). Late complications such as incisional hernia (5.4% v. 9.9%, $p = 0.034$) and bowel obstruction (1.3% v. 4.3%, $p = 0.026$) were also lower for the TLC group. TLC results in improved postoperative recovery, short and long-term complications, but requires a longer operative time. The adequacy of lymph node harvest is equivalent.

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Surgical site infection rates following implementation of a "colorectal closure bundle" in elective colorectal surgeries. ***A. Ghuman, C. Brown, A. Karimuddin, M. Raval, P.T. Phang.* From St. Paul's Hospital, University of British Columbia, Vancouver, BC**

Colorectal surgery is associated with high rates of surgical site infection (SSI). We implemented a change in our operative care bundle consisting of change in gown and gloves, redraping, wound lavage and new set of instruments for closure. The aim of this study is to determine whether this intervention has decreased SSI. We reviewed prospectively collected data for consecutive elective colon cancer or inflammatory bowel resections with primary anastamosis from August 2013 to July 2014 enrolled in our enhanced recovery after surgery (ERAS) program. Patients were excluded that had stoma creation or pre operative chemoradiation. SSI was defined using Centers for Disease Control criteria. Our perioperative protocol includes carbohydrate loading, mechanical bowel prep, hair clipping in OR, warming blankets in the pre-, intra- and postoperative periods, antibiotics in OR before incision and after 4 hours, and subcutaneous heparin after anesthetic induction. We compared SSI rates for colorectal resection surgeries before (August to December 2013) and after (January to July 2014) implementation of the new care bundle. In total, 205 patients were reviewed: 111 preintervention and 94 postintervention. Overall SSI rates were 25.2% preintervention versus 26.6% postintervention ($p = 0.82$). SSIs were subdivided into superficial and deep and organ space, and the rates were 14.4% and 10.8%, respectively, preintervention versus 14.9% and 11.7%, respectively, postintervention (p = NS). Smoking and diabetes were found to be independently associated with SSIs on multivariate analysis, with adjusted ORs of 4.32 (95% CI 1.70–10.94, $p = 0.002$) and 2.87 (95% CI 1.30–6.34, $p = 0.009$), respectively. SSI rates for our elective colon resections of 26% are at the upper range of reported rates from the literature. Operative care bundle of change in gowns, gloves, drapes and instruments for wound closure did not decrease SSI rates. Further changes in our care bundle are required to decrease our SSI rate.

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Quality of life and anorectal function of rectal cancer patients in long-term recovery. ***X. Wang, M. Raval, C. Brown, A. Karimuddin, P.T. Phang.* From St. Paul's Hospital, University of British Columbia, Vancouver, BC**

Quality of life (QoL) is significantly altered by rectal cancer surgery and radiation. Here, we ask whether QoL and anorectal function improves from short to long-term recovery and what factors affect long-term QoL and anorectal function. We studied rectal cancer patients treated for cure at a single academic institution between 2005 and 2012 who had low rectal anastamosis after closure of defunctioning stoma. Patients were asked to return questionnaires on general and colorectal specific quality of life (EORTC-QLQ-CR29 and C30) and anorectal function (Wexner score). Patients were grouped as short-term postoperative (1–3 yr) or long-term postoperative (4–5 yr). In total 132 patients returned questionnaires, of which 58 were short-term and 74 long-term postoperative. There was no difference between short- and long-term recovery groups in global QoL scores from EORTC-QLQ-CR29 (70.1 ± 21.6 v. 71.7 ± 18.9, $p = 0.761$) or Wexner scores (7.8 ± 4.6 v. 8.1 ± 4.9, $p = 0.526$). In C30, there was no difference between long and short-term groups in physical (81.16 ± 18.33 v. 89.60 ± 17.24, $p = 0.433$), role (83.10 ± 25.23 v. 81.90 ± 28.66, $p = 0.209$), emotional (76.31 ± 22.45 v. 80.46 ± 23.76, $p = 0.909$), cognitive (81.28 ± 18.20 v. 83.62 ± 18.86, $p = 0.838$) or social function (69.86 ± 33.18 v. 73.28 ± 28.94, $p = 0.171$). QoL was not affected by sex ($p = 0.824$), age (0.771), tumour height ($p = 0.579$), anastomosis type ($p = 0.339$), preoperative radiation ($p = 0.753$), anastomosis height ($p = 0.465$) and TNM staging (0.293). Anorectal function scores were not affected by sex ($p = 0.167$), age (0.460), tumour height ($p = 0.185$), anastomosis type ($p = 0.178$), preoperative radiation ($p = 0.147$), anastamosis height ($p = 0.169$) or TNM staging (0.060). QoL and anorectal function after rectal cancer surgery and radiation was stable and did not change with increased time after surgery up to 5 years. Long-term QoL and anorectal function were not affected by any risk factor in this study.

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Combined laparoscopic/transanal endoscopic microsurgery approach to radical resection for rectal tumours. ***C.J. Brown, A. Karimuddin, P.T. Phang, M.J. Raval.* From the University of British Columbia, Vancouver, BC**

In patients with low rectal cancer, a minimally invasive surgery (MIS) approach is difficult to complete using conventional laparoscopic techniques. Transanal endoscopic microsurgery (TEM) enables excision of large lesions endoluminally. Combined TEM/laparoscopic surgery may improve short and long-term outcomes in patients with rectal cancer. Between March 2014 and April 2015, combined TEM/total mesorectal excision (TME) surgery was offered as an alternative to select patients with low rectal lesions where conventional open or MIS techniques would likely result in permanent colostomy. The TEM component was performed by surgeons with minimum 100 case experience with TEM. Transanal specimen extraction and handsewn anastomosis were performed in all patients, as was diverting ileostomy. Short-term outcomes were collected prospectively. TEM/TME surgery has been performed in 6 patients. The patients were median 57 (range 40–72) years old and mostly men (4 men, 2 women). Patients were treated for adenocarcinoma ($n = 5$) and adenoma ($n = 1$), and 3 of 6 patients with cancer had previous TEM tumour excision. Of the cancer patients, there was a stage distribution of I:II:III of 3:1:1. Median lymph node harvest was 14 (range 11–23). One patient had R1 resection but refused further surgery. Mean OR time was 253 (range 77–402) minutes and improved with experience. Median hospital stay was 7 (range 3–15) days. There were no significant 30-day complications. In summary, our early experience with TEM/TME has been favourable. Introduction of this technique in centres with experienced TEM surgeons seems safe and feasible.

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Transanal endoscopic microsurgery resection of rectal neuroendocrine tumours: a single centre Canadian experience. ***C. Jonker, A. Karimuddin, P.T. Phang, M.J. Raval, C.J. Brown.*** **From the University of British Columbia, Vancouver, BC**

Transanal endoscopic microsurgery (TEM) has been shown to be a safe and effective treatment option for early rectal cancers. Few studies have looked at the use of TEM for small rectal neuroendocrine tumours (NETs), which have historically been treated with radical resection when not amenable to complete colonoscopic snare. Our objective was to review the experience of TEM resection of rectal NETs at a quaternary referral centre. Between April 2006 and October 2014, data for all patients undergoing TEM procedure at a single Canadian centre were collected in a database. Patient demographics, tumour characteristics, operative details and postoperative course were collected prospectively and annual follow-up performed by a research coordinator. All patients with preoperative or postoperative pathology confirmed NET were included in this study. Our primary outcome is recurrence-free survival. Over 8 years, 17 patients were treated by TEM for rectal NETs. There was a slight female predominance (10:7, 65%) and the average age was 57.9 years. Less than half were treated with primary excision (7 of 17, 41%), while the remainder were for re-excision for incomplete colonoscopic resection. Most re-excisions were immediately after colonoscopic removal, but 1 (6%) was for excision of a recurrence post colonoscopic removal. The average tumour size was 7.6 (range 1–18) mm and the average height was 6.5 (range 3–10) cm from the anal verge. Histopathologically, none of the re-excised NETs showed residual disease and all of the resections had negative margins. Average operative time was 39 minutes and all patients were discharged the day of surgery. There was no morbidity postoperatively. Median follow-up after surgery is 27.9 (range 2–93) months, and there have been no local or distant recurrences in this cohort. TEM is a safe and effective primary therapy and definitive treatment after incomplete endoscopic removal in patients with small (< 2 cm) low-grade rectal NETs.

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Abdominoperineal reconstruction with a myocutaneous flap. ***A-M. Dufresne, C. Richard, R. Loungnarath, E. Debroux, J. Pelletier, S. Nicholaidis, J-P. Brutus.*** **From Université de Montréal, Montréal, Que.**

Abdominoperineal resection (APR) is the recommended curative treatment for distal rectal cancer as well as persistent or recurrent anal cancer. The procedure is often preceded by neoadjuvant therapy, which can complicate the healing of vascularized tissue at the perineum in the postoperative period. Consequently, in order to improve recovery, a pediculated muscle or musculocutaneous flap can be added during reconstruction of the perineum. The aim of this study is to compare selected patients with locally advanced distal rectal cancer, or non–complete responders with anal cancer, who were operated on an earlier period without myocutaneous flap with those who had the reconstruction. We measure the hospitalization stay as well as the operative and recovery time in order to compare both groups. A review of the cases was carried out to determine the benefits and complications arising from the use of these flaps. The focus of the study is therefore retrospective and comparative. Between May 2009 and September 2013, we performed 18 abdominoperineal resections that included the addition of a flap. Of these, the male:female ratio was 9:9. Ten patients had rectal cancer and 8 had anal cancer. They were specifically selected because of their preoperative staging at T3 or T4. Perineal reconstruction was carried out using rectus abdominis flaps for 8 patients and gracilis flaps for the remaining 10. Mean operation time was 7 hours 20 minutes for the cases and 5 hours 49 minutes for the controls. In the same order, the duration of the hospital stay averaged 20.8 days versus 18.8 days. Recovery time of the perineal wound was 61.89 days versus 160.23 days ($p = 0.000166$). Our study demonstrates a statistically significant decrease in the recovery time of the perineal wound for patients post-APR with a flap reconstruction. This impacts on the adjuvant treatment and also, indirectly on the quality of life of these patients.

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Comparison of robotic and laparoscopic colorectal surgery with respect to 30-day perioperative morbidity. ***A.E. Feinberg, A. Elnahas, S. Bashir, M.C. Cleghorn, F.A. Queresby.*** **From the University of Toronto, Toronto, Ont.**

Robotic surgery has emerged as a minimally invasive alternative to traditional laparoscopic surgery. Robotic surgery addresses many of the technical and ergonomic limitations of laparoscopic surgery but the literature regarding outcomes in colorectal surgery is limited. The objective of this study was to compare robotic and laparoscopic colorectal resections with respect to 30-day perioperative outcomes. The American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP) database was used to identify all patients who underwent colorectal surgery via robotic or laparoscopic approaches during 2013. Univariate logistic regression analysis was performed to compare intraoperative variables and 30-day outcomes. A subgroup analysis was performed for rectal resections. There were 8392 patients who underwent laparoscopic colorectal surgery and 472 patients who underwent robotic colorectal surgery. The robotic cohort had a lower incidence of unplanned intraoperative conversion to an open procedure (9.5% v. 13.7%, $p = 0.0084$). There were no significant differences between laparoscopic and robotic surgery with respect to other outcomes, such as operative time (187 min v. 190 min, $p = 0.4806$), length of stay (6.2 d v. 6.5 d, $p = 0.2483$), incidence of ileus (10.5% v. 9.4%, $p = 0.4852$), incidence of anastomotic leak (3.1% v. 3.8%, $p = 0.3359$), venous thromboembolism (1.1% v. 0.9%, $p = 0.8210$), infection (5.8% v. 4.8%, $p = 0.472$), cardiac complications (0.4% v. 0.6%, $p = 0.4464$) and pulmonary complications (1.0% v. 1.9%, $p = 0.062$). Within the subgroup analysis, 1370 patients underwent laparoscopic rectal resections and 79 patients underwent robotic rectal resections. There were no significant differences in the intraoperative variables. With respect to 30-day outcomes, the incidence of ileus was significantly lower in the robotic group (3.8% v. 11.2%, $p = 0.0389$). Robotic colorectal surgery has comparable 30-day perioperative morbidity relative to the laparoscopic approach in the appropriately selected patient. In certain patients, robotic surgery may decrease the rate of intraoperative conversion to an open procedure and reduce postoperative ileus.

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Definitive management of fistula-in-ano using draining setons. ***O. Daodu, J. O'Keefe, J. Heine.*** **From the University of Calgary, Calgary, Alta.**

Although traditionally viewed as an initial step toward definitive management of fistula-in-ano, placement of a draining seton is sphincter sparing and may result in fistula resolution. The objective of this study is to identify the proportion of patients who have either resolution or significant amelioration of their symptoms following placement of draining setons alone in the management of fistula-in-ano. This is a retrospective case series of procedures performed at a major teaching centre from June 1, 2005, to June 30, 2014. Patients were identified using Schedule of Medical Benefits billing and ICD-9 diagnostic codes. Patients aged 18 and older treated exclusively with draining seton placement were included. Minimum follow-up was 6 months. Excluded were patients with Crohn's disease and those treated with fistulotomy, fistula plug, cutting seton, or ligation of intersphincteric fistula tract. Data collected included age, sex, pre- and postoperative symptoms, fistula location and weeks to seton removal. Additionally, recurrence as well as the number of additional operative procedures — tract unroofing and seton replacement — were tabulated. In total 383 patients with surgically treated fistula-in-ano were identified. Eighty-eight (60 male) met the inclusion criteria. Mean age was 45 (range 19–73) years. Median follow-up was 58 (range 7–117) months. Seventy-seven (87.5%) patients had only 1 fistula at initial presentation. Twenty-seven (30.1%) patients required 1 or more additional surgeries to unroof a collection and/or replace the seton. The average time to seton removal was 32.9 (range 7–158) weeks. Forty-eight (54.5%) had complete symptom resolution and 25 (28.4%) had significant amelioration of symptoms with no further surgical management required. Fourteen (16%) chose to have their seton left in place. Two (2.3%) had persistent severe symptoms. Eight (9.1%) had recurrence after seton removal. All eventually resolved with another draining seton insertion. This study demonstates that draining seton alone is an effective option in the management of fistula-in-ano.

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Oncologic outcomes following complete pathologic response to neoadjuvant therapy in rectal cancer. ***D. Mihalicz, M.S. Brar, W.D. Buie, I. Datta, A.R. MacLean, C. MacPherson, H. Huang, B. O'Connor, S. Schmocker, H. Wang, E. Kennedy, J.A. Heine.*** **From the University of Calgary, Calgary, Alta.**

The objective of this study is to determine if achieving a complete pathologic response (pCR) after neoadjuvant chemoradiotherapy and radical excision in rectal cancer leads to improved oncologic outcomes. A secondary outcome is to determine if extending the time to resection affects the rate of pCR and subsequent oncologic outcomes. Patients diagnosed with stage II and III rectal cancer from Jan. 1, 2005, to Dec. 31, 2013, in 3 major urban centres were identified. Those treated with curative intent neoadjuvant chemoradiotherapy and surgery were examined. Demographic, clinical and pathologic data were collected via retrospective chart review. Rates of local recurrence, metastatic disease, and death were documented. In total 576 patients fulfilled the inclusion criteria (385 males; mean age 60.7 [range 27–90] yr). Ninety-six patients (16.7%) had a pCR following neoadjuvant therapy. None of the patients who achieved a pCR had a local recurrence (mean follow-up 32.6 [range 0.36–120.6] mo) v. 27 (5.6%) of the non-pCR patients ($p = 0.017$). Distant metastases developed significantly less frequently in the pCR group (4.2% v. 16.7%, $p = 0.002$). Overall mortality did not differ between the pCR and non-pCR groups (7.6% v. 10.6%, $p = 0.407$). While pCR rates were greater when the interval between completion of neoadjuvant chemoradiotherapy and surgery was greater than 8 weeks compared with less than 8 weeks (20.1% v. 12.6%, $p = 0.017$), this did not translate into a difference in local recurrence (5.4% v. 3.8%, $p = 0.366$), distant metastases (13.4% v. 16.4%, $p = 0.306$), or overall mortality (8.7% v. 11.3%, $p = 0.438$). Achieving a pCR after neoadjuvant therapy in rectal cancer decreases the rate of local recurrence and distant metastases after surgery. Intervals of greater than 8 weeks between the completion of neoadjuvant chemoradiotherapy and surgery increase the rate of pCR, but do not appear to affect rates of local recurrence, distant metastatic disease, or overall mortality.

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Laparoscopic total mesorectal excision in obese patients with rectal cancer: What is the oncological impact? ***F. Letarte, A. Brind'Amour, S. Drolet, R. Gregoire, P. Bouchard, C. Thibault, J.P. Gagne, A. Bouchard.*** **From Laval University, Québec, Que.**

Operating on obese patients with rectal cancer is a major challenge and can limit the effectiveness of adequate total mesorectal excision (TME) and negative circumferential resection margin (CRM). The purpose of this study is to evaluate and compare the oncological impact of laparoscopy in this population. Medical files of all consecutive patients who had resection for rectal cancer from January 2006 to July 2013 in a single academic centre were reviewed retrospectively. Patients with elective rectal resection were included and placed in 4 groups according to their body mass index (BMI < 30 v. BMI > 30) and according to their surgical approach (open v. laparoscopic [LSC]). Oncologic and perioperative outcomes were then compared. In total 396 patients were included. Eighty-four patients were placed in group A (LSC and BMI > 30), 27 in group B (open and BMI > 30), 252 in group C (LSC and BMI < 30) and 33 in group D (open and BMI < 30). Groups A and B were associated with significant longer operating time. Intraoperative complications were similar in all groups. Groups A and B were associated with a trend for higher anastomotic leak rates. Conversion rate was higher in group A than group C (14.0% v. 2.3%, $p < 0.001$). Rates of adequate TME and negative CRM were similar in all 4 groups. There was no difference between groups regarding local recurrence rates (3.6% v. 11.1% v. 9.1% v. 9.1%), 5 year disease-free survival rates and 5-year overall survival rates (84.1% v. 77.1% v. 77.6% v. 63.9%). In the obese patients with rectal cancer, laparoscopic resection seems to be an adequate, feasible and safe oncologic procedure, hence allowing this population to benefit from the advantages of minimally invasive surgery.

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Improving the enhanced recovery programs in laparoscopic colectomy: liposomal bupivacaine may not be the answer. ***C. Peeples, S.A. Chadi, R. Akiba, C. Reategui, G. DaSilva, S. Wexner, E. Weiss.*** **From Cleveland Clinic Florida, Weston, Fla.**

Enhanced recovery programs (ERP) are standard of care in colorectal surgery. The addition of long-acting liposomal bupivacaine as

part of multimodality pain control may decrease reliance on opioids. We investigated the relationship of liposomal bupivacaine with amount of opioid used, incidence of AEs (adverse effects) and hospital length of stay (LOS) after minimally invasive (MIS) sigmoid colectomy. A single-centre retrospective review was performed in patients undergoing a MIS sigmoid colon resection from 2012 until 2014. The intervention group received 266mg of liposomal bupivacaine in their incisions by a single surgeon. Patients were matched to controls for age, sex, BMI, procedure and extraction site. Primary outcome was total opioid use in the first 72 hours. Secondary outcomes included LOS, time to flatus and bowel movement, and incidence of AEs (ileus and urinary retention). Confounding variables were determined a priori and were accounted for. Univariate analyses included a *t* test and a Mann–Whitney *U* test, and multivariate regression identified the role the intervention had in predicting the primary outcome. 70 patients (43% female; mean-age 60 yr), with 35 intervention patients were studied. Thirty-nine percent of incisions were midline with 61% Pfannenstiel. On univariate analysis, no difference in total opioid use was identified (61 mg v. 70 mg, p = 0.51). Sensitivity analysis accounting for outliers in opioid use revealed no difference (59 mg v. 60 mg, p = 0.98). LOS was similar in both groups (median 5 d), with no difference in AEs. Furthermore, there was no significant difference in time to flatus or bowel movement (p = 0.23 and 0.35, respectively). Multivariate logistic regression adjusting for ketorolac and acetaminophen use demonstrated that liposomal bupivacaine was not found to predict total opioid use (OR 0.56–3.73, p = 0.446). When added to an aggressive ERP, liposomal bupivacaine does not decrease the amount of total opioid consumption, the incidence of AEs or the LOS in patients undergoing MIS sigmoid resection.

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Fistulae related to colonic diverticular disease: a single institution experience. ***A.S. Jastaniah, C.J. Brown, P.T. Phang, M.J. Raval, A.A. Karimuddin.*** **From the University of British Columbia, Vancouver, BC**

Fistulae related to colonic diverticulitis remain a complex problem. The role of preoperative investigations, laparoscopy and proximal diversion remains controversial. Our aim is to investigate our institutional management of this complex problem. A retrospective review of patients undergoing surgery for diverticular disease at our institution (2005–2014) was undertaken. From this, patients with fistulae were identified. Patient demographics, comorbidities, preoperative investigations, type of surgery, proximal diversion, operating time, hospital stay and complications were recovered. Fifty-seven patients, median age 63 years, with a majority (63.2%) women were identified. In total 89.5% of patients had preoperative colonoscopy, 87.7% of patients had preoperative CT, with 21.1% undergoing cystoscopy. A total of 88.6% of fistulae were identified accurately preoperatively. Fifty-three patients underwent resection and primary anastomosis; 23 (40.4%) were attempted laparoscopically, with 8 (34.8%) converted to open due to technical issues. Eight patients were diverted at surgery. A total of 21.1% of patients had multiple fistulae; 54.4% had colovesicular, with another 33.3% colovaginal. Fourteen percent of patients had colocutaneous fistulae, with 5.3% coloenteric. Sixteen (28.1%) received an omental patch. The bladder was managed in colovesicular fistulae by suture repair in 54.8%, with no repair required in 45.2%. These patients had a mean hospital stay of 11.9 (range 2–43) days, with a mean operative time of 2 hours, 47 minutes (range 1 h 7 min to 5 h 42 min), with an average time for open versus minimally invasive attempted 2 hours 59 minutes versus 2 hours 33 minutes, respectively. Eight patients (14%) had complications ≥ Clavien–Dindo grade 3. There was 1 death, and 3 anastomotic leaks (5.3%) with 2 requiring surgery. There were 2 (3.5%) fascial dehiscences requiring emergent surgery. At early follow-up, 1 patient had recurrence of the fistula. Diverticular related fistulae represent a complicated surgical problem and carry significant diagnostic and management challenges. Preoperative investigations, while helpful, do not identify all fistulae. A minimally invasive approach is possible, and recommended. Routine diversion is not necessary.

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Laparoscopic colectomy for malignancy provides similar pathologic outcomes and improved survival outcomes compared with open approaches. ***S.A. Chadi, M. Berho, S.D. Wexner.*** **From Cleveland Clinic Florida, Weston, Fla.**

Complete mesocolic excision results in an increase in the volume of the mesocolon resected as well as higher lymph node (LN) yields. Our objective was to compare the pathological and clinical outcomes between laparoscopic and open colon cancer surgery on the outcome of survival. A retrospective review was performed for patients receiving a colectomy for malignancy between 2000 and 2012. Primary outcome was overall (OS) and disease-free survival (DFS). The independent variable assessed was surgical approach: 1) totally laparoscopic (TL), 2) hand-assisted (HAL), 3) converted (LC) or 4) open procedures (LAP). Mesenteric length and number of LNs were collected as indicators of the quality of resection. Continuous variables were compared with Student's *t* test or analysis of variance, Multivariable logistic regression (MLR) was employed to create predictive models of mortality with significance set at $p < 0.05$. Following IRB approval, 485 patients (52% TL/HAL) were found that underwent a colectomy for malignancy (mean age 68 yr, 42% female). Patients in each group were well matched by sex, BMI, primary tumour site/size and AJCC stage. Median follow-up was 786 days. TL resulted in less blood loss (p = 0.008), and shorter incisions ($p < 0.0001$) than HAL, LC and LAP. Mortality was significantly higher in HAL, LC and LAP compared with TL ($p < 0.01$). MLR revealed that, when adjusting for tumour site, age, AJCC stage and surgeon, TL was protective for the outcome of all-cause mortality (OR 0.07, p = 0.012). No significant differences in specimen length, mesenteric volume and LN numbers were observed between TL/HAL/LC/LAP. An inverse correlation was noted between the mesenteric volume and both DFS/OS (p = 0.02). Mesocolic volume and LN retrieval rates are comparable between different surgical modalities with demonstrable survival benefits with laparoscopic surgery. Continued prospective efforts are needed to further substantiate these findings.

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MRI utilization and completeness of reporting in rectal cancer: a population-based study. ***D. Mihalicz, H. Wang, C.A. MacPherson, M. Taylor, A.R. MacLean, T. McMullen, W.D. Buie.*** **From University of Calgary, Calgary, Alta.**

Preoperative staging is essential to guide treatment in the management of rectal cancer. MRI is the current modality of choice for locoregional staging. The objective of this study was to determine

the utilization of MRI for rectal cancer staging in a Canadian province over time, and to determine the completeness of reports. Patients diagnosed with stage I–IV rectal cancer between Jan. 1, 2011, and Dec. 31, 2013, were identified from the provincial cancer registry. A retrospective chart review identified MRIs performed before neoadjuvant chemoradiation or surgery. The rate of MRI utilization was determined, and reports were analyzed for completeness based on items included in a synoptic template. The proportion of patients being staged with a pelvic MRI after the diagnosis of rectal cancer increased in each year: 180 of 464 (38.7%) in 2011, 239 of 519 (46.3%) in 2012, and 236 of 445 (53%) in 2013. An explicit T-stage was reported in 48.3%, 46.7% and 62.2% of MRI reports respectively. T-stage was reported descriptively in 51.7%, 50.7% and 35.6% of reports. A description of mesorectal nodal status was provided in 99% in all years. The relationship of the tumour to the anterior peritoneal reflection was only reported in 4.5%, 5.7%, and 15.9% of reports in 2011, 2012 and 2013, respectively, while tumour height was reported numerically in 40.9%, 44.5%, and 56.8%. The proportion of patients receiving a staging MRI after the diagnosis of rectal cancer increased over time; however, MRI reports lacked many of the elements that are critical for making informed treatment decisions in rectal cancer. A provincial synoptic reporting system for rectal MRI is needed.

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Supporting quality assurance initiatives for rectal cancer: Is the CAP protocol enough? ***C.A. MacPherson, D. Mihalicz, A.R. MacLean, T. McMullen, W.D. Buie.* From the University of Calgary, Calgary, Alta.**

Completeness of pathology reporting for rectal cancer is critical for ascertaining the necessity of adjuvant therapy, determining prognosis, and assessing quality of surgical technique. The aim of this study was to assess the completeness of pathology reporting for rectal cancer. All pathology reports following radical resection of rectal adenocarcinoma diagnosed in a single province from January 2012 to December 2013 were reviewed. Reports were assessed for completeness according to the College of American Pathologists (CAP) protocol for primary carcinoma of the colon and rectum. In total 702 pathology reports were reviewed, of which 91.3% were reported in synoptic format. Key clinical and prognostic elements including tumour size, histologic type and grade, and lymphovascular and perineural invasion were present in more than 93.0% of reports. T-stage, N-stage, lymph nodes involved, and longitudinal margins were captured in > 99.0% of reports. Circumferential resection margin status was reported in 99.4%. Completeness of the mesorectal envelope was reported in 88.6%, and tumour location relative to the anterior peritoneal reflection was reported in 91.8%. Reporting inclusive of all mandatory CAP protocol elements was observed in 69.9% of reports. Only 62.6% included mesorectal completeness and tumour location relative to the peritoneal reflection in addition to all mandatory CAP protocol elements. There is high uptake of synoptic reporting for rectal cancer among the province's pathologists. Mandatory clinical and prognostic pathologic elements from current guidelines were reliably reported. However, despite evidence for prognostic and clinical value for mesorectal completeness and tumour position relative to the peritoneal reflection, these elements were less reliably reported. Reclassification of mesorectal completeness and tumour position relative to the peritoneal reflection as mandatory elements would improve the quality of rectal cancer pathology reporting and support quality assurance initiatives for surgeons treating rectal cancer.

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Accuracy and predictive ability of preoperative MRI for rectal adenocarcinoma: room for improvement. ***C.A. MacPherson, D. Mihalicz, A.R. MacLean, H. Wang, T. McMullen, M. Brar, W.D. Buie.* From the University of Calgary, Calgary, Alta.**

MRI is the current gold standard for the preoperative staging of most rectal cancers. The aim of this study was to assess the accuracy and predictive ability of MRI for T- and N-staging in rectal adenocarcinoma. All patients diagnosed with rectal adenocarcinoma during 2012 and 2013 who subsequently underwent radical resection were identified from the provincial cancer registry. Preoperative MRI stage (preop) was compared with pathologic stage in patients receiving primary surgery or short course radiotherapy. Postneoadjuvant MRI stage (post-NA) was compared with pathologic stage in patients receiving long course chemoradiotherapy (LCRT). Patients who had MRIs performed before LCRT were excluded from analysis. Of 702 patients identified, 382 (54.4%) had a staging MRI; 134 (19.1%) had a preop MRI and 70 (10.0%) had a post-NA MRI. Preop MRI T-stage was accurate in 66 of 133 patients (49.6%, 95% CI 41.3–58.0) and accurately differentiated pT > 3 from pT < 2 in 86 of 133 patients (64.7%, 95% CI 56.2–72.3). In this setting, 35.0% of pT > 3 lesions were understaged and 35.6% of pT < 2 lesions were overstaged by MRI. Preop MRI N-stage was accurate in 82 of 134 patients (61.2%, 95% CI 52.7–69.0). In this group, pN-stage was understaged in 23.9% and overstaged in 14.9% by MRI. Post-NA MRI T-stage was accurate in 26 of 66 patients (39.4%, 95% CI 28.5–51.5), and N-stage was accurate in 56 of 68 patients (82.4%, 95% CI 71.6–89.6). The accuracy of MRI for T- and N-staging in rectal adenocarcinoma was poor in this cohort. Further study is necessary to identify opportunities for quality improvement for this patient population.

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A population-based study of colorectal cancer in patients ≤ 40: Does the extent of resection affect outcomes? ***R. Daigle, M. Brar, T.W. Clements, J. Heine, W.D. Buie, I. Datta, H. Singh, A.R. MacLean.* From the University of Calgary, Calgary, Alta.**

The purpose of this study was to examine the oncologic outcomes of colorectal cancer (CRC) in patients diagnosed ≤ 40 years of age and to compare outcomes according to extent of resection performed. All patients ≤ 40 years of age, diagnosed with CRC, who underwent resection between 2003 and 2012 were identified using the provincial cancer registry. Patients with ulcerative colitis, familial polyposis syndrome, nonadenocarcinoma cancers, local excision and unresectable disease were excluded. We classified extensive resection (XR) as a proctocolectomy, total or subtotal colectomy. Other resections were grouped as segmental resection (SR). A total of 352 patients were identified (2% of all CRC); 175 met the inclusion criteria (mean age 35, 51% female, mean follow up 60 [range 0.1–143] mo). Compared with the general CRC population in the province, rectal cancer was more frequent (38% v. 28%, $p = 0.04$); the stage grouping

was similar. Twenty patients had XR and 155 had SR. The SR group developed 3 (2%) advanced polyps and 3 (2%) metachronous CRC (mCRC; 0% in XR, $p = 0.5$); the median time to mCRC was 96 months. All mCRC occurred while on Q2 yearly colonoscopic surveillance program. The local and distant recurrence rate were 8% (XR 25% v. SR 6%, $p = 0.004$) and 23% (XR 30% v. SR 22%, $p = 0.5$), respectively. The 5-year overall survival (5-yr OS) was 82% and the 5-year recurrence-free survival (5-yr RFS) was 71%. There was no difference in 5-yr OS (79% v. 83%, $p = 0.6$) and 5-yr RFS (53% v. 79%, $p = 0.2$) between XR and SR. Patients ≤ 40 years of age with CRC represents about 2% of all CRC in our province. They have a higher rate of rectal cancers. There was a low rate of mCRC in the SR group. XR conferred no benefit with respect to OS and RFS. SR is an acceptable treatment strategy for young CRC patients.

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Transanal minimally invasive surgery (TAMIS) for rectal neoplasms. ***U. Hameed, F.A. Angarita, S. Asbamalla.* From the University of Toronto, Toronto, Ont.**

Transanal minimally invasive surgery (TAMIS) is an emerging approach in managing rectal neoplasms. We describe the initial experience with TAMIS at a Canadian academic cancer centre. Patients over the age of 18 who had undergone TAMIS for rectal neoplasm were identified using a prospectively collected database. Data collection included clinical and pathological characteristics and perioperative outcomes. Primary outcomes included perioperative outcomes and margin status. Forty patients (21 male, 19 female) with a median age of 60 (range 31–90) years underwent TAMIS between June 2013 and February 2015. The median distance from the dentate line was 8 (range 0–12) cm and median tumour size was 2.3 (range 0.1–7.0) cm. Fourteen patients who underwent TAMIS had no residual disease on final pathology, 15 had adenoma (4 with high-grade dysplasia), 10 had adenocarcinomas (3 T1, 2 ypT1, 2 T2, 1 ypT2, 1 T3, 1 ypT3), and 1 had a neuroendocrine tumour. Two patients were converted to laparoscopic resections. Median operative time was 49 (range 25–213) minutes, and median length of stay was 1 (range 0–3) day. Two patients had R1 resections and 2 had piecemeal resections. There were 6 (14.6%) Clavien–Dindo grade I complications, including suture-line bleeds (2), perianal pain (3) and diarrhea (1). All complications resolved with conservative measures. TAMIS is a safe technique to manage rectal neoplasms in appropriately selected patients when performed by a qualified surgeon.

CANADIAN SOCIETY OF SURGICAL ONCOLOGY

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01

The impact of blood transfusion on perioperative outcomes following resection of gastric cancer: an analysis of the ACS-NSQIP. ***M. Elmi, A. Mahar, D. Kagedan, C.H.L. Law, P.J. Karanicolas, N.G. Coburn, J. Hallet.* From the University of Toronto, Toronto, Ont.**

Allogeneic red blood cell transfusions (RBCT) cause immunosuppression and may impact outcomes in patients with gastric malignancies undergoing resection. We investigated the association between perioperative RBCT and postoperative short-term outcomes following gastrectomy for gastric cancer. We conducted a retrospective comparative cohort study using the ACS-NSQIP Database. Patients who underwent elective gastrectomies for gastric malignancies between 2007 and 2012 were included. We excluded those with disseminated cancer or who were missing data on key variables, such as cardiac history, preoperative hematocrit or ASA class. Modified Poisson regression, logistic regression and negative binomial regression were used for multivariate analysis. Outcomes included postoperative infections, wound complications, cardiac event, respiratory complications, venous thromboembolic events, mortality, reoperation and length of stay. Among 3520 patients undergoing gastrectomy for gastric malignancy, we included 2884 patients, of whom 535 (18.6%) received RBCT. Overall, 20% of patients experienced major morbidity, 20% experienced a postoperative infection, and 3.5% died within 30 days of surgery. After adjustment for baseline and clinical characteristics, perioperative RBCT was independently associated with increased 30-day mortality (RR 3.1, 95% CI 1.9–5.0, $p < 0.0001$), major morbidity (RR 1.6, 95% CI 1.3–1.9, $p < 0.0001$), postoperative infections (RR 1.4, 95% CI 1.1–1.6, $p < 0.0001$), respiratory failure (RR 2.3, 95% CI 1.6–3.3, $p < 0.0001$) and reoperation (RR 1.6, 95% CI 1.1–2.3). Transfusion was also associated with an increased length of hospital stay (RR 1.2, 95% CI 1.1–1.2). Receipt of RBCT is associated with worse postoperative short-term outcomes, increased mortality, and prolonged length of stay. Comprehensive strategies are needed to minimize the use of perioperative RBCT in gastric cancer patients.

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Association of wait time to surgical management with overall survival in Ontarians with melanoma. ***A.B. Crawford, C. Nessim, J. Weaver, C. van Walraven.* From The Ottawa Hospital and Queensway Carleton Hospital, Ottawa, Ont.**

Longer wait times for treatment may lead to worsened cancer burden and prognosis, thus target wait times have been mandated in multiple oncology guidelines. A paucity of data exists on the effect of wait times on patient outcomes. The purpose of this study was to address the effect of wait times to surgical treatment on overall survival in patients with melanoma. A retrospective review using the Institute for Clinical Evaluative Sciences (ICES) databases identified all Ontario patients diagnosed with melanoma between 2004 and 2011. Data were abstracted for date of diagnosis, date of treatment of wide local excision (WLE), sentinel node biopsy (SNB), lymph node dissection (LND), and confounding factors affecting survival. Wait time was defined as days from diagnosis to treatment. The cohort was stratified by stage, and descriptive and survival analyses using time-dependent covariates were performed. A total of 2573 patients were included. Patients with stage I occupied 54.2% of the study population, followed by stage II (26.5%), stage III (17.1%), and stage IV (2.2%). In the overall cohort 82.9% of patients underwent a WLE with a median wait time of 43 days (interquartile range (IQR), 24–64). 28.1% of patients underwent a SNB, and 35.0% underwent a LND, with median wait times of 59 (IQR, 41–81) and 63 days (IQR, 43–91), respectively. About 15.9% of the patients received a WLE and SNB on the same date, and 13.3% of patients received a WLE and a LND on the same date. In multivariate analysis, the wait time to treatment did not affect overall survival for WLE (hazard ratio [HR], 0.97, 95% CI 0.87–1.08, $p = 0.62$), SNB (HR 0.89, 95% CI 0.74–1.07, $p = 0.21$) or LND (HR 0.99, 95% CI 0.89–1.11, $p = 0.92$). Overall survival for patients with melanoma was not associated with wait times to WLE, SNB and LND.

04

General surgeons' attitudes toward breast reconstruction in the province of Quebec. ***E. Karam, M. Guez, M. Beniey, R. Younan, J. Bou-Merhi, A.M. Danino, E. Patocskai.* From Université de Montréal, Montréal, Que.**

Breast reconstruction after mastectomy is associated with psychological, social and sexual benefits. However, less than 7% of eligible Canadian women undergo breast reconstruction after mastectomy. Surgeons' attitude and practice factors affect referrals to plastic surgeons. We sought to examine further these issues in our province. Attending general surgeons involved in the treatment of breast cancer patients were mailed self-administered questionnaires. The gathered information included demographics, practice patterns, questions evaluating knowledge and perception on breast reconstruction. The surgeons reported the proportion of their mastectomy patients who they referred to plastic surgeons. Referral patterns were divided into 3 categories. A univariate analysis was conducted in order to identify factors influencing referral rates. A total of 112 surgeons completed the questionnaire. The response rate was of 33.7%. Only 11.11% of surgeons referred more than 75% of their patients to plastic surgeons before surgery. About 22.58% did not offer immediate breast reconstruction. Twenty-five percent believed that autologous flaps would prevent the detection of recurrences, 52.69% were worried that breast reconstruction has a high morbidity, 53.76% would rather avoid breast reconstruction if an adjuvant treatment is needed, and 44.47% did not have access to a plastic surgeon for an immediate breast reconstruction. High referral

rates were associated with surgeons who worked in urban regions, in an academic setting and with a high breast surgery volume and who attended multidisciplinary team meetings ($p < 0.05$). Most general surgeons do not refer breast cancer patients to a plastic surgeon before surgical treatment. The adoption of a multidisciplinary approach to breast cancer patient management should be emphasized. Further development in patient decision aids and better population awareness are required in order to reduce the inequality of information received by patients.

06

Neoadjuvant chemotherapy for breast cancer: Is practice changing? A population-based review of current surgical trends. ***P. Graham, M. Brar, T. Foster, M. McCall, A. Bouchard-Fortier, W. Temple, M.L. Quan.* From the University of Calgary, Calgary, Alta.**

Neoadjuvant chemotherapy (nCTx) in breast cancer has been used to downstage locally advanced and inoperable tumours. Expanded benefits of nCTx include downstaging of tumours to allow breast conserving surgery (BCS) and assessment of in vivo tumour response. We sought to identify patterns and predictors of nCTx use to determine if this has translated into population level clinical practice. All patients undergoing surgery for invasive breast cancer between January 2012 and June 2014 were identified from our provincial synoptic OR database. Patient demographics, hospital, operating surgeon, preoperative tumour characteristics, neoadjuvant treatment, and type of surgery performed were collected. Descriptive statistics and multivariable analysis were used to identify predictors of nCTx. The model incorporated a random effect to account for the variability between surgeons in utilization of nCTx. A total of 4186 patients were identified during the study period; 363 (8.53%) underwent nCTx. There was a significant increase in the use of nCTx over time during the study period. In multivariable analysis, use of nCTx was associated with prechemotherapy tumour size, multicentricity, LN positivity, and decreasing patient age. In addition, there was significant variability in nCTx use between operating surgeons. Of patients who underwent nCTx, 68.9% were not considered pretreatment candidates for BCS. At the time of definitive surgery, however, 72.1% had mastectomy with 18.7% opting for contralateral prophylactic mastectomy. As reported by the surgeon, this was due to the tumour being advanced/too large (50.4%), patient preference (12.6%), multicentricity (8.8%) and margins, genetics, and previous radiotherapy (4%). Although we identified a significant increase in the use of nCTx over time, treatment with mastectomy as definitive surgical management remained high. There was significant variability in nCTx use by the operating surgeons, in addition to factors generally associated with more locally advanced/aggressive tumours.

07

Robotic versus laparoscopic versus open gastrectomy for gastric adenocarcinoma. ***E. Kakiashvili, E. Brauner, O. Ben Yshai, R. Almog, A. Beny, Y. Kluger.* From Rambam Health Care Campus, Haifa, Israel**

Robotic surgery has gained acceptance in oncological surgery. Its relevance in gastric cancer surgery is being examined. The study presents preliminary comparison of operative and postoperative outcome between robotic, laparoscopic and open gastrectomies for gastric adenocarcinoma. We included a retrospective cohort of 85 consecutive patients who underwent total or partial gastrectomy for gastric adenocarcinoma at Rambam Hospital during 2012–2015. For each patient data were collected on basic demographic characteristics, BMI, operating room time (ORT), number of dissected lymph nodes (LN), length of hospitalization (LOH), intra- and postoperative complications. Nonparametric statistical tests were the Mann–Whitney and Kruskal–Wallis tests, used for group comparisons. Study population included 55 patients after total gastrectomies, 10 of them robotic, and 30 partial gastrectomies, 12 of them robotic. Age, sex and BMI were similar between patients who underwent robotic, laparoscopic and open procedures. Median length of hospitalization (LOH) for robotic total gastrectomy was 4.5 days and it was significantly shorter than both laparoscopic total gastrectomy (LTG) 7.0 days ($p = 0.003$) and open total gastrectomy (OTG) 9.0 days ($p < 0.001$). Similar significant differences in LOH among the 3 groups were observed among patients who underwent partial gastrectomy, but the comparison between robotic and laparoscopic procedures was limited due to small numbers of LPG. Median ORT was significantly longer among robotic gastrectomies compared with open, the difference was 64 minute in total gastrectomy group and 145 minute in partial gastrectomy group ($p < 0.001$ for both differences), but the difference in ORT between laparoscopic and robotic procedures were smaller and nonsignificant. The number of dissected LNs was similar among the 3 procedures in total gasrectomies. In partial gastrectomies, the number of dissected LNs was even higher among both laparoscopic and robotic gastrectomies than open ($p < 0.001$). Robotic total and partial gastrectomies for gastric adenocarcinoma are associated with oncologically adequate lymphadenectomy and faster patient recovery, but longer operating time.

15

Influence of preoperative MRI on the surgical management of breast cancer patients. ***A. Parsyan.* From McGill University, Montréal, Que.**

Magnetic resonance imaging (MRI) is gaining popularity in the preoperative management of breast cancer patients. However, the role of this modality remains controversial. We aimed to study the impact of preoperative MRI (pMRI) on the surgical management of breast cancer patients. This retrospective study included 766 participants with breast cancer treated operatively at the Cedars Breast Clinic of McGill University Health Centre. Between those who underwent pMRI (MRI group, $n = 307$) and those who did not (no-MRI group, $n = 458$), there were no significant differences ($p = 0.254$) in the proportions of either total mastectomies (20.5% v. 17.2%) or segmental mastectomies (79.5% v. 82.8%). Patients in the MRI group were significantly more likely ($p = 0.002$) to undergo contralateral surgery (11.7% v. 5.5%). Similar results were obtained in multivariate regression analysis adjusting for age, with the proportions of contralateral breast operations significantly higher in the MRI group (OR = 2.25, $p = 0.007$). Preoperative MRI had no significant effect ($p = 0.54$) on the proportion of total re-excisions (7.5% v. 8.7%). Neither univariate ($p = 0.099$) nor multivariate (OR = 0.32, $p = 0.083$) analyses showed significant differences in the type of re-excision (total v. segmental mastectomy) between the groups. Preoperative MRI

does not have a significant impact on the type of operative intervention on the ipsilateral breast but is associated with an increase in contralateral operations. Similarly, pMRI does not change the proportion of re-excisions or the type of the re-excision performed. This study demonstrates that pMRI has little impact on the surgical management of breast cancer and its value as a routine adjunct in the preoperative workup of recently diagnosed breast cancer patients needs to be re-examined.

17

Adverse events related to lymph node dissection for cutaneous melanoma: a systematic review and meta-analysis. ***H.H. Alabbas, A.M. Rodriguez-Rivera, S. Krotneva, S. Chang, L. Patakfalvi, T. Landry, A. Meguerditchian.*** **From McGill University, Montréal, Que.**

The purpose of this study was to review the collective experience with complications associated with lymph node dissections (LND) in cutaneous melanoma (CM) patients. A systematic literature search was performed to review the incidence of complications associated with LND in CM patients; PROSPERO: CRD42013006040. Data extraction quality was validated by comparing it to a second database created with 10% of randomly selected studies using a modified STROBE checklist. The incidence of each complication type was extracted from each study and compiled according to basin site and then by type of complication (wound infection, acute lymphatic and lymphedema). Meta-analyses were performed using a random-effects model, and pooled estimates of complication rates for each basin and 95% CIs were calculated. Eighty-eight studies were included, with a total of 9505 patients and 9594 LNDs. Data were collected for 372 cervical, 2476 axillary and 5867 groin LNDs. The pooled rates of wound complications for cervical, axillary and groin LNDs were 8.2% (95% CI 2.4–14), 9% (95% CI 6.5–11.6) and 22.3% (95% CI 18.9–25.7), respectively. The pooled rates of acute lymphatic complications for cervical, axillary and groin LNDs were 7.4% (95% CI 2.2–12.7), 23% (95% CI 17.8–28.2), 25.3% (95% CI 21.1–29.4), respectively. The pooled rates of lymphedema for axillary and groin LNDs were 10.2% (95% CI 7.5–13.0) and 33% (95% CI 28.1–38.0), respectively. Intraoperative and systemic complications were uncommon or underreported in the literature. Morbidity after LND in CM patients remains considerably high, particularly in those undergoing groin dissections. Our results provide the collective knowledge needed to improve patient-centred outcomes and enhance recovery in this specific population. It also proposes a simple, reproducible classification of LND.

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Regional variations in survival, case volume and intraoperative margin assessment in resected gastric cancer. ***T.D. Hamilton, H. Adamson, H. Lim, H. Kennecke, W. Cheung, C. Speers, A.F. McFadden, Y.J. McConnell.*** **From the University of British Columbia, Vancouver, BC**

The objective of this study was to evaluate regional variations in gastric cancer surgery. A population-based cohort was constructed including all patients referred to a provincial cancer agency with nonmetastatic gastric adenocarcinoma treated with curative-intent surgical resection between 2004 and 2012. Clinical, pathologic and survival data were collected. Statistical analysis included χ^2 testing, survival analysis with Kaplan–Meier estimation and log-rank testing, and Cox proportional hazards modelling. A total of 377 patients were included in the analysis. Median age was 67 (range 22–88) years, 67.6% were male, and 49.9% were pathologic stage III. Median and 5-year overall survival (OS) were 39.4 months and 40.4%, respectively. The majority (70.6%) of cases were performed in 2 urban health regions, where median OS was significantly better than in nonurban regions (48.8 v. 29.3 mo, $p < 0.001$). Three institutions in the urban regions performed half of the total cases, while 20 institutions performed ≤ 1 case/year. Pathologically positive surgical margins were noted in 15.6% of cases and were associated with worse OS (16.4 v. 52.5 mo, $p < 0.001$). Higher volume institutions (> 12 cases/year) were more likely to perform intraoperative frozen section for margins (51.7% v. 25.3%, $p < 0.001$) and this was associated with a lower final positive margin rate (8.2% v. 18.3%, $p = 0.02$). Performing frozen section was associated with improved OS (60.5 v. 37.9 mo, $p = 0.03$). The OS benefit associated with urban region (Hazard Ratio [HR] 0.64, 95% CI 0.42–0.98, $p = 0.04$) and frozen section (HR 0.55, 95% CI 0.34–0.90, $p = 0.02$) persisted on multivariate analysis. Patients with gastric cancer treated in higher-volume centres were more likely to have intraoperative frozen section, less likely to have a positive final margin, and had improved survival in urban regions. These data confirm the importance of frozen section as a quality indicator for gastric cancer surgery.

20

Comparison of clinical and economic outcomes between robotic, laparoscopic and open rectal cancer surgery: early experience at a tertiary care centre. ***K.M. Ramji, J.M. Josse, M.C. Cleghorn, A. MacNeill, C. O'Brien, D. Urbach, F.A. Quereshy.*** **From the University of Toronto, Toronto, Ont.**

Robotic surgery has gained popularity in surgical oncology. Rectal cancer surgery, known to be technically challenging, may benefit from robotics in achieving better mesorectal dissection and may contribute to improved perioperative outcomes. The objective of this study was to compare early experience in robotic surgery to conventional approaches with regards to clinicopathologic and economic parameters. A retrospective review using a prospectively maintained database of rectal cancer surgeries performed at a tertiary cancer centre from 2007 to 2013 was conducted. These resections included those performed via laparotomy, laparoscopy, and robotic-assisted operations. Perioperative demographic and tumour characteristics were collected and short-term clinicopathologic outcomes were compared. Additionally, economic variables were evaluated for each patient's episode of care. Seventy-nine cases were identified; 26 were completed via open approach, 27 laparoscopically, and 26 via robotic assistance. Demographic characteristics were similar among all groups including age, sex, BMI, and Charlson score. Comparison of intraoperative characteristics showed a lower rate of conversion to laparotomy (12% v. 37%, $p = 0.05$), and lower estimated blood loss (mean 296 cc v. 524 cc, $p = 0.04$), in the robotic group compared with laparoscopy or open resection. There was no significant difference in quality of total mesorectal excision (TME) and number of lymph nodes harvested among the 3 cohorts. Postoperative complication rate, mean length of stay, 30-day

readmission, and 30-day mortality were comparable among the cohorts. Median cost per episode of care was lower in laparoscopic surgery ($11 493) compared with open ($12 558) and robotic approach ($18 273, $p = 0.029$). The findings demonstrate similar perioperative and short-term outcomes between robotic surgery and conventional approaches. Robotic assistance is associated with decreased intraoperative blood loss and fewer conversions, albeit at an increased overall cost. Given these benefits, and as data and experience matures, future study is needed to fully define the value of the robotic approach.

21

Outcomes and clinicopathologic features of patients with Angiosarcoma of the breast. ***M.K. Gervais, S.M. Burtenshaw, J. Maxwell, B. Dickson, M. Blackstein, J.M. Escallon, R. Gladdy.*** **From the University of Toronto, Toronto, Ont.**

Breast angiosarcoma is a rare clinical entity and accounts for less than 1% of all breast cancers. This study aims to determine the outcomes of patients with radiation-associated angiosarcoma of the breast (RAAS) and sporadic breast angiosarcoma (AS). We sought to evaluate patterns of recurrence and predictors of breast angiosarcoma survival and recurrence. Patients with pathologically proven diagnosis of breast angiosarcoma from 1994 to 2014 referred to Mount Sinai Hospital or Princess Margaret Cancer Center were included in the study. The primary outcome was overall survival (OS). Secondary outcomes were disease-free survival (DFS), clinicopathologic characteristics, patterns of recurrence and predictor factors of survival. Kaplan–Meier and log-rank tests were used for OS and DFS. Univariate analysis were conducted to determine predictors of outcomes, using Kaplan–Meier method. A total of 26 patients were included in the study: 6 AS and 20 RAAS. Median follow up was 24 (range 3–115) months. Five-year OS for RAAS and sporadic subgroups were 44% and 40%, respectively (p = ns). Five-year DFS for RAAS and sporadic subgroups were 54% and 53% respectively (p = ns). The overall recurrence rate was 67% with median time to recurrence of 11 months (7 and 12 mo for RAAS and sporadic AS, respectively). Age and tumour size were not statistically significant predictor factors for DFS and OS. Breast angiosarcoma is associated with poor survival and high recurrence rate. Prognosis of this disease may be mainly determined by its aggressive biology. Referring to tertiary care centre for multimodality treatments and long-term follow-up is recommended.

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Postmastectomy radiation: Should subtype factor in to the decision? ***A.S. Scheer, F. Zih, E. Maki, C.A. Koch, D.R. McCready.*** **From the University of Toronto, Toronto, Ont.**

The current indications for postmastectomy radiation (PMRT) do not consider the biologic heterogeneity of breast cancer. The implication of constructed subtype on locoregional treatments is conflicting, clouding whether constructed subtype should impact locoregional management. Objectives: 1) to determine if constructed subtype influences delivery of PMRT in an academic cancer centre, 2) to determine if there are differences in postmastectomy locoregional recurrence (LRR) by constructed subtype. Patients with a mastectomy as primary surgical therapy, at Princess Margaret Cancer Centre were identified from a prospectively collected surgical database. Mastectomies for recurrence, patients with neoadjuvant therapy, or unknown human epidermal growth factor (HER)2 status were excluded. Univariate and multivariate logistic regressions assessed the association between covariates and receipt of radiation. Kaplan–Meier estimates for the time to the earlier of LRR or last follow-up were obtained for each subtype. Univariate and multivariate Cox PH regressions examined the effect of covariates on time to LRR. In total 1010 patients with invasive breast cancer underwent primary mastectomy between September 1997 and May 2012. Complete receptor status was available for 895. A total of 363 patients (41.6%) received PMRT. The usual clinicopathologic factors were associated with PMRT on univariate and multivariate analyses. Subtype was not associated with PMRT. Triple negative (TN) subtype had the lowest 5-year LRR-free survival (80.6% v. 96.6%, $p < 0.0001$), and earlier disease (82% Stage 1/2, 66% N0). On univariate analysis, not receiving chemotherapy and TN were associated with worse LRR. On multivariate analysis, TN was the strongest predictor of LRR (HR 5.76, 95% CI 2.94–11.26, $p < 0.0001$). Despite variations in LRR by constructed subtype, TN does not appear to factor in the decision making for PMRT in our database. TN patients often had earlier stage disease, but the highest LRR. It appears that the TN subtype should factor in predicting LRR and further research should explore the efficacy of PMRT for TN patients.

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Omission of axillary staging in elderly patients with early stage breast cancer impacts regional control but not survival: a systematic review and meta-analysis. ***S. Liang, J. Hallet, J.S. Simpson, A.C. Tricco, A.S. Scheer.*** **From the University of Toronto, Toronto, Ont.**

In a global context of aging populations, 40% of new breast cancer diagnoses are made in elderly women, and significant variation exists in the management of this complex population. Thus we undertook a systematic review and meta-analysis of RCTs in elderly women with early stage breast cancer to evaluate whether omission of axillary staging impacts breast cancer outcomes. The electronic databases Medline, Embase, and Cochrane Register of Controlled Trials were searched from inception until Aug. 14, 2014. RCTs with at least 50% of patients over the age of 70 that evaluate the outcomes of axillary staging in early breast cancer (T1/T2, N0) were included. Studies on in situ breast cancer, advanced disease, and studies that compared sentinel lymph node biopsy (SNBx) to axillary dissection, or completion axillary dissection following a positive SNBx, were excluded. The primary outcomes were overall mortality and recurrence. Secondary outcome was morbidity of the ipsilateral arm. Initial search returned 4640 titles and abstracts; 32 full-text articles were screened; ultimately 2 RCTs were selected and included. The effect of axillary dissection on reducing axillary recurrence is favoured (RR 0.24, 95% CI 0.06–0.95). There was no statistically significant difference in overall mortality (RR 0.99, 95% CI 0.79–1.24), breast cancer-specific mortality (RR 1.07, 95% CI 0.73–1.58), local breast recurrence (RR 1.66, 95% CI 0.30–4.50), or distant recurrence (RR 1.17, 95% CI 0.75–1.83). No meta-analysis was completed for morbidity of the ipsilateral arm as only 1 study reported on this outcome. This meta-analysis demonstrated a slight increase in risk of regional recurrence with omission of

axillary staging but no difference in overall or breast cancer–specific survival. The results of this study suggest that omission of axillary staging in elderly patients with early stage breast cancer does not impact overall or disease-specific survival despite improved locoregional control.

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Objective pathological assessment of CRCLM by MALDI. ***B. Alabdulkarim, H. Patterson, A. Lazaris, P. Chaurand, P. Metrakos*. From McGill University and Université de Montréal, Montréal, Que.**

Colorectal cancer (CRC) is the fourth leading cause of cancer mortality. Survival trends between stages suggest that death from CRC is largely due to metastatic disease. Due to the nature of the portal circulation the liver is a frequent site of metastasis. Surgical excision when feasible is the only definite cure for liver metastasis; however, it can be offered only to a limited group of patients. Conversion modalities, such as neoadjuvant chemotherapy, have extended on this group. Postresection pathological grading, such as modified tumor regression grade (mTRG), is used to predict patient outcome, including disease free survival. At present pathologist assessment remains subjective and semiquantitative. Recent advances in MALDI imaging mass spectrometry (IMS) have made it possible to directly profile lipid composition and distribution. Using MALDI we developed clusters that represent an objective quantitative pathological tumour grading. Tissue was banked from over 50 patients that underwent liver resections. Clinical data was collected, including primary tumour TNM classification, type of chemotherapy, number of cycles and each lesion was classified according to RECIST. Pathological evaluation was performed for every lesion, along with full histological characterization. For MALDI imaging, each frozen tissue was sectioned, mounted onto glass slides dedicated for MALDI and analysis was performed. As preliminary results, MALDI IMS was able to differentiate different histologies within the sample according to lipid clusters. This was done by first performing a histology driven analysis on a training set (n = 12), followed by a histology-independent analysis on a validation set (n = 30). Necrosis was one of these histologies picked up by IMS, 2 types of necrosis where identified by lipid signature and used in the grading. Furthermore each cluster presentation in a sample was used to generate the pathological grade objectively. MALDI grading will be compared with pathological grading and patient outcome.

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Identification of predictive tumour markers in breast cancer tissue — a pilot study research plan. ***A.E. Schellenberg, T.A. Harkness, G. Groot, G.F. Davies, T. Arnason*. From the University of Saskatchewan, Saskatoon, Sask.**

Approximately 1 in 8 women will one day face breast cancer and approximately 25% of women receiving anti-hormone therapy will return to the clinic within 15 years with a recurrent, untreatable multiple drug resistant (MDR) form of the disease. We hypothesize that early detection of MDR cancer, before clinical presentation, and reversal of MDR protein markers will provide novel and viable treatment options for women suffering recurrent tumours. Our laboratory has recently discovered that the widely prescribed antidiabetic drug metformin renders MDR cancer cells sensitive to chemotherapy by reversing the expression of critical protein markers of MDR. The objective of our study is to monitor the expression of protein markers defining MDR cancer, established using our in vitro methods, and in human breast tumour tissue in vivo. Also, we will investigate the efficacy of a novel MDR inhibitor, metformin, in reversing MDR in resected breast cancer tissue after transplant into severe combined immunodeficiency mice. This study involves the collection of breast cancer tissue from women at the time of scheduled mastectomy for large (> 3.0 cm) breast tumours. Initial data collection includes pathological tumour characteristics, including tumour grade, hormone receptor status, and patient factors, with subsequent follow up at one year to determine clinical response to treatment. Western blots were performed using antibodies against MDR markers to determine tumour resistance. We have collected 5 individual tumour samples (1 cm × 1 cm blocks of tumour, plus adjacent control breast tissue) thus far. Two patients have reached the 1-year point, 1 of whom exhibited markers of MDR and developed local recurrence at 1 year. The other patient was negative for markers of MDR and remained in remission with adjuvant therapies.

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Reframing women's risk: counselling on contralateral prophylactic mastectomy in non–high risk women with early breast cancer. ***A.M. Covelli, N.N. Baxter, F.C. Wright*. From the University of Toronto, the Li Ka Shing Knowledge Institute of St. Michael's Hospital, and Sunnybrook Hospital, Toronto, Ont.**

Rates of contralateral prophylactic mastectomy (CPM) for early-stage breast cancer (ESBC) have been increasing. Our previous research has demonstrated that despite surgeons describing no survival benefit and recommending against CPM, non–high risk women overestimated their risk of recurrence, contralateral cancer, and death, and overestimated the benefit of CPM. We sought to understand how surgeons might improve communication with non–high risk women who are choosing unilateral mastectomy (UM)+CPM. We conducted a qualitative study to explore how communication with those patients demonstrating an overestimated risk of ESBC could be improved. Purposive sampling was used to identify surgeons across Ontario, Canada and the United States who varied in length/location of practice, training, and sex. Data were collected through focus groups. Constant comparative analysis identified key concepts. Data saturation was achieved after 3 focus groups consisting of 20 surgeons that lasted 55–95 minutes. Reframing risk was the dominant theme. All surgeons stated non–high risk women who choose UM+CPM do so in response to the misperceived risks associated with ESBC. Dominant ideas to reshape this risk included 1) slowing down the decision-making process and prolonging the timing to CPM, 2) addressing the emotionality of breast cancer, 3) presenting a cohesive message across medical specialties, 4) use of decision-making tools including narrative videos and visual aids depicting both positive and negative outcomes across treatment options, and 5) a formal surgical statement describing for whom CPM is recommended/not recommended. Both Canadian and US surgeons note that non–high risk women with EBSC choose CPM in response to an overestimated risk. As CPM may not offer benefit and is not without risks, reframing a woman's perception of risk is fundamental to

ensure that the choice for CPM is truly informed and not simply chosen for misperceived benefits.

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Withdrawn

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Comparison of different methods of immediate breast reconstructions for breast cancer patients: Is "single stage" really better? ***Y. Zhang, A. Arnaout.* From the University of Ottawa, Ottawa, Ont.**

Postmastectomy reconstruction is an important component of breast cancer treatment. The most commonly used methods for immediate reconstruction are 1) single-staged with acellular dermal matrix (ADM) and immediate implant insertion (SSIR) and 2) 2-staged with insertion of tissue expanders (TSTR). There exists no formal study comparing SSIR and TSTR with regards to differences in long-term rates of clinic visits, repeat surgeries, and other surgical procedures. The purpose of our study is to determine and compare the number of clinic visits, repeat surgeries, and minor surgical procedures between 1) SSIR, 2) intermediate stage reconstruction with expander-implant (ISER), and 3) TSTR. A retrospective chart review was performed. The population of interest is all patients who underwent mastectomy followed by immediate implant-based reconstruction at an academic hospital from Jan. 1, 2011, to June 1, 2013. In total, 820 patients underwent mastectomy; 82 underwent implant-based immediate reconstruction. Eleven patients were excluded as they did not meet study criteria. The final cohort included 71 patients with a total of 102 immediate reconstructions. Thiry patients underwent SSIR, 8 underwent ISER, and 33 underwent TSTR. Average length of follow up was 2 years after index surgery. Patients undergoing TSTR had significantly more clinic visits ($p < 0.0001$) and repeat surgeries ($p = 0.0035$) within the first year of follow-up. Patients undergoing ISER had more clinic visits in the second year ($p = 0.011$). Patients undergoing SSIR had less minor surgical procedures performed in the first 2 years following the initial reconstruction ($p = 0.045$). TSTR had the lowest rates of long-term complications, such as malposition ($p = 0.017$) and capsule contracture ($p = 0.006$). Patients undergoing immediate reconstruction via SSIR have the lowest rates of healthcare resource use. However, they have higher rates of malposition and capsule contracture. These complications affect the aesthetic outcome of the reconstruction and lead to more revisit surgeries for affected patients.

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Is lymph node ratio a more accurate prognostic factor in stage III colon cancer than standard nodal staging? ***A.J. MacNeill, M. Clegborn, W. Jin, H. Yang, T.D. Jackson, A. Okrainec, F.A. Queresby*. From the University of Toronto, Toronto, Ont.**

Lymph node involvement is the most important prognostic factor in nonmetastatic colon cancer. Lymph node ratio (LNR) has been suggested to be of greater prognostic significance than absolute lymph node yield, but the optimal cut-off value remains unknown. The purpose of this study was to evaluate the prognostic value of LNR with respect to recurrence-free survival (RFS) and overall survival (OS) in stage III colon cancer patients. A retrospective review was conducted on a prospectively maintained database of all patients who underwent curative resection for colon cancer at a large tertiary academic centre from 2004 to 2012. RFS and OS were calculated using the Kaplan–Meier method and compared by the log-rank test. Univariate and multivariable Cox proportional hazard regression models were used to evaluate clinicopathologic variables. Optimal cut-offs for LNR were identified by maximizing log-rank statistics. In total 471 patients were included in the study, of whom 156 had nodal metastases. Advanced T stage, lymph node metastases, and LNR were associated with RFS and OS. The optimal LNR cut-off value was found to be 0.32. Patients with LNRs above this threshold were found to have significantly worse RFS (HR 3.02, 95% CI 1.72–5.31, $p < 0.001$) and OS (HR 2.71, 95% CI 1.39–5.29, $p = 0.003$). When a cut-off value of 0.18 was applied, in agreement with existing literature, these results retained significance (RFS: HR 2.31, 95% CI 1.4–3.81, $p = 0.001$; OS: HR 2.01, 95% CI 1.1–3.67, $p = 0.023$). LNR is a valuable predictor of outcome in stage III colon cancer, and may represent a more accurate marker of nodal staging than the standard TNM system. LNR ≥ 0.32 is highly predictive of reduced RFS and OS. This study builds upon current literature by validating the published cut-off of 0.18 as being a statistically significant threshold. Consideration should be given to incorporation of LNR into future TNM classification.

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Costs associated with reoperation in the setting of attempted breast-conserving surgery: a decision analysis. ***C.R. Baliski, R. Pataky*. From the BC Cancer Agency, Kelowna and Vancouver, BC**

Breast-conserving surgery (BCS) is the preferred surgical approach for the majority of patients with early stage breast cancer. Frequently there are concerns regarding the pathologic margin status, with population-based studies reporting reoperation rates ranging from a low of 17% to as high as 35%. The European Society of Breast Care Specialists (EUSOMA), suggests a reexcision rate of 10%, suggesting quality of care initiatives may be warranted. While repeat re-excision is an option, many patients often choose mastectomy plus or minus reconstruction. Each of these procedures adds further patient stress, morbidity, and cost to the health care system. We attempted to identify the cost associated with inadequate initial BCS in a publicly funded health care system. A decision analysis of the options available to patients undergoing initial BCS was developed. This featured the most common surgical treatment options, including initial successful BCS followed by postoperative radiation, repeat BCS, mastectomy, or mastectomy with reconstruction. A PubMed literature search was performed to identify population-based studies that have evaluated reoperation rates after BCS. Physician surgical procedure charges were based on MSP fee codes associated with the most common surgical procedures. These codes were cross-referenced with 2012 Canadian Institute for Health Information (CIHI) data. Resource intensity weights (RIW) and case mix groups (CMG) associated with these procedures were then used to determine the facility cost (Cost = RIW × CMG) of these procedures. The costs associated with various management strategies were quite variable ranging from a low of $7533 for those undergoing initial definitive BCS to a high of $22 009 if autologous reconstruction was used.

Based on a conservatively estimated reoperation rate of 17%, if quality care intiatives could be initiated to decrease this to that suggested by EUSOMA, it would translate to a cost savings of $900 000 dollars annually in our province.

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Polo-like kinase 4 (Plk4) activates Cdc42, stimulates cell invasion and enhances cancer progression in vivo. ***K. Kazazian, R. Xu, O. Brashavitskaya, H. Wu, C. Go, C.J. Swallow*. From the Lunenfeld-Tanenbaum Research Institute, Mount Sinai Hospital, and the University of Toronto, Toronto, Ont.**

Metastasis remains the most common cause of death following resection of primary breast, pancreas or colorectal cancer; high expression of the putative oncogene Plk4 in these cancers predicts aggressive behaviour and resistance to therapy. Our objective is to describe and understand the mechanism(s) of Plk4's oncogenic effect in order to therapeutically modulate the pathways/networks that facilitate metastatic capacity. We hypothesize that Plk4 enhances cancer progression through RhoGTPase based pathways. Cancer cell spreading and protrusion formation were facilitated by Flag-Plk4 transfection, and were suppressed by Plk4 depletion ($p < 0.01$, $n = 4$). Cell polarity, migration and invasion were also impaired by Plk4 knockdown ($p < 0.05$, $n = 3$), and actin rearrangement toward a scratch wound was markedly reduced. Investigation of pathways upstream of actin polymerization revealed that Plk4 regulates activation of the small motility-related RhoGTPase Cdc42, while interaction proteomics identified members of the actin related protein (Arp) 2/3 complex as novel Plk4 interactors. Stable knockdown of Plk4 in MDA-MB-231 breast cancer xenografts resulted in a modest suppression of tumour growth. Histological analysis at early time points (4–6 weeks, tumours matched for size) showed a marked inhibition of invasion into underlying muscle and lymphovascular invasion in Plk4 shRNA xenografts. At later time points (7–10 weeks, tumours matched for size), Plk4 knockdown similarly inhibited gross invasion through the abdominal wall and into the peritoneal cavity. In addition, lung metastasis was suppressed in Plk4 shRNA xenograft mice, with reduced incidence of metastatic colonies and much smaller size of micro-metastases. This was in conjunction with a gene expression signature consistent with mesenchymal-to-epithelial reprogramming in cancer cells upon Plk4 knockdown. Plk4 enhances cancer cell spreading, polarity, migration, and invasion, possibly through regulation of the Cdc42 pathway. The dependence of cancer invasion and metastasis on Plk4 in preclinical models supports the evaluation of Plk4 inhibitors in patients who experience cancer progression on conventional chemotherapy.

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Negative predictive value of preoperative abdominal CT in determining gastric cancer resectability on a population level. ***D.J. Kagedan, F. Frankul, A. El-Sedfy, A.L. Mahar, C. McGregor, M. Elmi, B. Zagorski, M. Dixon, J. Vasilevska-Ristovska, L. Helyer, C. Rowsell, C.J. Swallow, C.H. Law, N.G. Coburn*. From the University of Toronto, Toronto, Ont.**

Prior to undergoing curative-intent resection of gastric adenocarcinoma (GA), most patients undergo abdominal computed tomography (CT) scan to determine contraindications to resection (local invasion, metastases); however, the reported ability to detect contraindications is variable, and the literature limited to single institution studies. We sought to assess the negative predictive value (NPV) of preoperative CT among patients undergoing surgery for GA on a population level. Using a provincial cancer registry, 2414 patients with GA diagnosed between 2005 and 2008 at 116 institutions were identified, with a primary chart review of radiologic, operative, and pathologic reports performed for all patients. In total 1127 patients underwent surgical exploration without neoadjuvant therapy, of whom 570 underwent gastrectomy at that operation. Preoperative abdominal CT reports were compared with intraoperative findings and final pathology reports (reference standard) to determine the NPV of CT in assessing local invasion, nodal involvement, and intra-abdominal metastases. Subgroup analysis of radiologic reports indicating uncertainty was performed to determine the effect of uncertainty in reporting on NPV. In detecting local invasion, the NPV of CT scan was 86.9% ($n = 561$). For nodal metastasis, the NPV of CT was 43.3% ($n = 563$). Among patients undergoing surgical exploration, the NPV of CT scan for intra-abdominal metastases was 52.3% ($n = 484$). The NPV of CT reports indicating uncertainty regarding local invasion was 100% ($n = 13$), and 49.3% ($n = 75$) for intra-abdominal metastases. Preoperative abdominal CT scans reported as negative were most accurate in determining local invasion, and least accurate in nodal assessment. The poor NPV of CT should be taken into account when selecting patients for neoadjuvant therapy and staging laparoscopy. Further investigation into the effect of uncertainty on accuracy in radiologic reporting is needed.

36 ***2015 CJS Editor's Choice Award Recipient***

(18)F-fluoroazomycin arabinoside positron emission tomography (FAZA-PET) imaging predicts response to chemoradiation and evofosfamide (TH-302) in a preclinical xenograft model of rectal cancer. ***A. Haller, T. Mckee, Y. Wang, E. Lima-Fernandes, B. Wouters, M. Smith, D. Jaffrey, C. O'Brien*. From the University Health Network, Toronto, Ont.**

Rectal cancer is often managed with radiation and neoaduvant 5-fluoruracil (5FU), followed by surgical resection. A pathological response to therapy in surgical specimens is a favourable prognostic factor; however, our understanding of the underlying biological factors remains limited. An established driver of radiation resistance and a negative predictor of outcome in numerous cancer types is hypoxia, the pathophysiological result of an imbalance in oxygen supply and demand. We questioned whether baseline hypoxia could identify rectal cancers that will exhibit a poor response to chemoradiation, and if we could increase response by targeting the hypoxic niche with a hypoxia activated prodrug (evofosfamide). As a noninvasive indicator of tumour hypoxia we used FAZA-PET imaging in a cohort of mice bearing rectal cancer patient derived xenograft tumours. Mice were arranged into 4 groups: control (saline), evofosfamide (50 mg/kg × 10 days), chemoradiotherapy (CRT; 2Gy/day and 20mg/kg 5FU × 5 days), or CRT + evofosfamide. One day before treatment, FAZA-PET uptake values were obtained from individual tumours in the CRT and CRT + evofosfamide groups, allowing us to stratify tumours into high FAZA (high hypoxia) and low FAZA (low hypoxia). Tumours with high FAZA uptake demonstrated minimal response to CRT, in contrast low FAZA uptake tumours treated with CRT

exhibited a significant growth inhibitory effect. Treatment with CRT followed by evofosfamide in tumours with high FAZA uptake elicited a significant inhibitory effect on tumour growth. The addition of evofosfamide to CRT in the low FAZA uptake tumours demonstrated no additional benefit with respect to growth inhibition. These results indicate that FAZA-PET imaging may have a role in prospectively identifying rectal cancer patients with tumours that will respond poorly to CRT. More importantly, we potentially identify a therapeutic that may increase response in combination with CRT in a subset of rectal cancer patients.

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Impact of a regional guideline on the surgical treatment of the axilla in patients with breast cancer: a population-based study. ***M. Tsao, S.D. Cornacchi, N. Hodgson, M. Simunovic, L. Thabane, M.A. O'Brien, B. Strang, S.D. Mukherjee, D. Bhatia, P.J. Lovrics.*** **From McMaster University, Hamilton, Ont.**

Completion axillary lymph node dissection (cALND) has traditionally been the standard of care following positive sentinel lymph node biopsy (+SLNB) in breast cancer (BC). Recent evidence from ACOSOG Z0011 suggests cALND after +SLNB does not improve outcomes in select patients, likely leading to uncertainty and practice variation among surgeons. In response to Z0011, a multidisciplinary group of surgeons, oncologists and pathologists developed a regional guideline for cALND following +SLNB which was disseminated in August 2012. We assessed the impact of Z0011 and the regional guideline on rates of cALND. Consecutive cases undergoing SLNB for invasive BC were reviewed at 12 hospitals performing BC surgery. Patient, tumour, and process measures were collected for 3 time periods: TP1 — before publication of Z0011 (05/2009 to 08/2010); TP2 — after publication of Z0011 (03/2011 to 06/2012); and TP3 — after regional guideline dissemination (01/2013 to 04/2014). Cases were categorized by whether they did (i.e., ≤ 50 yr, mastectomy, T3 tumour, ≥ 3 positive SLNs) or did not (e.g., age > 50 yr, breast conserving surgery, T1/T2 tumour, and 1–2 positive SLNs) meet guideline criteria for cALND. SLNB rate increased from 56% (n = 620), to 70% (n = 774), to 78% (n = 844) in TP1, TP2 and TP3, respectively. Among cases not recommended for cALND by guideline criteria, rates of cALND decreased significantly over time (TP1 71%, TP2 43%, TP3 17%) ($p < 0.001$). cALND rate also decreased over time among cases recommended to have cALND by guideline criteria (TP1 92%, TP2 69%, TP3 58%) ($p < 0.001$). Overall cALND rate varied across hospitals for all times (TP1 65%–100%; TP2 24%–90%; TP3 9%–60%). For TP3, physicians at academic hospitals were more likely to omit cALND while surgeon volume and specialty had no effect. Publication of ACOSOG Z0011 and regional guideline dissemination were associated with a marked decrease in cALND after +SLNB, even among cases recommended to receive cALND.

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Recent trends in port-site metastasis following laparoscopic resection of gallbladder cancer: a systematic review. ***D. Berger-Richardson, T. Chesney, M. Englesakis, A. Govindarajan, S.P. Cleary, C.J. Swallow.*** **From the University of Toronto, Toronto, Ont.**

Gallbladder adenocarcinoma (GBCA) is recognized as an aggressive cancer with a propensity for local and distant recurrence. The early experience with laparoscopic cholecystectomy revealed a high incidence of port site metastasis (PSM), estimated at 14% in a review of case series up until 1999. Recognition of this phenomenon prompted changes in surgical technique. We questioned whether the incidence of port site metastasis has changed in the past 15 years. The pattern of PSM (extraction vs. nonextraction port) may provide a clue to mechanism. We conducted a systematic review of publications reporting on a minimum of 5 patients who underwent cholecystectomy-harboring GBCA, with specific analysis of subsequent wound recurrence. Two independent reviewers assessed articles for eligibility. Nineteen papers published since 1999 met inclusion criteria; all were case series. PSM were found in 57 of 589 patients (incidence 10%). Only 2 of the 19 studies included > 100 patients with GBCA and prospectively assessed for PSM with follow-up more than 20 months: in these studies the incidence of PSM was 7% and 13%. Since the first reported case of PSM in the setting of GBCA in 1991, a total of 376 patients have been reported to have GBCA PSM (case series and case reports). In these, 327 individual port sites were found to harbor recurrence (median PSM/person 1, range 1–4). Of 190 PSM whose location was decipherable, 53% were at extraction sites and 47% at nonextraction sites ($p = 0.526$). Despite implementation of techniques for risk reduction, PSM following cholecystectomy is an unresolved issue with an incidence of 7%–13%. Equal rates of recurrence at nonextraction and extraction ports indicate mechanism(s) other than direct contact with the wound during extraction.

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Real-time electromagnetic navigation for breast tumour resection: pilot study on palpable tumours. ***G. Gauvin, T. Ungi, C.T. Yeo, G. Fichtinger, R. Walker, J. Rudan, C.J. Engel.*** **From Queen's University, Kingston, Ont.**

Breast cancer, the most common cancer in women, is ideally treated by breast-conserving surgery during its early stages. Current strategies, including gold-standard wire-localization, have positive margin rates as high as 47%. We propose using real-time electromagnetic (EM) navigation to 3-dimensionally delineate and track the tumour resection volume intraoperatively. An ultrasound is used to register the resection volume from a tracked needle fixed in the tumour, allowing tumour movement to be followed in real time during surgery. A previous study done on breast phantoms showed a decrease in positive margin rate from 42.9% (wire localization) to 19.0% (EM navigation). A pilot study was done on patients with a single palpable breast tumour to test the ease of use of EM navigation in the operating room setting. Feasibility was assessed via demonstration of safety and sterility, as well as acceptable duration of the operation and tumour registration. Six patients (mean age 53.5 yr) underwent a lumpectomy under EM navigation. The mean operative time was 59 minutes for the cases of lumpectomy with sentinel lymph node biopsy and 35 minutes for the lumpectomy alone. The mean tumour registration time was 9.5 (range 6–12) minutes. Pathology revealed stage IA to IIIA breast cancers, and all margins were negative. There were no EM-specific complications or breach in sterility during surgery. Feedback questionnaires stated that none of the participants found that the EM sensors interfered with the surgical procedure, and that EM navigation was easy to use. This pilot study shows that EM navigation in breast-conserving

therapy could provide real-time feedback to surgeons that may improve treatment outcome. It is feasible and safe to use this method intraoperatively. These encouraging results will be extended to inform the next phase of research: a clinical trial on nonpalpable tumours to prove the benefit of navigation compared with conventional methods.

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Neoadjuvant imatinib for primary gastrointestinal stromal tumour (GIST): mutational status and timing of resection. ***D.A. Bischof, J. Swett-Cosentino, A.J. Cannell, K. Kazazian, S. Burtenshaw, M.E. Blackstein, C.J. Swallow*. From the University of Toronto, Toronto, Ont.**

Neoadjuvant imatinib (NI) has been established as safe in primary GIST; however, its efficacy has not been well studied. The purpose of this study was to assess the efficacy of NI in downsizing primary GIST and to identify predictors of downsizing. Patients diagnosed with primary nonmetastatic GIST between 2003 and 2014 who received NI were identified from a prospective institutional database. A retrospective chart review was conducted to capture tumour and treatment data. Response to NI was measured by an independent assessor using RECIST criteria (sums of longest tumour diameter in 3 dimensions, on serial CT scans). In the study cohort of 28 patients, 17 were male and median age was 57 (22–79) years. Median maximal tumour diameter at diagnosis was 11 (range 3–25) cm. The site of GIST was gastric in 12 patients, duodenum in 4, jejunum/ileum in 5 and rectum in 7. Using RECIST criteria, 17 patients had a partial response (PR) to NI, 10 had stable disease and 1 had progressive disease. The majority of patients with exon 11 mutations had a PR (13/16), while a minority of patients with exon 9 (0/2) or other (3/7) mutations had a PR (mutation status unknown in 3). Median time to maximal downsizing was 8 (range 2–29) months. The most frequent triggers for surgery were stabilization of tumour size (12), desired radiologic response (11) and development of an enhancing nodule within the tumour (2). Three patients had secondary mutations discovered on final pathology. NI was effective in downsizing primary GISTs, though time to maximal downsizing varied considerably. Mutation status is predictive of response to NI, and should be determined before its initiation. Duration of NI should be goal-directed, with serial reassessment by the operating surgeon and resection should be undertaken at earliest point after goals of NI are met to minimize emergence of imatinib-resistant mutations.

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Adherence to osteoporosis screening guidelines in seniors with breast cancer treated with anti-estrogen therapy: a population-based study. ***D. Henault, S. Dumitra, S.-L. Chang, R. Kramer, N. Mayo, A.N. Meguerditchian*. From McGill University, Montréal, Que.**

Adjuvant antiestrogen therapy (AET) for patients with estrogen-receptor positive breast cancer (BC) is considered the standard of care to optimize BC survival. Bone mineral density (BMD) should be monitored throughout treatment as it is decreased by AET. We aimed to characterize the rate of guideline-appropriate baseline BMD measurement in senior breast cancer survivors taking AET and to identify predictors of adherence to guideline in Quebec, Canada, where universal health insurance is in place. A historical prospective cohort study using the provincial hospital discharge and medical and pharmaceutical services databases was conducted in the province of Quebec. All women with incident, stage I, II or III BC (1997–2012) were identified. Odds ratios (ORs) and 95% CIs for baseline BMD measurement were calculated with a generalized estimating equations regression model, adjusting for clustering of patients within physicians. Of the 16 480 women taking AET, 36.1% (n = 5944) received baseline BMD. This percentage increased to 58.4% (n = 4328) when restricted to the 7407 women taking aromatase inhibitor (AI) only. Relative to women 65–69 years old, women 70–79 and 80+ years old were less likely to receive baseline BMD measurement (ORs 0.79 and 0.41, 95% CI 0.72–0.86 and 0.37–0.47, respectively). Women who were also cared for by a radiation oncologist, a medical oncologist or a family physician had an increased likelihood of receiving guideline appropriate BMD measurement (ORs 1.71, 1.22 and 1.28, 95% CI 1.56–1.87, 1.06–1.40 and 1.17–1.40, respectively). Moreover, nonadherence to AET by the patients was also a risk factor for nonadherence to baseline BMD measurement (OR 0.75, 95% CI 0.67–0.84). Demographic and clinical patient-related risk factors, multidisciplinary oncological care and gaps in other aspects of BC management predicted receipt of guideline appropriate BMD measurement.

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Automated robot interventions for enhanced clinical outcomes in breast biopsy. ***M. Anvari, N. Duchesne, K.G. Chan, T. Chapman*. From McMaster University and the Centre for Surgical Invention and Innovation (CSii), Hamilton, Ont.; Hôpital du Saint-Sacrement and Université Laval, Québec, Que.**

Current practice for MRI-guided breast biopsy is a manual procedure whereby a radiologist identifies suspicious lesions under MRI and performs calculations to target a lesion. This procedure can be time consuming, error-prone and expensive. Patients may experience pain, especially if targeting is inaccurate and multiple insertions are required. Outcomes are variable and depend on the skill and experience of the radiologist. An image guided automated robotic (IGAR) device has been developed to address the limitations of the manual procedure and allows the radiologist to target the lesion, plan approach and thereafter will carry out the injection of local anesthesia and performance of MRI biopsy in an automated manner. This can be performed in the bore of the magnet and use real time image guidance. A Phase I safety trial was completed with 7 patients. All 7 IGAR-breast biopsies in Phase I was successful. IGAR-breast procedures were seen with a mean of 72.86 minutes, which is generally less than a typical manual breast biopsy with a mean of 84 minutes. Patient reported pain scores were low (McGill) with a mean of 0.85/45 with high patient acceptance of the procedure. Average tool tip accuracy was 3.11 ± 1.14 mm. Phase I demonstrated successful IGAR-breast biopsies, demonstrating that it is easier, more accurate and the repeatability is high. IGAR-breast has demonstrated execution that is robust, dependable, and highly accurate that could enable earlier clinical intervention. Following the success of Phase I, a multicentre cohort study was initiated to evaluate efficacy. Patients will undergo an IGAR-breast or routine manual MRI-guided breast biopsy. Outcomes including diagnostic

quality of the biopsy sample, procedure time, rebiopsy rates, target accuracy, subject pain, cosmesis, and ease of use will be compared between the 2 arms. Results from both the Phase II procedures will be available for presentation at conference.

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Preoperative pregabalin or gabapentin for postoperative acute and chronic pain among patients undergoing breast cancer surgery: a systematic review and meta-analysis of randomized controlled trials. ***A.S. Rai, H. Clarke, J. Dhaliwal, S. Choi, J.W. Busse, P.J. Devereaux, J. Khan.*** **From the University of Toronto, Toronto, Ontario, and McMaster University, Hamilton, Ont.**

Pain continues to be a significant challenge after breast cancer surgery. Gabapentin and pregabalin have anti-hyperalgesic effects that have been used to prevent acute and chronic postoperative pain. The aim of this study was to systematically evaluate the use of gabapentin or pregabalin in breast cancer surgery. We conducted a systematic search of Medline, Embase, Central, Web of Science, and ProQuest from inception to 2014. Eligible studies were randomized controlled trials that enrolled patients to undergo breast cancer surgery, randomly assigned them to preoperative pregabalin/gabapentin or to a placebo group, and collected effects on acute or chronic (≥ 3 mo) postoperative pain. Two reviewers independently agreed on eligibility, independently assessed methodological quality and extracted outcome data. A total of 824 articles were found after the systematic search; 10 were eligible for review, 6 of which assessed gabapentin and 4 pregabalin. Pain scores in recovery (within 1 h of surgery) were reduced by gabapentin compared with placebo (numeric rating scale 1.49 cm, 95% CI –2.71 cm to –0.2 6 cm, I^2 = 73%; minimally important difference 1 cm). Gabapentin did not reduce 24-hour pain scores, but did decrease 24-hour morphine consumption (MD –3.56 mg, 95% CI –5.23 to –1.89, I^2 = 52%). There was no effect of gabapentin on chronic mastectomy pain. Pregabalin decreased morphine consumption in recovery compared with placebo (MD –4.8 mg, 95% CI –8.76 to –0.83, I^2 = 88%). Although, pregabalin did not reduce pain at 24 hours, it did reduce the rate of chronic mastectomy pain (OR 0.31, 95% CI 0.13–0.72, I^2 = 85%). Preoperative admission of either gabapentin or pregabalin before breast cancer surgery may reduce postoperative opioid consumption and acute pain compared with placebo. Pregabalin may also have an effect on reducing chronic mastectomy pain. Large randomized trials are needed to verify results.

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Uptake and impact of synoptic reporting on breast cancer operative reports in a community care setting. ***J. Eng, C. Baliski.*** **From the University of British Columbia, Vancouver, BC**

Dictated operative reports represent the primary means by which cancer surgeons document the intraoperative details essential for informing clinical decision-making. Despite their importance, operative reports are often incomplete. Synoptic operative reports were developed and implemented in an effort to improve surgical documentation. We sought to determine the rate of adoption of synoptic reporting (SR) in our region, and the influence it has had on the completeness of operative reports compared with narrative reports (NRs) produced in the same community care setting. Essential breast cancer operative report elements were identified and the completeness of breast cancer operative reports produced over a consecutive 3-year period (Jan. 1, 2011, to Dec. 31, 2013) was assessed in terms of these elements through a retrospective chart review. Logistic regression was used to assess the relationship between completeness, report type (SR or NR), and surgeon experience and volume. In total 16.4% of the analyzed operative reports used SR. Ten out of 38 eligible surgeons have produced at least one synoptic operative report. Low-, medium- and high-volume surgeons were all represented among those who used SR; however, surgeons with 10–19 years experience were more likely to adopt SR. Analysis of operative reports shows that SR has higher rates of completion for 36 of the 44 individual elements. When surgeon volume and experience were controlled for, SRs were shown to be more complete than NRs. Breast cancer NRs are failing to capture all of the essential data needed for optimal patient care, but improvement has been shown with the use of SR. The uptake of SR in our region has been poor and further engagement is needed to promote uptake in nonadopters.

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Withdrawn

