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Abstracts of presentations to the Annual Meetings of the

Canadian Association of Bariatric Physicians and Surgeons

Canadian Association of General Surgeons

Canadian Association of Thoracic Surgeons

Canadian Hepato-Pancreato-Biliary Association

Canadian Society of Surgical Oncology

Canadian Society of Colon and Rectal Surgeons

Ottawa, Ont.
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Forum canadien de chirurgie

Résumés des communications présentées aux congrès annuels de

l'Association canadienne des médecins et chirurgiens bariatriques

Association canadienne des chirurgiens généraux

l'Association canadienne des chirurgiens thoraciques

Canadian Hepato-Pancreato-Biliary Association

la Société canadienne d'oncologie chirurgicale

la Société canadienne des chirurgiens du côlon et du rectum

Ottawa (Ont.)
du 19 au 22 sept., 2013

Abstracts • Résumés

Canadian Association of Bariatric Physicians and Surgeons

Association canadienne des médecins et chirurgiens bariatriques

1

Revisional weight loss surgery after failed laparoscopic gastric banding: an institutional experience. ***T. Tran, E. Pauli, J. Lyn-Sue, R. Haluck, A. Rogers.*** **From the Penn State Hershey Medical Center, Hershey, Pa.**

Increasing experience with laparoscopic adjustable gastric bands (LAGB) has demonstrated a high rate of complications and inadequate weight loss. Laparoscopic Roux-en-Y gastric bypass (LRYGB) and laparoscopic sleeve gastrectomy (LSG) have been reported to be safe and effective in selected patients. The purpose of our study was to evaluate the incidence and outcomes of revisional weight loss surgery after LAGB at our institution.

From June 2006 to August 2012, all patients undergoing LAGB and those requiring revision were retrospectively analyzed. All procedures were performed by 2 surgeons with extensive experience in bariatric surgery. Parametric data are presented as mean ± SD, nonparametric data are presented as median and interquartile range (IQR). During the study period, 253 patients underwent LAGB. A total of 101 patients (40%) required reoperation. Fifty-five patients (51 women, age 46 ± 12) with BMI of 42 (39–45) successfully underwent reoperative weight loss surgery (48 RYGB, 7 LSG). Indications for surgery included dysphagia in 34 patients (62%), inadequate weight loss in 16 patients (29%), symptomatic reflux in 2 patients (4%), gastric prolapse in 2 patients (4%) and needle phobia in 1 patient (2%). Two of the 55 patients required conversion to an open RYGB. Revisional surgery was undertaken approximately 33 ± 13 months after LAGB. A staged removal of gastric band and revisional weight loss procedure was performed in 15 patients with an interval of 2.5 (1.2–7) months between procedures. Operative time was 160 (142–183) minutes. Hospital length of stay was 2 (1–3) days. Early complications occurred in 9 patients (16%), including 2 anastomotic leaks. Twelve patients (22%) presented with late complications requiring intervention. There was 1 death. At a median follow up of 7 months, excess body weight loss was 42% ± 24% and 49% of patients achieved a BMI of less than 33.

Laparoscopic adjustable gastric bands are associated with a high incidence of reoperation. Reoperative weight loss surgery can be performed in selected patients with a higher rate of complications than primary surgery. Good short-term weight loss outcomes can be achieved.

2

Predictors of post–bariatric surgery appointment attendance: the role of psychosocial factors. ***S. Sockalingam, S. Cassin, R. Hawa, A. Khan, S. Wnuk, T.D. Jackson, A. Okrainec.*** **From the Toronto Western Bariatric Surgery Program, University of Toronto, Ryerson University, the University Health Network, the Toronto Western Hospital, University of Toronto, Ont.**

Attendance at bariatric surgery follow-up appointments has been identified as an important predictor of bariatric surgery outcomes. In this prospective study, we sought to examine psychosocial predictors of attendance at postoperative follow-up appointments.

Consecutive bariatric surgery patients (n = 132) were assessed presurgery for demographic variables, depressive symptoms and relationship style. Patients were followed for 12 months postsurgery and, based on their attendance at follow-up appointments, were classified as postsurgery appointment attenders (or "attenders"; attended at least 1 appointment within the past 6 mo) or postsurgery appointment nonattenders (or "nonattenders"; attended no follow-up appointments within the past 6 mo). Psychosocial and demographic variables were compared between the attender and nonattender groups. Multivariate logistic regression was used to identify significant predictors of attendance at post–bariatric surgery follow-up appointments.

At 12 months postsurgery, 68.2% of patients were classified as attenders. The nonattender group was significantly older (p = 0.04) and had significantly higher avoidant relationship style scores (p = 0.02). There was a trend toward patients in the nonattender group living a greater distance from the bariatric centre (p = 0.05). Avoidant relationship style was identified as the only significant predictor of postoperative appointment nonattendance in the logistic regression analysis.

These findings suggest that avoidant relationship style is an important predictor of post–bariatric surgery appointment nonattendance. Effective interventions aimed at engaging patients with an avoidant relationship style should be developed to improve attendance at postoperative appointments.

3

Bariatric surgery for obesity: a systematic review and network meta-analysis. ***H. Alobaid, G. Wells.*** **From The Ottawa Hospital, the Cardiovascular Research Methods Centre, University of Ottawa Heart Institute, Ottawa, Ont.**

Obesity is the fifth leading cause of global deaths. The efficacy and safety of obesity treatment are still controversial. The objective of this systematic review and meta-analysis is to assess the efficacy and safety of bariatric surgery, in modifying clinically important outcomes such as weight and comorbidities including diabetes, hyperlipidemia, hypertension, and obstructive sleep apnea.

Randomized controlled trials (RCTs) from January 1950 to September 2010, comparing different surgical procedures, or surgical to nonsurgical treatment in adolescents and adults, who fulfill the definition of obesity, were included. Percentage of excess

weight loss, body mass index, weight loss in kilograms, resolution or improvement of obesity related comorbidities, and safety were evaluated. Weighted mean differences were calculated. A random-effects model was used.

Nineteen RCTs with 1346 participants were included. Bariatric surgery resulted in greater weight loss when compared to nonsurgical treatment. Weight loss was also associated with resolution and/or improvement of the obesity related comorbidities such as diabetes, hypertension, hyperlipidemia, and sleep apnea. Weight loss varied across the surgical procedures, where malabsorptive procedures such as biliopancreatic diversion/duodenal switch had the greatest weight loss, followed by sleeve gastrectomy and Roux-en-Y gastric bypass. Purely restrictive procedures such as vertical banded gastroplasty and adjustable gastric banding resulted in the least weight loss and were associated with greater risk of reoperations as well as conversion to other types of bariatric surgery procedures. Malabsorptive procedures led to more early complications when compared to others.

Bariatric surgery is more effective than nonsurgical treatment for obesity. The safety and efficacy varied across the surgical procedures. Long-term, high-quality and adequately powered trials are still needed to support the available evidence.

4

Longitudinal versus transverse gastrojejunostomy during RYGB for morbid obesity: impact on marginal ulcer rate and excess weight loss. ***F. Saleh, L. Ambrosini, S. Cassie, J.J. Gnanasegaram, C. Mueller, T.D. Jackson, A. Okrainec.*** **From the Division of General Surgery, University Health Network, University of Toronto, Toronto, Ont.**

We have previously shown that transverse enterotomy closure significantly reduces the rate of gastrojejunostomy (GJ) stricture after laparoscopic Roux-en-Y gastric bypass (RYGB) for morbid obesity compared to a longitudinal closure. The objective of this study was to compare marginal ulcer (MU) rates and percent excess weight loss (%EWL) between the 2 closure techniques.

A retrospective review of consecutive patients who underwent RYGB at our institution was performed between November 2009 and December 2011. Baseline patient demographics were tabulated by chart review. The MU rates based on endoscopy findings with up to 2 years of follow-up and %EWL at 1 year were recorded. Multivariable logistic and linear regression analyses were used to compare MU rates and %EWL for the 2 GJ closure techniques.

A total of 197 patients were included in this study, 97 (49.2%) with a longitudinal closure and 100 (50.8%) with a transverse closure. The mean age and BMI of the study population were 44.4 (SD 10.0) and 48.1 (SD 7.1), respectively. There were no statistical differences between closure groups regarding age, BMI, or baseline comorbidities. The mean %EWL was 69.1% in the transverse group and 71.3% in the longitudinal group ($p = 0.67$). There remained no statistical difference in %EWL after adjusting for baseline characteristics. Marginal ulcers occurred in 23 (11.6%) patients overall, 7 (7.2%) in the longitudinal group and 16 (16.0%) in the transverse group (OR 2.45, 95% CI 0.89–7.37; $p = 0.055$). Controlling for obstructive sleep apnea and hyperlipidemia in our multivariate model, MU rate was significantly higher in the transverse closure group (OR 2.63, 95% CI 1.02, 6.79; $p = 0.046$).

In exchange for a lower postoperative GJ stricture rate, there appears to be a significant increase in MUs after transverse GJ closure after RYGB for morbid obesity, while %EWL appears unaffected. Further research is needed to determine potential causes of this increase in MU rate.

5

High rates of gastric band removal in Ontario: a population-based analysis. ***T.D. Jackson, R. Saskin, A. Okrainec, C.M. Bell, D.R. Urbach.*** **From the Department of Surgery, University of Toronto, the Institute for Clinical Evaluative Sciences of Ontario, the Department of Medicine, University of Toronto, Toronto, Ont.**

The laparoscopic adjustable gastric band (LAGB) is amongst the most commonly performed bariatric surgical procedures in North America. While the short-term outcomes appear favourable, controversy remains over the longer-term safety profile and effectiveness of the LAGB. The objective of our study was to determine the rate of LAGB removal for complications in Ontario.

Ontario Health Insurance Plan fee code claims for removal of gastric band were measured between Jan. 1 and Dec. 31, 2011. The population-based rate of gastric band removals for failure or complications was estimated assuming a steady state of LABG insertions in Ontario annually.

A total of 122 LAGB removal procedures were performed in Ontario during the 2011 calendar year. The mean age was 46.7 years and 108 patients (88.5%) were female. The number of procedures ranged from 8 to 15 per month. Estimated annual rates of LAGB removal ranged from 29.4% (95% CI 20.7%–28.4%) assuming 500 LAGB insertions per year, 12.2% (95% CI 10.2%–14.4%) assuming 1000 LAGB insertions per year, and 6.1% (95% CI 5.1%–7.2%) assuming 2000 LAGB insertions per year.

This population-based estimate of LAGB removals demonstrates an unexpectedly high number of LAGB are being removed in Ontario likely exceeding 6% per year. It appears that a LAGB is removed for complications approximately every 3 days in Ontario hospitals. High explanation rates after LAGB represent an important patient safety and public health concern. These findings highlight the need to better define the long-term risks associated with LAGB as a treatment modality for morbid obesity.

6

The impact of laparoscopic sleeve gastrectomy on plasma ghrelin levels: a systematic review. ***B. Anderson, N.J. Switzer, A. Almamar, X. Shi, D.W. Birch, S. Karmali.*** **From the Department of Surgery, University of Alberta, Edmonton, Alta., the Centre for the Advancement of Minimally Invasive Surgery (CAMIS), Royal Alexandra Hospital, Edmonton, Alta.**

Within the last decade, several authors have proposed laparoscopic sleeve gastrectomy (LSG) as a potential definitive treatment for morbid obesity. While initially perceived as being a solely restrictive procedure, it is now theorized to have additional hormonal effects (primarily the reduction of circulating levels of plasma ghrelin). However, there is limited supporting evidence for this claim. Therefore, the purpose of our study is to conduct a systematic review of the literature to clarify the effects of LSG on modulation of postoperative ghrelin concentrations. A comprehensive literature search for published or unpublished studies of

sleeve gastrectomy and ghrelin written in English prior to February 2013 was performed using PubMed, EMBASE, the Cochrane database and Scopus. Grey literature was also searched through Google. Inclusion criteria for searches were randomized controlled trials, nonrandomized clinical trials, retrospective and prospective cohort studies, or case series. Seven studies were deemed suitable for analysis. The mean patient age was 43 ± 8.8 years and female percentage was 74.4% ± 15.3%. The mean initial BMI was 46.2 ± 7.8 and mean follow-up time was 9.5 ± 15 months. The mean postoperative BMI was 37.3 ± 5.8 over the same follow-up period. Pooled mean preoperative ghrelin levels were 698.4 ± 312.4 pg/mL and postoperative levels were 414.1 ± 226.3 pg/mL ($p < 0.0001$). Pooled analysis of ghrelin levels at 3, 6 and 12 months showed a significant reduction in circulating levels. Our systematic review shows that LSG has a significant effect on ghrelin levels, leading to considerable reduction in circulation levels following surgery. Further research and standardization is necessary to clearly establish a causative relationship between LSG and reduction of circulating ghrelin levels.

7

The impact of bariatric surgery on obstructive sleep apnea: a systematic review. ***N.J. Switzer, K. Sarkhosh, M. El-Hadi, D.W. Birch, X. Shi, S. Karmali.*** **From the Department of Surgery, University of Alberta, Edmonton, Alta., and the Centre for the Advancement of Minimally Invasive Surgery, the Royal Alexandra Hospital, Edmonton, Alta.**

There is a strong relationship that exists between obesity and the development of obstructive sleep apnea (OSA). It goes beyond merely a disorder of excessive daytime sleepiness and sleep disturbance, as it has important long-term sequelae in the development of the metabolic syndrome. It is well understood that metabolic surgery, as a whole, is the most effective option for managing and treating obesity and its comorbidities, including OSA. However, there remains a paucity of data in the literature of the comparison and evaluation of all the specific types of bariatric surgery themselves. In an effort to answer this question a systematic review was performed, to determine, of the available bariatric procedures (Roux-en-Y gastric bypass, laparoscopic sleeve gastrectomy [LSG] or biliopancreatic diversion [BPD]), which procedures were the most efficacious in the treatment of OSA.

A total of 69 studies with 13 900 patients were included in the review. All the procedures achieved profound effects on OSA, as over 75% of patients saw at least an improvement in their sleep apnea post–bariatric surgery. The BPD was the most successful bariatric procedure in improving or resolving OSA, with LAGB being the least.

It appeared that malabsorptive procedures were more successful in achieving clinically significant effects on OSA compared with restrictive procedures. This was postulated to be due to alterations in gut anatomy and hormones, as well as to a reduction in low-level systemic inflammation, but still more studies are needed to be devoted to the exact physiological mechanism that accounts for the impressive action of malabsorptive procedures on OSA. In conclusion, bariatric surgery is a definitive treatment for obstructive sleep apnea, regardless of the specific type.

8

Perception and awareness of bariatric surgery in Canada: a national survey of general surgeons. ***T.D. Jackson, S. Sockalingam, F.A. Quereshy, J. Kwong, F. Saleh, A. Okrainec.*** **From the University of Toronto, Toronto, Ont.**

The number of bariatric surgeries performed in Canada continues to increase and general surgeons are likely to encounter bariatric surgical patients in their practice. The objectives of this survey were to assess Canadian general surgeons' perceived knowledge regarding bariatric surgery and perceived availability of resources to manage bariatric surgery patients.

A self-administered questionnaire was developed based on the study aims and a focus group was conducted to solicit feedback on relevance of the questions. General surgeons were asked to complete the survey at 2 large general surgery conferences between September 2012 and November 2012 (Canadian Surgery Forum 2012, update in Minimally Invasive Surgery 2012). The survey was disseminated electronically by Ontario Association of General Surgeons e-news in November 2012 and Canadian Association of General Surgeons e-news in December 2012.

A total of 158 questionnaires were completed (104 practising surgeons and 54 general surgery residents/fellows) representing 8 provinces (68.5% Ontario). Twenty respondents were bariatric surgeons. Among 84 nonbariatric surgeons, 68.3% referred a patient in the last year for bariatric surgery, 79% agreed bariatric surgery resulted in sustained weight loss, and 81.7% would consider referring a family member. Knowledge gaps were identified in estimates of mortality and morbidity associated with bariatric procedures and indications for surgery. The majority of surgeons surveyed have encountered patients with complications from bariatric surgery over the last 12 months. Over 50% of surgeons who do not perform bariatric procedures reported not feeling confident to manage early or late complications; 35.4% reported adequate resources/equipment to manage morbidly obese patients, and few have an effective mechanism to transfer patients to a bariatric centre. Overall, 73.3% of respondents reported residency training provided inadequate exposure to bariatric surgery and 85.3% felt that additional continuing medical education resources would be useful.

There appears to be support for bariatric surgery among Canadian general surgeons participating in this survey. Knowledge gaps identified indicate the need for more education and resources to support general surgeons managing bariatric surgical patients.

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(CAGS Basic Science Award) A novel model for measuring surgeons' visual perception of tissue planes. ***S.T. Ali, C.M. Schlachta, R. Eagleson.*** **From the Canadian Surgical Technology and Advanced Robotics, the Department of Surgery, London Health Sciences Centre, the Faculty of Engineering, Western University, London, Ont.**

The most basic principle of surgery, to operate in tissues planes, is something we rely on trainees to acquire seemingly by simple diffusion. With close collaboration from expertise in human factors design, we hypothesized that we could develop a test of surgeons' ability to identify tissue planes that could distinguish between surgeons of different levels of experience. Sixteen progressive, captured, video images from a single laparoscopic rectal cancer surgery were presented on a tablet computer to 12 surgeons with different levels of experience. Surgeons were divided into 3 groups based on level of experience. The consultant group (C) included general surgeons already in practice. The senior trainees group (ST) were residents in their third to fifth years of training, and the junior trainee group (JT) in their first 2 years of general surgery residency. Participants were asked to draw a line on the screen indicating the precise dissection plane. Using MATLAB computer software, each line was divided into 8 equal segments by 9 ordinal points. Lines were compared to each other using the sum of calculated pairwise distances between these 9 points. Pairwise comparisons within each group of participants representing JT, ST and C regarding total distance between lines demonstrated statistically significant greater variability with JT versus C in 9 images, ST versus C in 6 images, and JT versus ST in 5 images. For 6 images, no significant differences in variability were calculated. This novel model for testing visual perception of surgical tissue planes appears to be able to discriminate between surgeons at different levels of experience, with variability declining with experience. This model may hold promise as an evaluation tool and ultimately an instruction tool.

10

MicroRNA profiling of pulmonary hypoplasia associated with congenital diaphragmatic hernia. ***R. Kholdebarin, N. Khoshgoo, B.M. Iwasiow, R. Keijzer.*** **From the University of Manitoba, Winnipeg, Man.**

Congenital diaphragmatic hernia (CDH) is associated with pulmonary hypoplasia. The pathophysiology of abnormal lung development and a genetic cause for CDH are unknown. This warrants investigating epigenetic regulators such as microRNAs. These are small RNA molecules that regulate gene expression without altering the genetic code. We aimed to investigate the role of microRNAs in CDH.

We performed a microarray screen and real-time quantitative polymerase chain reaction (qPCR) on lung tissues from prenatal cases of CDH and age-matched controls. We used in situ hybridization (ISH) to detect expression of microRNA-200b (miR-200b) in postnatal lung tissues from human cases of CDH. We also studied miR-200b expression in the nitrofen rat model of congenital diaphragmatic hernia at various stages of embryonic development. We used a luciferase bioluminescent assay, qPCR and Western blotting to determine the role of miR-200b in transforming growth factor (TGF)-β/SMAD signalling in bronchial epithelial cell cultures.

The microarray screen identified miR-200b as 1 of 2 miRNAs that is overexpressed in human cases of CDH. The results were confirmed by qPCR ($p < 0.05$). The ISH revealed increased expression of miR-200b in terminal saccules of human cases of CDH. In rats, nitrofen-induced CDH was associated with decreased miR-200b expression. In early stages of lung development, epithelial miR-200b expression is highest at the elongating tips of the bronchial tree. In mesenchymal tissue, miR-200b expression drops with differentiation into parabronchial smooth muscle cells. In cultured bronchial epithelial cells, we demonstrated a negative feedback loop between miR-200b and TGF-β/SMAD signalling.

Pulmonary hypoplasia in CDH is associated with abnormal miR-200b expression. TGF-β/SMAD signalling accounts for observed differences between human and animal models of congenital diaphragmatic hernia.

11

The role of Oncostatin M in macrophage activation. ***P.Y. Young, Q.N. Mian, C.A. Compston, T.A. Churchill, T.F. Mueller, R.G. Khadaroo.*** **From the Department of Surgery, University of Alberta, and the Department of Medicine, University of Alberta, Edmonton, Alta.**

Sepsis is a major contributor to inpatient mortality and morbidity in Canada. Oncostatin M (OSM) is a member of the interleukin-6 (IL-6) family of cytokines. Our laboratory has previously shown that deficiency of OSM receptor (OSMR) is beneficial in sepsis, with reduced kidney injury. The molecular mechanism of this novel protective effect is still unknown. We hypothesize that OSM primes for macrophage responsiveness to lipopolysaccharide (LPS) through macrophage-epithelial interactions.

Human monocyte (THP1) and proximal renal tubular epithelial cells (HK2) were grown in monoculture and coculture. THP1 were differentiated into macrophages using 5 ng/mL phorbol myristate acetate for 48 hours. In monoculture, cells were treated with OSM (1 ng/mL) and/or LPS (100 ng/mL) and analyzed at varying time points. For coculture conditions, cells were treated with purified OSM (1 ng/mL) for 24 hours, and then LPS for varying concentrations and durations. Harvested cells were analyzed by quantitative reverse transcription polymerase chain reaction for changes in OSM, OSMR, IL-6, suppressor of cytokine signalling 3 (SOCS3), and LPS binding protein (LBP), and by enzyme-linked immunosorbent assay for NFκB activation.

In a monoculture of HK2 alone, treatment with OSM and LPS resulted in a 33-fold increase in LBP transcript levels at 24 hours, compared to 1.1-fold and 7.5-fold with LPS or OSM alone. In

THP1 monoculture, LPS strongly upregulated OSM and OSMR transcripatients with increases of 5.9-fold and 40-fold, respectively, at 12 hours. In coculture conditions, levels of proinflammatory transcripatients (IL-6, LBP) were more highly upregulated through macrophage-epithelial interactions. At low dose LPS (0.1 ng/mL), pretreatment with OSM resulted in 1.5-fold higher NFκB activation compared to OSM or LPS alone.

Oncostatin M is an important early immunomodulatory cytokine that promotes macrophage activation through macrophage-epithelial interactions. The OSM/OSMR axis may represent a novel target in the treatment of sepsis.

12

Initial validation of force and torque measures during direct laryngoscopy and endotracheal intubation. ***P. Dawe, B. Unger, L. Gillman, A. Colwell, A. Vergis, J. Park.*** **From the University of Manitoba, the Health Sciences Centre, the St. Boniface Hospital, Winnipeg, Man.**

Direct laryngoscopy and endotracheal intubation (DLETI) is a critically important skill that medical professionals must learn to master, but there are few well-developed and objective measures of technical skill related to DLETI. We constructed a force- and torque-measuring laryngoscope to quantify the applied forces and torques during DLETI.

We built a laryngoscope with ATI Industrial Automation's ATI Mini45 6-axis force and torque sensor integrated between the handle and blade. The z axis was aligned with the handle, y axis aligned along the blade, and x axis perpendicular to these 2 planes. Using our custom-designed laryngoscope, 12 experts and 10 novices each performed 5 DLETI trials on a SimMan 3G (Laerdal Medical) patient simulator. Experts were attending physicians in anesthesia or critical care. Novices were medical students with little DLETI experience. Data were acquired at less than or equal to 100 Hz using National Instruments (National Instruments Corporation) and ATI data acquisition units.

Experts applied greater mean force in the z and y axes and the resultant force vector in these 2 axes was different for experts as compared to novices (Fmean = 18.7 ± 8.9 N, θ = 16º above the y axis for experts v. 14.0 ± 6.2 N, θ = –4º relative to the y axis for novices, $p < 0.01$ for both magnitude and direction). There was a trend toward less mean torque about the x axis for experts compared to novices (TX = 1.3 ± 0.9 Nm v. 1.7 ± 0.7 Nm, $p = 0.06$). Experts were faster than novices (mean trial time 18.40 ± 1.41 s v. 33.97 ± 4.7 s, $p < 0.01$).

The different force profiles shown by experts and novices during simulated DLETI provide reliable and objective process metrics that can be used to help DLETI training and evaluation. Our system also displays applied forces in real time and alongside earlier recordings, which has the potential to act as a source of feedback to enhance learning.

13

Ileocolic resection recruits CD11c+ CD103+ dendritic cells to the gut and suppresses the inflammatory response in a surgical mouse model. ***T. Perry, B. Dicken, R. Fedorak, K. Madsen.*** **From the University of Alberta, Edmonton, Alta.**

Crohn disease commonly reoccurs early at the site of anastomosis after ileocolic resection (ICR). Immunologic factors leading to recurrence have yet to be defined. This study was designed to evaluate changes in gut dendritic cell (DC) populations resulting from ICR, and correlate these changes with the intestinal response to a gut insult after surgery.

Ileocolic resection with anastomosis was performed in adult mice. After 9 (short-term) or 23 (long-term) days following ICR, mice were given dextran sodium sulfate (2.5%) for 5 days followed by sacrifice. Myeloperoxidase (MPO), interleukin (IL)-1β, KC/GRO, TNF-α, TGF-β, IL-12, IFN-γ, IL-6, IL-10, IL-17 and IL-23 levels were determined in the terminal ileum (TI), and colon. TI bacteria load was measured using real-time polymerase chain reaction. Double immunofluorescence for CD11c with CD103, or CD11b, was performed.

The ICR caused an initial elevation of MPO, KC/GRO, and IL-1β ($p < 0.05$) in the TI and colon, but these decreased in the TI of long-term mice; conversely, bacteria increased in this tissue. Immunohistology revealed an influx of CD11c+CD103+ DCs in the lamina propria after ICR ($p < 0.001$). The DSS induced occult blood positive stools 48 hours earlier in ICR groups versus controls. This was associated with immunosuppression, and lack of cytokine response. In contrast, control mice had significant elevations in colonic MPO, IL-1β, KC/GRO, TNF-α, IFN-γ, IL-6, IL-10, IL-17 and IL-23 ($p < 0.05$).

Ileocolic resection causes an initial innate inflammatory response as evidenced by elevated MPO, KC/GRO, and IL-1β. The increased numbers of CD11c+CD103+ DCs at the surgical site coupled with a blunted cytokine response suggests a possible induction of inappropriate tolerance, which may explain the increased numbers of bacteria in the TI of mice given dextran sodium sulfate after 23 days. This study reveals a potential mechanism whereby increased tolerance to gut antigens after surgery allows enhanced bacterial loads to occur at surgical sites; leading to chronic infection, and contributing to Crohn disease relapse after ICR.

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Associating liver partition with portal vein ligation for staged hepatectomy (ALPPS) versus conventional 2-stage hepatectomy with portal vein occlusion: results of a multicentre analysis. ***R. Hernandez-Alejandro, K.P. Croome, E. Schadde, V. Ardiles, C. Tschuor, J. Baumgart, H. Lang, E. de Santibanes, P.-A. Clavien.*** **From the Western University, London, Ont., the University Hospital Zurich, Switzerland, the Italian Hospital, Buenos Aires, Argentina, the University of Mainz, Germany**

To compare the resection efficacy of associating liver partition with portal vein ligation for staged hepatectomy (ALPPS) and 2-stage approaches with portal vein ligation (PVL) or portal vein embolization (PVE). Staged hepatic resection was developed as strategy to allow resection of advanced liver cancers and avoid postoperative liver failure. In certain instances PVE or PVL fails to induce adequate liver hypertrophy, resulting in excessive wait times and tumour progression. Recently, ALPPS has been described as a revolutionary strategy to induce a rapid and large future liver remnant (FLR) volume increase; however, its effect on oncological results remains to be answered. A multicentre analysis was performed to evaluate the outcome of ALPPS and its performance at achieving complete resections (R0).

Patients undergoing ALPPS in 4 international centres were

compared with patients who underwent conventional 2-stage procedures with PVE/PVL. Primary end points were complete (R0) resection and DFS at 6 months. Secondary end points included 90-day mortality, complications and volume increase of the FLR. Multivariate analysis was performed to adjust for potential confounders.

Forty-seven patients undergoing ALPPS were compared with 83 patients who underwent conventional PVE/PVL. Only 54 of the 83 patients completed the second stage hepatectomy. A total of 77% of ALPPS patients achieved an R0 resection compared to 58% in the conventional arm (OR 2.74, $p = 0.031$). Recurrence within 6 months after resection in both groups was comparable. Ninety-day mortality in patients who completed both stages of ALPPS and PVE/PVL were 14.9% and 9.2%, respectively ($p = 0.38$). Volume increase per day was 11 times more rapid in ALPPS (35 cc/day; interquartile range [IQR] 26.2–49.5) compared with PVE/PVL (3 cc/day, IQR 1.7–5.8; $p = 0.001$).

This study provides the best evidence so far that ALPPS is superior to conventional 2-stage procedures to achieve a complete resection. These results support the need for longer follow-up and randomized controlled trials to definitively delineate the role of ALPPS in liver surgery.

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Polarizing invariant natural killer T cells toward a Th2 phenotype reduce disease severity in intra-abdominal sepsis. ***R.V. Anantha, D.M. Mazzuca, T.S. Mele, D.D. Fraser, C.M. Martin, S.M.M. Haeryfar, J.K. McCormick.*** **From the Western University, Children's Health Research Institute, Lawson Health Research Institute, London, Ont.**

Invariant natural killer T (iNKT) cells are potent lymphocytes that can produce pro- and/or anti-inflammatory cytokines. They present an attractive target for therapy in human disease. Because little is known about their role in sepsis, however, we sought to determine the frequency of iNKT cells in septic patients. Furthermore, we developed a mouse model of intra-abdominal sepsis (IAS) to test the effect of OCH (a Th2-polarizing agonist of iNKT cells that induces an anti-inflammatory phenotype) on disease severity.

Blood samples were drawn from patients with or without sepsis admitted to the intensive care unit within 48 hours. The frequencies of CD3+ T cells and CD3+CD1d tetramer+ iNKT cells were determined by flow cytometry. A fecal solution was administered intraperitoneally to OCH- and vehicle-treated C57BL/6 (B6) mice to induce IAS. After 20 hours, lymphocyte subsets (T cells and iNKT cells) were evaluated within the liver and spleen by flow cytometry.

Twenty-three septic and 7 nonseptic patients were identified. Both groups were similar with respect to age ($p = 0.43$), Acute Physiology and Chronic Health Evaluation II score ($p = 0.38$), and comorbidities ($p = 0.689$). In the septic group, 43% had IAS, 39% had pneumonia, and 17% had soft-tissue or urogenital infections. Peripheral blood iNKT cell frequency was higher in patients with sepsis (0.077% of T cells) compared to nonseptic patients (0.0093% of T cells), although not statistically significant ($p = 0.072$). The OCH-treated B6 mice with IAS had significantly lower sepsis severity scores ($p < 0.0001$) and reduced splenic and hepatic iNKT cell frequencies ($p = 0.028$) compared to vehicle-treated B6 mice.

Septic patients have an increased proportion of iNKT cells compared to nonseptic patients. Polarizing iNKT cells toward an anti-inflammatory phenotype significantly reduces disease severity in intra-abdominal sepsis. This study highlights iNKT cells as potentially important targets for therapy in sepsis.

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(CAGS Education Award) Gender and surgical education: exploring the role of gender for women in surgery. ***T. Cil, N. Baxter, C.-A. Moulton, F. Webster.*** **From the Department of Surgery, University of Toronto, the Department of Family Medicine, University of Toronto, the Wilson Centre for Research in Education, Toronto General Hospital, Toronto, Ont.**

For some time gender issues have been considered resolved; indeed, use of the term "postfeminist" to describe the period after 1980 has in part led to this perception. Our team conducted a qualitative study to explore the experiences of women in surgical specialties. This study forms the basis of a more extensive program of research in the area of gender and medical education.

Using a grounded theory approach, 3 focus groups were conducted with purposively selected participants from surgical specialties. Data was transcribed and coded using standard qualitative methods and developed into themes.

Women in surgery reported their experiences related to career selection, academic promotion, and issues of gender harassment and discrimination. Female surgeons frequently described active examples of harassment and open discrimination within their roles as trainees as well as staff. Lack of female mentorship and role models were cited as a common concern, particularly for future trainees. It was felt that gender issues were difficult to discuss among their peers as they were viewed as "complaining" and this potentially undermined their professional standing.

Despite increasing numbers, women in surgery face particular barriers to career selection and advancement. We argue that gender remains a salient issue to be addressed in surgical education research and curriculum design.

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Pressures to measure up in surgical training. ***P. Patel, M.A. Martimianakis, S. Kitto, L.M. Murnaghan, N. Zilbert, C.-A. Moulton.*** **From the University of Toronto, The Wilson Centre, Toronto, Ont.**

The surgical culture values certainty and confidence, which surgeons have described as a source of internal conflict during decision-making moments. Surgeons previously suggested the need to manage their image during these times, putting on an external appearance of certainty that is inconsistent internally. The purpose of this study was to explore the experience of impression management among surgical trainees' during moments of decision-making and uncertainty.

Using a constructivist grounded theory approach, we conducted 15 semistructured, 60-minute interviews with general surgery residents. Theoretical sampling was employed to explore emergent themes. Participants reflected on the pressures they felt to manage their image when making decisions in the face of uncertainty. Data was collected and analyzed using an iterative design.

Three major themes emerged. 1) Trainees appeared to uphold a dual identity as "student" and "surgeon." As a student, asking questions and projecting uncertainty was considered acceptable but was in paradox to the ideal surgeon identity ("always certain…and decisive"). Consequently, the pressure to actively manage the surgeon identity of certainty manifested as "making up" information or avoiding calling for help. 2) Trainees believe they quickly develop a reputation that can consequently facilitate or hinder learning: "I know for a fact, in this program, if they… branded you an idiot…you're done." 3) Impression management seemed to interfere with cognitive ability: "I was doing a kidney transplant and the staff showed up…the fellow [got] nervous… telling me "go faster," to the point that we [put] the kidney upside down."

This study deepens our understanding of how social pressures may influence the development of surgical competency and patient care. Translation would include formal instruction of these conceptions into the training curriculum, encouraging trainees to recognize, reflect on and cope with these pressures.

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Abolishment of 24-hour continuous medical call duty in Quebec: a quality of life survey of general surgical residents following implementation of the new work hour restrictions. ***F. Hamadani, A. Sauvé, D.L. Deckelbaum, K. Khwaja, T. Razek.*** **From the McGill University, the Montréal University Health Centre, Montréal, Que.**

The implementation of work hour restrictions across North America have resulted in decreased levels of self-injury and medical errors for residents. An arbitration ruling in Quebec has led to further curtailment of work hours beyond that proposed by the Accreditation Council of Graduate Medical Education's limit of an 80-hour work week. This may threaten resident quality of life and in turn decrease the educational quality of surgical residency training. Our study assessed the perspectives of general surgical trainees at McGill University affiliated teaching hospitals on several domains of surgical education, quality of life, and quality of care delivered to patients.

We administered a quality of life questionnaire with an integrated education quality assessment tool to all general surgery residents training at McGill 6 months after the work hour restrictions through an online anonymous survey (surveymonkey.com). We assessed 4 major areas: sleep assessment, perception of work hours and effect on future competency, relationship to attending surgeons, and perception of ability to provide safe and continuous care to patients. Survey results were collected and analyzed to provide an early descriptive overview of resident's experience with the new model.

Across several strata respondents reveal a decreased sense of educational quality and quality of life (see Table for perception of quality of patient care and relationship with attending staff as an example of 1 strata).

The arbitration argued that work hour restrictions would be necessary to improve quality of life for trainees and hence improve patient safety. Results from this study demonstrate the exact opposite in a large majority of respondents, who report a poorer quality of life and a self-reported inability on their part to provide continuous and safe patient care.

Table, abstract 18

Response based on 34 respondents	No. (%)
Perception of quality of patient care	
I am able to know my patients better	1 (2.9)
I am able to diagnose and manage patients more effectively	2 (5.9)
The new work hour schedule improves patient safety	5 (14.7)
Perception of relationship to staff	
My exposure to staff has improved	4 (11.8)
My relationship with staff has improved	1 (2.9)

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A scoping review of resident duty hour (RDH) changes in surgery: what these mean for resident wellness, training and patient safety. ***N. Ahmed, K.S. Devitt, I. Keshet, J. Spicer, N. Lipsman, A. Kayssi, T. Mainprize, L.S. Feldman, P. Fata, M. Elmi, J. Cools-Lartigue, C. Wallace, S. Gorman, B. Muir, S.M. Feinberg, J.T. Rutka.*** **From the St. Michael's Hospital, the Department of Surgery, University of Toronto, Toronto, Ont.**

In 2003, the Accreditation Council for Graduate Medical Education (ACGME) mandated 80-hour duty limit for residents. The stated goal was to improve patient safety, resident well-being and education. In 2011, the ACGME mandated 16-hour in-house duty maximums for postgraduate year 1 residents. Recently in Quebec, 16-hour maximums were imposed for all in-house duty. Review of the literature can inform future decision-making.

A scoping review (1980–2013) was executed on Cumulative Index to Nursing and Allied Health Literature, Cochrane Databases, EMBASE, MEDLINE, and Scopus; articles were added after searching references and recommendations from content experts. Quantitative and qualitative data extraction was performed for studies meeting specified inclusion criteria.

Abstracts and articles were reviewed independently by 2 research team members. A total of 123 articles met inclusion criteria; 38% were considered moderate–high quality. Surveys and interventional studies were the most common study designs (47%, 37%). There was no overall improvement in patient level outcomes as a result of resident duty hours (RDH), but there was an increase in complications related to emergency and complex operations. We found no evidence of improvement in education related to RDH restrictions, however performance on certification exams for the American Board of Thoracic and General Surgery have declined. Survey studies reveal a perception of decreased resident education and patient safety. There was an improvement in resident wellness following the institution of 80 hour duty limits. However, studies suggest no improvement or detrimental effects of 16-hour duty maximums on resident well-being.

The 2011 ACGME and 2012 Quebec RDH changes are not associated with improvements in resident well-being in surgery. Resident duty hours may have negative impacts on some patient outcomes and resident examination performance. Strategies such as forced naps and greater attention to sleep hygiene should be considered to mitigate fatigue, while preserving access to key mentorship and learning opportunities in surgery.

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The impact of physician assistants on patient and resident based outcomes on a general surgery service. ***N. Dies, S. Rashid, C.J. Swallow, M. Shandling, A.M. Easson, E.D. Kennedy.*** **From the Mount Sinai Hospital, Toronto, Ont.**

Residents face competing demands for their time that affect education to service workload. The purpose of this paper is to report the impact of physician assistants (PAs) on patient and resident based outcomes on a general surgery service.

Two PAs were employed as members of the surgical team on our general surgery service at Mount Sinai Hospital. Outcome measures were collected prospectively and included number of patient discharges completed by 1000 hours (including home care forms and prescriptions), number of resident hours logged for electronic order entry (EMR) and resident satisfaction.

Over a 4-month time period, 258 patients were discharged and of these, 81% (210 of 258) had discharge orders completed by 1000 hours on the day of planned discharge. Of the remaining 48 discharges, 45 were "unplanned" discharges requiring medical reassessment and discharged on the same day (i.e., early discharges) and 3 discharges (1.2%) were delayed due to incomplete discharge orders. Compared to previously collected data, PAs led to a significant decrease in delayed discharge due to incomplete orders (19.8% [25 of 126] without PAs v. 1.2% [3 of 258] with PAs, $p < 0.05$).

Overall, resident hours logged on the EMR were relatively unchanged. However, junior residents on surgical teams with PAs logged significantly fewer hours on the EMR compared to junior residents on surgical teams without PAs (113.6 h v. 256.5 h; $p < 0.01$).

Resident satisfaction with PAs was extremely high. 100% of the residents (12 of 12) agreed that the PAs improved the quality of patient care and efficiency of the surgical team. One hundred percent also agreed that the PAs improved the quality of their surgical rotation and improved their education to service workload.

Our results indicate that PAs can be successfully integrated into a surgical team model and have a significant and positive impact on both patient care and resident workload.

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Learning lessons from success: defining excellence in surgery. ***M. Cocks, C.-A. Moulton, N. Roberts, T. Cil.*** **From the University of Toronto, Toronto, Ont., the Southern Illinois University School of Medicine, Springfield, Ill.**

An emphasis on competency is critical for the acquisition and development of surgical knowledge and skills. However, beyond the competency-based achievements, we must strive for mastery, expertise and innovation. While the skills that define surgical competency are well established, the definition of what constitutes an "excellent" surgeon is less clear.

Between July 2011 and November 2012, 16 surgeons representing a range of experience levels and surgical subspecialties were interviewed (11 general surgeons, 2 plastic surgeons, 2 orthopedic surgeons, 1 urologic surgeon; 13 males, 3 females). Semistructured interviews ranging from 20 to 60 minutes were conducted with participants. During interviews, participants were asked what qualities or skills they thought made an excellent surgeon. Data collection and analysis occurred in an iterative manner. Interview transcriptions were coded and qualitative analysis using grounded theory was performed.

Technical skill was the most often cited objective indicator of excellence. This encompassed a range of technical abilities including speed in the operating room, efficiency of motion and "looking good" by limiting errors and performing procedures elegantly. Practice and experience were a component of attaining such technical skills. Participants also emphasized nontechnical skills, including clinical reasoning and interpersonal skills. Among these, adaptability and effective decision-making skills were thought to be most important. A number of personality traits such as equanimity and ambition were cited. Finally, a strong knowledge base in both medical and surgical management was thought to be the foundation in the development of surgical excellence.

Three main categories of excellence attributes emerged from analysis of the data: technical skills, nontechnical skills, and personal factors. No single characteristic was underlined as paramount; rather, it was the combination of various skills that were thought to contribute to surgical excellence.

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Improving residency training in end-of-life care: a survey of Canadian general surgical faculty and trainees. ***A. Kayssi, S.A. Chadi, S. Merani, S. Steigerwald, R. Snelgrove, W. Davies, D.E. Schiller, A. Vergis, L.A. Mack, J. Downar, A.M. Easson.*** **From the Division of General Surgery, Western University, London, Ont., the Department of Surgery, Faculty of Medicine and Dentistry University of Alberta, Edmonton, Alta., the Department of Surgery, University of Manitoba, Winnipeg, Man., the Department of Oncology and Surgery, University of Calgary, Calgary, Alta., the Department of Medicine, University of Toronto, Toronto, Ont., Department of Surgery, University of Toronto, Toronto, Ont.**

Despite receiving little formal training in end-of-life care, general surgical trainees are expected to be familiar with the fundamentals of end-of-life care to satisfy surgical residency training requirements. The aim of this study was to determine the current level of knowledge among Canadian general surgery faculty and trainees in end-of-life care and identify self-assessed concerns and areas for future educational initiatives.

General surgical faculty and trainees were invited to complete an online questionnaire at 5 Canadian university centres (Toronto, London, Winnipeg, Calgary and Edmonton). The questionnaire used was previously validated to assess the level of knowledge, self-confidence, and concerns regarding end-of-life care.

One hundred and twenty surgeons completed the survey (51 faculty, 69 trainees, 23% overall response rate). Trainee knowledge scores were significantly higher than faculty (66% ± 9.7% v. 63% ± 8.9%, $p = 0.028$). Respondents most frequently reported a need to learn about the use of adjuvant analgesics (16%) and the assessment and management of terminal delirium (14%) and dyspnea (13%) in dying patients. Presented with a number of scenarios, respondents were least comfortable withdrawing antibiotics from septic nondecisional patients at the request of their substitute decision-makers (because it would be illegal [22%], represent

medical malpractice [28%], or violate accepted ethical norms [33%] or personal religious and ethical beliefs [31%]).

Despite a growing acknowledgement of the importance of end-of-life care among surgeons, many general surgical faculty and trainees are uncomfortable with some of the clinical and ethical dimensions of end-of-life care. Future educational initiatives are needed to address those concerns.

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(CAGS Clinical Research Award) Cost–utility analysis comparing alternative timeframes of surgery for acute cholecystitis. ***C. de Mestral, J.S. Hoch, A. Laupacis, H. Wijeysundera, O.D. Rotstein, A. Alali, A.B. Nathens.*** **From the St. Michael's Hospital, Toronto, Ont., the Sunnybrook Health Sciences Centre, Toronto, Ont.**

The constrained nature of health care budgets mandates careful consideration of costs, relative to the clinical consequences of alternative treatments. We performed a cost–utility analysis comparing alternative timeframes of surgery for acute cholecystitis (AC).

A Markov cohort decision analytic model with a 5-year time horizon was developed to compare costs and quality-adjusted life-years (QALYs) gained from 3 alternative management strategies for AC: early cholecystectomy (within 7 days of emergency department presentation), delayed elective cholecystectomy (8–12 weeks from presentation) and watchful waiting, where cholecystectomy is performed urgently only if recurrent gallstone symptoms arise. Model inputs were selected to reflect patients with uncomplicated AC — without concurrent common bile duct obstruction, pancreatitis or severe sepsis. Outcome probabilities and costs from the perspective of the Ontario Ministry of Health were derived using population-based administrative databases and propensity score matching was employed to account for confounding by indication. The QALY values were based on directly elicited utilities identified in the literature. Uncertainty around input parameters was evaluated through probabilistic sensitivity analysis.

Early cholecystectomy was on average less costly ($6905 per person) and more effective (4.20 QALYs per person) than delayed cholecystectomy ($8511; 4.18 QALYs per person) or watchful waiting ($7274; 3.99 QALYs per person). In probabilistic sensitivity analysis, early cholecystectomy was most likely to be the optimal management strategy, regardless of the decision-maker's willingness-to-pay for additional health gains.

This cost–utility analysis, incorporating contemporary population-based outcome and cost estimates, suggests that early cholecystectomy should be considered for most patients with uncomplicated AC since it offered the best outcomes at the least cost.

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Disparities in referral for colorectal cancer screening. ***M.S. Brar, R. Hilsden, P. Peller, K.R. Klingbeil, J.A. Heine, W.D. Buie, A.R. MacLean, I. Datta.*** **From the University of Calgary, Calgary, Alta.**

Inequity in access to cancer screening programs in Canada has been demonstrated. The purpose of this study was to assess the impact of socioeconomic and demographic factors on the rate of referral to a regional colorectal cancer screening centre.

Patients ranging from 45 to 75 years old, at average risk or with a positive family history, referred to a regional colorectal screening centre from 2008 to 2010 were included. Patients were correlated to Canadian census dissemination area (DA). Using Canadian census data, the rate of referral of residents aged 45–74 years per DA was calculated. The DAs were separated by quintile for each socioeconomic and demographic variable. Univariate and multivariate analysis was performed.

A total of 9317 patients met the inclusion criteria. The average rate of referral per DA was 2.9% (0%–40%). DAs in the highest quintile with respect to the proportion of inhabitants with no official language knowledge ($z = 7.1$, $p < 0.001$); who were visible minorities ($z = 7.5$, $p < 0.001$); who were status Registered Indians ($z = 6.8$, $p < 0.001$); with no college or university education ($z = 11.7$, $p < 0.001$); or who were unemployed ($z = 4.5$, $p < 0.001$), had statistically significant lower rates of referral, as compared to all other DAs. In addition, DAs in the lowest quintile with respect to median household income had statistically significant lower rates of referral ($z = 10.7$, $p < 0.001$). Distance from DA to the screening centre did not significantly affect rate of referral. On multivariate analysis, the following factors were associated with a lower rate of referral: no official language knowledge (OR 0.64, $p = 0.001$), Registered Indian status (OR 0.62, $p < 0.001$), no college or university education (OR 0.35, $p < 0.001$), unemployment (OR 0.75, $p = 0.013$), and household income (OR 0.45, $p < 0.001$).

Socioeconomic and demographic disparities exist in referral for colorectal cancer screening. Efforts to improve referral from physicians, and population-level education may improve access to colorectal cancer screening programs.

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The association between perioperative factors and health care costs in older adults undergoing nonelective abdominal surgery. ***J.G. Bailey, P.J.B. Davis, A. Levy, M. Molinari, P.M. Johnson.*** **From the Division of General Surgery and the Department of Community Health and Epidemiology, Dalhousie University, Halifax, NS**

There is substantial concern regarding future health care costs associated with the aging population; however, the determinants of costs in this patient population remains unclear. The purpose of this study was to examine the association between perioperative factors and inpatient health care costs in older adult patients undergoing emergency abdominal surgery.

All patients 70 years of age or older who underwent nonelective abdominal surgery at a tertiary care teaching hospital between Jul. 1, 2011, and Sep. 30, 2012, were prospectively enrolled. Direct inpatient health care costs were calculated by tabulating patient-level resource use and assigning specific costs. The association between age, American Society of Anesthetists (ASA) score, operative severity (OS), frailty index (FI) and complications, and cost were analyzed using the Wilcoxon rank sum test and multiple linear regression.

During the study period, 212 patients underwent abdominal surgery (median age 78 yr [range 70–97]). The median cost of care was $9608 (range $2135–$107 653). On multiple linear regression ASA score ($p = 0.0015$), OS ($p < 0.0001$), FI ($p = 0.0001$) and in-hospital complications ($p < 0.0001$) were all independently associated with health care costs; however, age was not ($p = 0.6$). Health care costs were significantly higher for

patients who died in hospital ($21 472 v. $8321, $p = 0.0002$), had a complication ($17 163 v. $5845, $p < 0.0001$) or were discharged to an institution ($21 641 v. $7903, $p < 0.0001$). On multivariate analysis nonfatal complication ($p < 0.0001$) was independently associated with health care cost; however, mortality ($p = 0.6$) and discharge to institution ($p = 0.2$) were not.

Increasing age was not associated with direct health care costs among patients 70 years of age or older undergoing emergency abdominal surgery. Strategies to mitigate or prevent postoperative complications may achieve cost savings.

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Right colectomies: risk factors associated with anastomotic leakage. ***I. Jetté-Côté, J.-F. Latulippe, Y. Bendavid, S. Dubé, M. Poirier, F. Heyen, M. Henri.*** **From the Hôpital Maisonneuve-Rosemont, Department of Surgery, University of Montréal, Montréal, Que.**

Postoperative complications following right colectomy, especially anastomotic leakage (AL), are seldom reported. Recent publications have focused on the use of nonsteroidal anti-inflammatory drug (NSAIDS) as a plausible cause. We sought to identify this complication in our practice and factors associated with it. A single tertiary centre database was retrospectively queried for all patients having undergone a right colectomy. Age, American Society of Anesthesiologists (ASA) status, sex, reason for surgery (cancer v. other), use of laparoscopy, laparoscopy converted to laparotomy, use of bowel preparation, hand-sewn versus mechanical anastomosis, blood loss, need for nasogastric tube reinsertion postoperatively, urgent versus elective surgery, use of an epidural for postoperative analgesia, and use of postoperative NSAIDS as factors for anastomotic leakage were assessed. Univariate analysis was conducted using Pearson χ^2. Multivariate logistic regression was then used to further evaluate the subgroup of variables meeting univariate statistical significance ($p < 0.05$). Between January 2003 and January 2012, 431 patients had a right colectomy. Some AL occurred in 23 patients, for a rate of 5.3%. On univariate analysis the absence of preoperative bowel preparation ($p = 0.05$), mechanical anastomosis ($p = 0.02$), and need for nasogastric tube reinsertion ($p = 0.005$) were associated with anastomotic leakage. On multivariate analysis, hand-sewn anastomosis (OR 0.339, 95% CI 0.131–0.878, $p = 0.026$), and bowel preparation (OR 0.423, 95% CI 0.180–0.996, $p = 0.049$) remained significantly associated with AL. The use of NSAIDS for postoperative analgesia was not related to AL ($p = 0.11$). In this retrospective study of 431 right colectomies, a hand-sewn anastomosis and preoperative bowel preparation protected patients from anastomotic leakage.

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Use of chewing gum to alleviate postoperative ileus following intra-peritoneal surgery: an updated systematic review and meta-analysis. ***D.D. Paskar, N. Poonai, I. Ghaderi, R. Hernandez-Alejandro, T.S. Mele.*** **From Western University, London, Ont.**

Previous reviews have explored the role of gum-chewing (GC) following gastrointestinal (GI) surgery as a means of alleviating postoperative ileus (POI). The results of these have been variable in methodology and findings. The recent publication of additional trials in both GI and non-GI (i.e., urologic and obstetric) surgery has provided an opportunity for this topic to be revisited with an updated systematic review.

Published randomized trials comparing use of GC in addition to standard postoperative care to standard care alone (or with placebo) were identified using searches of scientific databases, clinical trial registries and citation lists of known references. There were no restrictions on language or publication date. Individual trials were assessed using the Cochrane Risk of Bias tool and the overall quality of the evidence assessed using GRADEpro. Primary outcomes were length of hospital stay (LOS), time to first flatus and bowel movement (BM) postoperatively. The weighted mean difference (WMD), with 95% confidence intervals, and the random-effects model was used to meta-analyze the outcomes. Subgroup analyses were performed on the basis of surgery type, open versus minimally invasive surgery, and patient age group. The I^2 statistic was used to quantify heterogeneity.

A total of 23 eligible studies were included from 11 countries and 4 languages. The overall WMD for GC versus control was –8.66 hours (–11.62, –5.69) for time to first flatus, –8.84 hours (–11.41, –6.28) for time to first BM and –0.25 days (–0.3, –0.2) for LOS. Significant heterogeneity was present and is likely explained by the subgroup differences, as well as variation in local practices. The overall quality of evidence was rated as moderate.

Gum-chewing results in reduced times to first flatus and BM following intra-peritoneal surgery, as well as decreased LOS. Larger, well-controlled clinical trials are required to increase the quality and clinical confidence of the evidence.

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Management of umbilical hernias in patients with ascites: development of a nomogram to predict mortality. ***F. Saleh, A. Okrainec, S.P. Cleary, T.D. Jackson.*** **From the University Health Network, University of Toronto, Toronto, Ont.**

Management of umbilical hernias in patients with ascites remains a significant clinical challenge. Controversy exists over the optimal way to predict mortality in cirrhotic patients with ascites undergoing umbilical hernia repair. Our objective was to develop a predictive model and develop an easy-to-use nomogram to help clinicians determine postoperative 30-day mortality risk.

The American College of Surgeons National Surgery Quality Improvement Program (ACS NSQIP) participant use files were used for this study during the years 2005–2011. Patients identified as having ascites who underwent umbilical hernia repair, aged 18 years old, were eligible for inclusion in this study. Our primary outcome was 30-day postoperative mortality. Multivariable logistic regression was used to develop a predictive model for postoperative mortality. Our model was examined for goodness-of-fit and we calculated a c statistic to examine the model's predictive ability.

A total of 688 patients with ascites undergoing umbilical hernia repair were identified and met inclusion criteria. There were 643 (93.5%) survivors and 45 (6.5%) mortalities. A total of 300 (43.6%) patients were classified as emergent cases. Using logistic regression to predict 30-day mortality, preoperative model for end-stage liver disease (MELD) score, albumin, white blood cell count, and platelet count were found to be significant predictors ($p < 0.05$) of mortality and were thus included in our model.

There was no evidence of lack of fit (p = 0.57) of our model and our c statistic was 0.82. Using this information we developed a nomogram to predict postoperative mortality.

In our analysis of a large cohort of patients with ascites undergoing umbilical hernia repair we have identified MELD score, albumin, white blood cell count and platelet count as important predictors of postoperative mortality. We propose a nomogram to enable clinicians to better estimate mortality in patients presenting with this challenging clinical problem.

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Outcomes from an enhanced recovery program for laparoscopic gastric surgery. ***N. Wong-Chong, H. Kehlet, T.P. Grantcharov*. From the University of Toronto, Toronto, Ont., the Section for Surgical Pathophysiology, Rigshospitalet, Copenhagen University, Copenhagen, Denmark**

Laparoscopic gastrectomy is associated with less pain and morbidity compared to open surgery. Several studies have shown that enhanced recovery after surgery programs (ERAS) for colorectal surgery improve length of hospital stay and reduce morbidity. However, its feasibility and safety in upper GI surgery has not been sufficiently evaluated. The purpose of this study was to evaluate the outcomes, in terms of morbidity and mortality, for patients undergoing minimally invasive gastric surgery in an enhanced recovery program.

This was a prospective study of 86 consecutive patients undergoing elective laparoscopic gastric resection in an ERAS protocol (early oral intake, no drains or nasogastric tubes, no epidural analgesia, urinary catheter removal by 24 h, planned discharge 72 h after surgery) at a single centre between 2008 and 2012. Outcomes included length of hospital stay, intraoperative and postoperative complications, readmission rate, reoperation rate, and 30-day mortality.

There were 86 patients who underwent laparoscopic gastrectomy combined with ERAS. Sixty patients underwent partial gastrectomy (proximal, distal or subtotal) and 26 patients underwent total gastrectomy. Median lymph nodes sampled was 15 (range 9–47). Median length of hospital stay was 4 (range 1–44) days. Four patients (4.7%) had an anastomotic leak. Three patients had postoperative bleeding (4.7%), and 1 of them required reoperation. A total of 4.7% (n = 4) required readmission, and 8.1% required reoperation (n = 7). The 30-day mortality rate was 3.5% (n = 3).

Laparoscopic gastrectomy with an ERAS protocol results in a short hospital stay and low morbidity and mortality rate.

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Comparative operative outcomes of early and delayed cholecystectomy for acute cholecystitis: a population-based propensity score analysis. ***C. de Mestral, O.D. Rotstein, A. Laupacis, J.S. Hoch, B. Zagorksi, A. Alali, A.B. Nathens.* From the St. Michael's Hospital, the Institute for Clinical Evaluative Sciences, the Sunnybrook Health Sciences Centre, Toronto, Ont.**

Randomized trials comparing early to delayed cholecystectomy for acute cholecystitis (AC) have limited contemporary external validity. Furthermore, no study to date has been large enough to assess the impact of timing of cholecystectomy on the frequency of rare but serious complications including bile duct injury and death. We therefore performed a population-based comparison of the operative outcomes of early and delayed cholecystectomy for AC.

This is a retrospective cohort study of patients emergently admitted to hospital with AC and managed with cholecystectomy over the period of April 2004 to March 2011. We used administrative records for the province of Ontario. Patients were divided into 2 exposure groups: those who underwent cholecystectomy within 7 days of emergency department presentation on index admission (early cholecystectomy) and those whose cholecystectomy was delayed. The primary outcome was major bile duct injury (MBDI) requiring operative repair within 6 months of cholecystectomy. Secondary outcomes included MBDI or death, 30-day postcholecystectomy mortality, completion of cholecystectomy with an open approach (started open or converted), and conversion among laparoscopic cases. Propensity score methods were used to address confounding by indication.

From 22 202 patients, a well-balanced matched cohort of 14 220 patients was defined. Early cholecystectomy was associated with a lower risk of MBDI (0.28% v. 0.53%, risk ratio [RR] 0.53, 95% CI 0.31–0.90, p = 0.025), of MBDI or death (1.36% v. 1.88%, RR 0.72, 95% CI 0.56–0.94, p = 0.016) and, albeit not significant, of 30-day postoperative mortality (0.46% v. 0.64%, RR 0.73, 95% CI 0.47–1.15, p = 0.21). No significant differences were observed in terms of open cholecystectomy (15% v. 14%, RR 1.07, 95% CI 0.99–1.16, p = 0.10) or in conversion among laparoscopic cases (11% v. 10%, RR 1.02, 95% CI 0.93–1.13, p = 0.68).

These results support the benefit of early over delayed cholecystectomy for patients with AC.

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How do you diagnose appendicitis? An international evaluation of methods. ***Y. Alfraih, R. Postuma, R. Keijzer*. From the Department of Surgery, Division of Pediatric Surgery, Departments of Pediatrics and Child Health, Physiology (adjunct) and the Manitoba Institute of Child Health, University of Manitoba, Winnipeg, Man.**

Considerable variability exists in the diagnostic approach to acute appendicitis (in children), affecting both quality and costs of care. Interestingly, an international evaluation of what is commonly practised today has not been performed. We aimed to document current practice patterns in the diagnosis of appendicitis in children and to determine whether a consensus exists in the workup of these patients among Canadian, Dutch and Saudi Arabian pediatric surgeons.

We performed a cross-sectional survey using a predesigned, self-administered, 14-item survey. We sent the survey to participants by electronic mail.

In total, 83 responses were received and analyzed. The majority of respondents practised at pediatric surgery centres with over 50 beds (58% of Canadian surgeons, 81% of Dutch surgeons, 93% of Saudi Arabian surgeons). The majority of Dutch surgeons had a preference for physical examination and radiological imaging as opposed to Canadian and Saudi Arabian surgeons, who favoured history and physical examination. Interestingly, only 1 of the surgeons surveyed used an appendicitis scoring system. Regarding history and physical examination, most respondents

deemed migratory abdominal pain and localized right lower quadrant tenderness to be most suggestive of appendicitis. Ultrasound was the most preferable imaging modality in acute appendicitis across all 3 countries.

This study demonstrates that international pediatric surgeons vary substantially in the diagnostic workup of patients with appendicitis. Furthermore, there is variability between common practice and the current evidence. We recommend that pediatric surgeons develop clinical practice guidelines that are based on consensus information (expert opinion) and the best available literature.

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An acute care surgery service facilitates the timely treatment of emergency colorectal cancer patients. ***R.V. Anantha, N. Parry.*** **From Western University, London, Ont.**

Colorectal cancer (CRC) commonly presents first as a surgical emergency in 15% to 30% of CRC patients and is associated with increased morbidity and poor long-term survival. Lack of emergency operating room (OR) resources may also contribute to delays in treatment. We sought to assess the impact of an acute care surgery service (ACCESS) with daily dedicated OR time, on outcomes for emergency CRC patients.

We retrospectively reviewed emergency patients who were diagnosed with CRC and underwent surgical resection at a tertiary care centre. Wait times for inpatient colonoscopy and surgical resection were calculated from the time of admission, for pre-ACCESS (July 2007–June 2010) and post-ACCESS (July 2010–June 2012) groups. Statistical analyses were performed using Mann–Whitney U test and Pearson χ^2 test. The p values less than 0.05 were considered significant.

A total of 108 patients (62 pre-ACCESS, 46 post-ACCESS) were identified, with no differences in the location of the cancer ($p = 0.09$). Sixteen patients (31%) and 15 patients (28%) in the pre- and post-ACCESS groups, respectively, underwent inpatient colonoscopy ($p = 0.68$), although 5 (31%) pre-ACCESS patients required a separate admission for colonoscopy compared to 0% for the post-ACCESS group ($p = 0.04$). Wait times for inpatient colonoscopy (3.5 and 2.4 d for pre- and post-ACCESS groups, respectively, $p = 0.11$) and surgical resection (5.4 and 4.6 d for pre- and post-ACCESS groups, respectively, $p = 0.67$) were similar. Median hospital stay (10.5 and 13 d for pre- and post-ACCESS patients, respectively) was also similar ($p = 0.22$).

An ACCESS eliminates the need for separate admissions for diagnostic colonoscopy and surgical resection in emergency colorectal cancer patients, thereby providing timely treatment and potentially improving clinical outcomes.

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Outcomes reporting in surgical journals: What are we measuring? ***I. Antonescu, C. Mueller, G.M. Fried, M.C. Vassiliou, N. Mayo, L.S. Feldman.*** **From the Division of General Surgery, the Department of Epidemiology, Biostatistics & Occupational Health, McGill University Health Centre, Montréal, Que.**

With advances in operative technique and perioperative care, traditional clinical outcomes like morbidity and mortality provide an incomplete description of surgical outcomes. There is increasing emphasis on the need for patient-reported outcomes (PROs) to fully evaluate the effectiveness and quality of surgical interventions. The objective of this study was to describe the outcomes reported in clinical studies published in high-impact surgical journals and to identify the frequency with which patient-reported outcomes are used.

We conducted a review of the 4 highest-impact nonsubspecialty surgical journals (*Annals of Surgery*, *Archives of Surgery*, *British Journal of Surgery* [BJS], *Journal of the American College of Surgeons*), and hand-searched the electronic versions of the material published between 2008 and 2012. We included clinical studies of adult patients undergoing planned abdominal, thoracic, or vascular surgery. We classified the outcomes reported using Wilson and Cleary's conceptual model of outcomes into 5 categories: biologic and physiologic outcomes, symptoms, functional status, general health perception and overall quality of life (QoL). Patient-reported outcomes were defined as any measure of health reported by the patient.

A total of 893 articles were assessed for eligibility, 770 of which were included in the final analysis (*Annals of Surgery* 272, *Archives of Surgery* 169, *BJS* 139, *Journal of the American Chemical Society* 190). Ninety-two percent of studies reported biological and physiological outcomes, 36% symptoms, 45% direct or surrogate indicators of functional status (of which length of stay was the only measure in 71%), 11% general health perceptions, and 15% overall QoL. The proportion of studies with at least 1 PRO was 39% overall and 73% in the *BJS*. The proportion of studies using a validated QoL instrument to evaluate the success of a surgical intervention ranged from 8% (*Archives of Surgery*) to 34% (*BJS*).

Although clinical endpoints are the most commonly reported outcomes in high-impact surgical journals, patient-reported outcomes and dedicated QoL instruments are being used to assess the success of an intervention. The use of patient-centered outcomes varied among the journals. This underscores the importance of understanding how these instruments can be applied in specific surgical populations and contexts.

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Application of Acute Physiology and Chronic Health Evaluation (APACHE) 4–predicted mortality rate in a surgical abdominal sepsis (SABS) cohort. ***M.S. Bleszynski, M.S. Hameed, A. Mui, J. Ronco, A.K. Buczkowski.*** **From the Department of General Surgery, Intensive Care Unit, Transplant Research, Vancouver General Hospital, Vancouver, BC**

The Acute Physiology and Chronic Health Evaluation (APACHE) 4 scoring system is a validated benchmark of intensive care unit (ICU) performance and can be used as a tool of risk stratification for patient outcomes based on predicted mortality rate (PMR). Surgical abdominal sepsis (SABS) was defined as abdominal sepsis requiring an exploratory laparotomy for source control (SC). Available Vancouver General Hospital (VGH) calculated PMR and available online APACHE 4 calculators were used to compare the PMR scores with observed hospital mortality in SABS cohort. To our knowledge this is the first study to externally assess APACHE 4 PMR in surgical sepsis.

Retrospective chart review of the VGH ICU 2006–2010 open

abdomen/sepsis registry, consisting of 691 ICU admissions. A total of 148 patients included fulfilled the criteria of abdominal severe sepsis or septic shock according to international sepsis definitions. Cases were managed by urgent or emergent SC surgery prior to or during ICU admission. Three sets of APACHE 4 PMRs included in the study were the Middle East Critical Care Assembly (MECA), Cerner (2 web-based calculators) and VGH ICU independent APACHE 4 values.

Receiver operator characteristic curve analysis was used to assess the accuracy of PMRs differentiating between hospital nonsurvivors and survivors by calculating the area under the curve (AUC). An AUC equal to 1 is ideal and is suggested to only use tests with score of 0.8 and higher (0.6–0.7 poor, 0.7–0.8 fair). Observed ICU and hospital mortality were 20% and 27.7%, respectively, while MECA, Cerner and VGH APACHE 4 mean PMRs were 36.3%, 44.7% and 52%, respectively. The MECA and Cerner PMRs had AUCs of 0.729 and 0.724, while the VGH PMR was 0.677.

All APACHE4 PMRs overestimated mortality risk for the surgical abdominal sepsis cohort. All AUCs scores were below good values for discriminating between survivors and nonsurvivors. Further assessment of mortality predictors in SABS should continue on a larger scale or novel surgical indicators should be identified.

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Choice of biomaterials for abdominal wall reconstruction in complex cases might impact on overall cost of care. ***M.S. Bleszynski, M.S. Hameed, O.N.M. Panton, A.K. Buczkowski.*** **From the Division of General Surgery, University of British Columbia, Vancouver, BC**

Biomaterials are considered a new standard of care for complex abdominal operations especially in contaminated or infected cases. There is significant upfront cost related to providing the biomaterial of choice. Pricing of currently available biomaterials depend on source of tissue and size of the bioprosthesis. We investigated associated costs in a group of patients receiving Alloderm (A) compared to a previous group that received Surgisis (S) at Vancouver General Hospital. Three groups were based on the period of time in which the biomaterial was used. The S group consisted of 3 patients. The first trial of Alloderm (A1), followed up by improved technique Alloderm (A2), both consisted of 3 patients. The A1 and A2 groups were combined for cost calculations. Intensive care unit stay for A1, A2 and S was 7, 14 and 16.7 days compared to hospital stay of 55, 67, and 88 days, respectively. The A1, A2, and S groups had 4, 9, and 6 operations per patient, respectively. Main difference between groups was length of hospital stay after the last OR which was 61 days in S group; A1 and A2 groups were 21 and 24 days, respectively. Average vacuum dressing changes in S group was 22 compared to 6.6 in A1 and 10 in A2. Total mean operating time per patient was 1173 minutes for S group compared to 951 minutes for A1 and 687 minutes for A2. Upfront cost per patient for S was $11 293 compared to $14 128 for A1 and A2. Difference in biomaterial costs was $2835. Overall hospital cost was $202 308 per Alloderm patient compared to $289 773 per Surgisis patient. The difference between biomaterial pathways was equal to a mean of $86 469. The cost effectiveness of biomaterial management pathways is multifactorial and not dependent on upfront material costs. Choice of biomaterial has to reflect the full length of hospital stay and community care. Bundled cost approach rather than initial cost should permit for the utilization of biomaterials that induce the lowest inflammatory response and have the best tissue integration postimplantation.

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Assessment of communication gaps during transfer to definitive care in a provincial trauma system. ***N. Bradley, R.K. Simons, T. Taulu, H. Wong, N. Bell, B. Heidary, M.S. Hameed.*** **From the Trauma Services, Vancouver General Hospital, Vancouver, BC**

Each year, 200–300 severely injured patients require transfer to the Vancouver General Hospital (VGH), a provincial level 1 trauma centre, for definitive care. Currently, there is no standardized information handover process for these transfers. Our objective was to characterize the completeness and accuracy of communication during these critical patient handovers.

Accuracy of documentation was examined subjectively and objectively. An online survey was administered to trauma surgeons, emergency physicians, residents and nurses at VGH (n = 190) to assess subjective perceptions of documentation. A retrospective audit of the provincial trauma registry and a chart review was conducted for all trauma patients with an injury severity score greater than or equal to 16 transferred to VGH from April 2011 to March 2012 (n = 243) to objectively determine errors and/or omissions in 37 critical data elements in transfer documentation.

Overall, documentation for transferred trauma patients was poor. The survey had a 35% response rate (66 of 190). Only 26% (95% CI 15%–36%) of receiving physicians/nurses felt an injury summary was provided "majority of the time" or "always" (high availability). Even fewer reported high availability of clear documentation for fluids/blood products (11% [95% CI 3%–18%]) and access to pretransfer imaging (9% [95% CI 2%–16%]). Sixty-seven per cent (95% CI 55%–78%) indicated the current process "likely" or "definitely" increases the risk of error. Chart audit revealed significant gaps in transfer of critical data elements from sending to receiving facilities. Paramedic crew reports, basic elements of the primary survey and recording of neurological status prior to intubation were among the critical data elements found to be missing or to contain inaccuracies.

Information handover during the transfer of severely injured patients is inefficient, incomplete and may contribute to adverse events. A standardized trauma transfer protocol may improve patient safety.

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Early colonoscopic surveillance is warranted following colorectal cancer resection. ***M.S. Brar, K.R. Klingbeil, M. Kwan, J. Arminan, I. Datta, J.A. Heine, W.D. Buie, A.R. MacLean.*** **From the University of Calgary, Calgary, Alta.**

Following resection for colorectal cancer (CRC), current guidelines recommend surveillance endoscopy at 1 year. The purpose of this study was to determine the yield of early colonoscopy in patients following CRC resection.

Patients who underwent curative resection for CRC from 2008

to 2010 were identified from a provincial database. Patients with a complete preoperative colonoscopy and colonoscopy within 18 months of resection were included. Patients who underwent transanal excision or total abdominal colectomy, and patients with a history of hereditary non-polyposis colorectal cancer or familial adenomatous polyposis were excluded. A clinically significant finding (CSF) was defined as a metachronous cancer, local recurrence, or advanced adenoma (> 1 cm, high-grade dysplasia, > 25% villous or serrated histology).

Of 393 patients who met our inclusion criteria, 270 patients (68.7%) underwent colonoscopy within 18 months of resection and were selected for analysis. At preoperative colonoscopy, 107 patients (39.6%) had synchronous adenomas removed, and 45 patients (16.7%) had advanced adenomas. The CSFs included 16 patients (5.9%) with advanced adenomas, 1 patient (0.37%) with a metachronous cancer and 2 patients (0.74%) with a local recurrence. Overall, 19 patients (7.0%) had a CSF on early colonoscopic surveillance. In subgroup analysis, synchronous advanced adenomas and poor bowel preparation at preoperative colonoscopy had a significantly greater risk of a CSF (15.6% v. 5.3%, $p = 0.023$; and 21.7% v. 5.7%, $p = 0.015$, respectively). In multivariate analysis, synchronous advanced adenoma (OR 4.81, 95% CI 1.10–21.1, $p = 0.037$) and poor bowel preparation (OR 4.59, 95% CI 1.34–12.7, $p = 0.015$) significantly increased the risk of CSFs on surveillance colonoscopy.

The rate of clinically significant findings on early colonoscopic surveillance following CRC resection was 7.0%. Patients with poor bowel preparation or advanced adenomas on preoperative colonoscopy were at higher risk. These findings support colonoscopic surveillance at 1 year following CRC resection.

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Is frailty associated with morbidity and mortality in older adults presenting for nonelective abdominal surgery?

P.J.B. Davis, J.G. Bailey, M. Molinari, J. Hayden, P.M. Johnson. **From the Dalhousie University, Halifax, NS**

While emergency surgery in elderly patients is associated with poor outcomes, it remains difficult to predict how patients will do after treatment. The purpose of this research was to examine the association between frailty and morbidity and mortality in older adults undergoing nonelective abdominal surgery.

Consecutive patients 70 years of age or older who underwent nonelective abdominal surgery between Jul. 1, 2011, and Sept. 30, 2012, were prospectively enrolled. Baseline frailty status was established at the time of admission for each patient using 2 measures of frailty (the Canadian Study of Health and Aging Clinical Frailty Score and the Frailty Index [FI]). All patients were followed for 3 months after admission. The relationship between preoperative factors (e.g., age, sex, frailty, the American Society of Anesthesiologists [ASA] Score, and Operative Severity Score) and morbidity and mortality was examined using multiple regression analysis.

During the study period 228 patients underwent surgery (median age 77.6 yr, 50.2% male). The 90-day mortality was 9.6% (22 of 228) and 66.2% of patients experienced a postoperative complication, of which 43.0% were major. Mortality rates increased with increasing ASA score, but not age decile. The only factor associated with 90-day mortality on multiple regression was increasing ASA score ($p < 0.0001$). Factors associated with experiencing a postoperative complication included the FI ($p = 0.04$), ASA Score ($p = 0.0009$) and surgery for malignant disease ($p = 0.03$).

Frailty was associated with developing postoperative complications, but not mortality, in older adults undergoing nonelective abdominal surgery. Increasing ASA score was the only factor associated with mortality in this patient population.

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Correlation of CT grading of small bowel obstruction with the need for surgical intervention.

P. Dawe, A. Barzcak, J. Mottola, B. Henderson, R. Saadia. **From the University of Manitoba, the Health Sciences Centre, Winnipeg, Man.**

Small bowel obstruction (SBO) is a common clinical problem that represents up to 20% of acute surgical admissions. Management of adhesive SBO tends to be influenced by radiographic interpretation, which is often classified as either high-grade (HGSBO) or non-HGSBO. In the absence of observed ischemia or strangulation, SBO can often be treated conservatively. The primary objective of this study is to assess the diagnostic/prognostic validity of CT grading of presumed adhesive SBO in prediction of surgical intervention.

A total of 107 participants were retrospectively identified using a chart review of patients admitted to our centre. Patients with a discharge diagnosis of SBO with code ICD K56.5 (intestinal adhesions with obstruction) were identified. Charts were reviewed to select patients with CT diagnosis of SBO presumed to be of adhesive etiology and free of evidence of ischemia or strangulation at the time of admission. Initial CT scans of identified participants were reviewed independently and blinded by 2 attending radiologists at our centre. They categorized the scans as HGSBO or non-HGSBO. Results were plotted categorically in a 2×2 table as either HGSBO or non-HGSBO and undergoing surgery or not undergoing surgery. Forty-two of 107 charts reviewed were excluded (11 were not presumed to be of adhesive etiology, 12 had no images available, 14 were not admitted with SBO, 2 were less than 30 days postop, 2 required emergent surgery and 1 refused surgery). Forty-nine of 65 included patients underwent surgery. Radiographic inter-rater reliability was 1. The sensitivity of radiographic HGSBO resulting in surgical intervention was 90%, specificity was 31%. Postitive predictive value and negative predictive value were 80% and 50%, respectively.

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Withdrawn

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Evaluation of preoperative MRI for breast cancer patients at The Ottawa Hospital.

V. Deslauriers, S. Duhaime, F. Haggar, J. Watters, A. Arnaout. **From the University of Ottawa, The Ottawa Hospital, Ottawa, Ont.**

Accurate preoperative assessment of disease dictates the extent of surgery in patients with breast cancer. Breast MRI is indisputably the highest sensitivity test available to detect breast cancer, with 30% to 40% greater sensitivity than traditional breast imaging like mammography and ultrasound. Despite this, routine use of

preoperative MRI has been controversial in improving local recurrence or survival. We performed a retrospective multicentered chart review to evaluate our local experience with preoperative MRI in breast cancer patients, specifically looking to see if there are any disadvantages to undergoing this test.

All patients with biopsy proven breast cancer treated at the Ottawa Hospital and Queensway Carleton Hospital between 2008 and 2010 were included in our study. Patients were excluded if they did not have preoperative MRI evaluation and/or did not undertake surgical resection immediately after MRI. Clinical, demographic, imaging and pathological data were obtained retrospectively through chart review. Statistical analysis was performed using paired-*t* or Fisher tests.

A total of 349 patients were analyzed, 269 in the MRI group and 80 in the no MRI group. The patients in the MRI group were younger ($p < 0.001$), but not statistically different in terms of histology of breast cancer, presence of neoadjuvant therapy, extensive intraductal component or breast cancer biomarkers. There was no difference in the overall mastectomy rates ($p = 0.27$), local recurrence ($p = 0.67$) at 36 month follow-up and re-excision rates ($p = 0.57$) between the 2 groups. Preoperative MRI resulted in another biopsy in 20.1% of patients, in which 53.7% were benign. A total of 11.1% of the biopsies (2.2% of all MRI patients) resulted an upstaging of their disease based exclusively on the MRI. Contralateral cancer was detected exclusively on MRI in 1.8% of the patients. Operating room wait times were longer in the MRI group by a mean of 7 days ($p = 0.03$). A total of 30.1% of MRI patients had at least 1 additional MRI after the first MRI.

Despite the increasing usage of preoperative MRI, no benefit in terms of local recurrence and re-excision rates were proven. Routine preoperative MRI may subject patients to unnecessary biopsies and surgical delay for an overall 2.2% benefit.

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Unexpected intraoperative findings in thyroid and parathyroid surgery: a survey of patient preferences for decision-making. ***K. Devon, P. Angelos.*** **From the University of Toronto, Toronto, Ont., the University of Chicago, Chicago, Ill.**

Occasionally during thyroid and parathyroid surgery unexpected intraoperative findings result in a decision that impacts both the risks and benefits to the patient. The aim of this study was to determine patient preferences and factors related to surrogate decision-making.

A 21-item questionnaire with demographic information and vignettes was given to 42 patients at an academic institution following thyroidectomy or parathyroidectomy. The first clinical scenario is nonspecific and describes risks, benefits and options. The second describes a suspicious thyroid nodule found during parathyroid surgery.

A total of 58.5% of respondents would prefer the surgeon speak with someone prior to proceeding. Twenty-seven percent wanted the surgeon to proceed with their best judgment and 7% said that they would not want the surgeon to proceed without speaking with them even if it meant a second operation. Fifty-six percent of patients had designated a decision-maker preoperatively; however, only 52% of patients informed a member of the team. Reasons for not designating someone included "did not feel this was important," "had no preference," "knew that the person listed to notify in an emergency is who I would designate," "did not have time," "was not aware of this" and "was not asked." The surgical team asked the patient to designate a decision-maker preoperatively in 36.5% of cases. Of those not asked, 96.5% said that if asked, they would have designated someone. Ninety-six percent of the time that person would have been either the person in the waiting room or the person listed in the medical record. Age, sex, race, education, cancer diagnosis or having a power of attorney did not affect results.

The first study evaluating intraoperative decision-making from the patient's perspective found that preferences vary widely with respect to how unexpected findings should be handled. Elucidating patient preferences should become part of informed consent. Further study from the patient and surgeon's perspectives is warranted.

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Does size matter? A retrospective study comparing adult versus pediatric colonoscopes. ***V. Falk, N. Hickey, M. O'Leary, D. Boone, M. Borgaonkar.*** **From the Memorial University of Newfoundland, St. John's, NL**

Guidelines have been established for high quality and safety of endoscopy to ensure high completion and disease detection rates while ensuring patient comfort and minimal complication rates. It is unclear from the literature whether a regular colonoscope is better or worse than a pediatric colonoscope for these purposes.

To compare the Fujinon adult scope (12.8 mm diameter) and Fujinon pediatric or "slim-line" scope (11.5 mm diameter) with respect to patient comfort and cecal intubation rate.

A retrospective review of patients who had undergone colonoscopy between January 2012 and June 2012 for any reason at either the Health Sciences Centre or St. Clare's Mercy Hospital in St. John's, NL, was performed. All patients were older than 18 years of age and had consented to the procedure. Thus far, data for 649 patients has been collected. Using a hospital-based electronic medical record system, procedure-related data and patient demographic information were collected for each case. Nursing records were also reviewed and data collected, including the type of colonoscope used and patient comfort level. Complications were determined based on predefined criteria from data collected at the time of the procedure or during subsequent health care visits. Statistical analysis was performed using Statistical Package for the Social Sciences 19.0. Student *t* test and χ^2 test were used for comparisons with a p value of less than 0.05 considered significant.

The pediatric scope was used slightly more often compared to the adult scope (338 v. 296 patients). The completion rates for both colonoscopes were identical at 92.6% each ($p = 1.00$). Mean doses used for pediatric and adult colonoscopes of fentanyl (100.725 mcg, 97.202 mcg, $p = 0.055$) and midazolam (2.966 mg, 2.892 mg, $p = 0.209$) were similar. No significant difference could be detected in comfort level between pediatric and adult colonoscopes ($p = 0.240$). The rate of adverse events with the pediatric adult colonoscopes was similar (11.5%, 8.8%, $p = 0.254$).

No statistically significant difference could be found with regards to completion rate, sedation use, adverse events, and patient comfort. There was a nonsignificant trend toward less

fentanyl use favouring the adult scope ($p = 0.055$). This suggests that both colonoscopes are equally effective with similar levels of patient discomfort.

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Development and evaluation of a web-based CanMEDS (WEBCAM) resident portfolio. ***P. Glen, F. Balaa, F. Momoli, D. Found, L. Martin-Houlton, A. Arnaout.*** **From the University of Ottawa, The Ottawa Hospital, the Ottawa Hospital Research Institute, Ottawa, Ont.**

The CanMEDS framework has been incorporated into medical training whereby each of the 7 domains must be reflected on a trainee's final in training evaluation. Skill improvement and objective assessment within this framework have proven difficult to evaluate. We propose a novel tool for objectively assessing longitudinal resident development in the CanMEDS roles. A review of resident activities in the University of Ottawa general surgery program was conducted. Activities were allocated to CanMEDS roles according to their fit within the framework. The web-based CanMEDS portfolio (WEBCAM) was developed to provide residents with a secure, personalized activities log. This record is used by the residency program director (PD) and resident to evaluate progress. A research ethics board–approved pilot study was conducted in which residents were oriented to the site and afforded 2 months to create a real-time activity log. The WEBCAM portfolio was developed with activities representing each CanMEDS role profiled on separate web pages within the site. The site has the capacity to store supporting documents (i.e. publications). A scoring system was incorporated for PD evaluation. Ninety-seven percent of eligible residents (36 of 37) consented to participate in the evaluation of the portfolio. Survey results at the end of the period found 92% of respondents agreed that the portfolio was an effective way to organize progress and accomplishments; 67% stated it provided a reliable method of assessing CanMEDS roles. Subjective impressions were solicited in the survey. We have successfully developed a secure, personalized online repository of resident CanMEDS activities in our general surgery residency program. The preliminary results show a positive first impression among residents who have used WEBCAM. There are promising signs that it will provide means for objective assessment of resident performance as it is integrated into the fabric of the training program.

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Determining the optimal configuration of surgical expertise for the 21st century. ***L. Gorman, E. Webber, K. Eady, S. Taber, J.R. Frank, K.A. Harris.*** **From the Faculty of Medicine, Department of Surgery, University of British Columbia, Vancouver, BC, the Clinical Research Unit, Children's Hospital of Eastern Ontario, Ottawa, Ont., the Royal College of Physicians and Surgeons of Canada, for the Task Force on the Future of General Surgery, Ottawa, Ont.**

The configuration of general surgery dates back to the 20th century and to an earlier era of medical practice. Research is needed to determine how subspecialization, technological change, and the development of other surgical specialties have impacted the training of general surgeons. As part of an overall reassessment of general surgical training, this study aimed to define priority competencies all general surgeons should acquire to serve the population of Canada.

All 2462 active Fellows certified in general surgery at the Royal College of Physicians and Surgeons of Canada were invited to complete an online survey. To optimize survey response rate, a tailored design method was used. The data were analyzed using descriptive statistics in SPSS.

The survey will close in one month. To date, a response rate of 20% is available for the interim analysis. When asked how well prepared they felt upon completion of their general surgery residency training, 94% of respondents indicated they felt "well prepared" or "very well prepared" in terms of their technical ability. Seventy-six percent reported feeling "not at all prepared" or "somewhat prepared" in terms of the skills to run a practice and 36% felt "not at all prepared" or "somewhat prepared" for ambulatory care. A total of 66% of respondents undertook additional training after their general surgical residency training. Thirty-eight percent of respondents indicated that they made changes to the scope of their practice within the last 2 years and 25% planned to change their practice or retire within the next 2 years. Data from the full study will be presented as part of the paper.

Preliminary findings suggest the current approach to general surgical training could be modified in order to match preparation with evolving practice patterns. This research will assist decision-making regarding surgical training and will contribute to national efforts to match physician training with societal health needs.

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An exploration of the research strategies of small to mid-sized Canadian surgical departments. ***G. Groot, N. Muhajarine.*** **From the University of Saskatchewan, Saskatoon, Sask.**

Research is and should be an important component of every academic surgical department. Unfortunately there is little evidence available to guide such academic departments, especially small to mid-sized ones, on how to effectively optimize their research programs. The purpose of this study was to explore and share what is being done across Canada, what works and what does not.

This was a mixed-methods study in which a qualitative review of what factors were responsible for the success of several multidisciplinary research units one university followed a qualitative review of the research supports of several small to mid-sized academic departments of surgery across Canada and finally a quantitative review of the research productivity of those same academics departments of surgery over a 5-year period compared to the support for research strategies they employed.

This study showed a strong correlation between research support and research productivity in small to medium sized academic surgical divisions across Canada ($p < 0.001$). Research productivity in small to mid-sized Canadian academic departments ranged from 0.73 to 6.46 papers/member/year. The range within divisions was greater (0–12.5 papers/member/yr). Low levels of support to conduct research resulted in a Research Productivity Score (RPS) of 0.48 papers/member/year compared with a RPS of 7 papers/member/year when research support was high ($p < 0.001$).

It can be concluded that institutional support in the form of salary support, connection with a full time research team and

financial support to conduct research are essential for an academic department of surgery to maximize its research capabilities.

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Sixteen-hour limitation to in-house duty hours: Quebec on the right path? No improvement in resident or patient safety but decreased trainees satisfaction on General Surgery rotations. ***J. Hallet, E. Desrosiers, A.-S. Laliberté, I. Raîche, M.C. Rousseau, C. Thibault, G. Brochu.*** **From the Department of Surgery, Faculty of Medicine, Université Laval, Québec, Que., the Department of Surgery, Faculty of Medicine, McGill University, Montréal, Que., the Department of Surgery, CHU de Québec — Hôpital Saint-François d'Assise, Québec, Que., the Department of Surgery, CHU de Québec — CHUL, Québec, Que.**

To improve resident and patient safety, in-house consecutive duty hours in Quebec were limited to 16 in July 2012. This study aims to evaluate the effects of Quebec duty hour limitations (QDHL) on resident health, training, and patient care in general surgery.

A weekly web-based survey was distributed to residents taking in-house calls in general surgery during 6 weeks pre- and post-implementation of QDHL. It inquired about sleep and work hours, well-being and educational experience. We also captured attendance to lectures and morbidity, mortality and readmissions data from admitted patients' charts. Surgical logbooks were also reviewed.

Response rates were 40% pre- and 53% post-QDHL. Although mean daily sleep hours was increased (6.4 v. 6.0; p = 0.04), there was no significant change in pre- and post-QDHL mean total weekly sleep hours (37.9 v. 37.3; p = 0.89) or work hours (60.6 v. 63.4; p = 0.44). Residents worked more days and more shifts to reach the same number of working hours. Perceived rest was decreased while perceived lack of attention, lack of energy and excessive workload was increased. The risk of professional burnout on the Maslach Burnout Inventory was higher post-QDHL. Attendance to lectures was similar. Mean number of surgical procedures per resident was unchanged. Satisfaction with training diminished. Patient outcomes did not change.

After implementing a 16-hour limit to resident consecutive in-house duty hours, the reported amount of sleep did not change but perceived fatigue, attention and workload worsened. Decreased resident satisfaction with their training was noted. Patient outcomes were not affected. The issue of resident duty hours seems more complex than the number of consecutive hours worked. To improve the delivery of residency education, further studies and interventions should focus on better understanding of the influence of duty hours on residents and patients, and optimization of work organization.

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New resident duty hours limitation in Quebec: Have all stakeholders input be considered? Analysis of a province-wide survey of general surgery physicians. ***J. Hallet, M.C. Rousseau, I. Raîche, A.-S. Laliberté, E. Desrosiers, C. Thibault, G. Brochu.*** **From the Department of Surgery, Faculty of Medicine, McGill University, Montréal, Que., the Department of Surgery, Faculty of Medicine, University of Ottawa, Ottawa, Ont., the Department of Surgery, Faculty of Medicine, Université Laval, Québec, Que., the Department of Surgery, CHU de Québec — Hôpital Saint-François d'Assise, Québec, Que., the Department of Surgery, CHU de Québec — CHUL, Québec, Que.**

To improve resident and patient safety, in-house consecutive duty hours in Quebec were limited to 16 in July 2012. We designed a survey to understand the attitudes of general surgery physicians toward the new Quebec duty hour limitations (QDHL).

We conducted a cross-sectional study in all general surgeons practising in teaching hospitals and general surgery residents in Quebec, post-QDHL. Domains assessed were 1) traditional duty hours evaluation, 2) ideal duty hours organization, 3) anticipated impacts of QDHL and 4) general appreciation of QDHL.

Our response rate was 25.3% (81 of 320). Most respondents reported that traditional duty hours provided quality training in general surgery, but agreed that the number (58.1%) and quality (88.7%) of sleep hours were insufficient. A majority agreed with the necessity of a limited number of calls (87.3%) and consecutive work shifts (71.4%) but not predetermined weekly work hours (39.7%). Most respondents felt that learning capacity will improve (63.6%), but clinical exposition will decrease (63.6%) so that the training standards won't be met (48.3%), resulting in the need for residency prolongation (45%). According to most, impacts on patient care will be neutral or negative, and negative for residents and work organization. On a 0 to 10 scale, the median satisfaction of residents with the QDHL was 2 (interquartile range: 1–4). Finally, a majority were not in favour of QDHL (82.5%).

Although they recognized the lack of sleep with traditional duty hours, surgeons and residents raised significant concerns regarding the impacts of QDHL in general surgery. Most of them believe the quality of training will suffer, without improved patient care or resident safety to compensate. In order to successfully implement new duty hours that meet the educational and organizational needs of various services and improve all stakeholders' experience, these perceptions have to be understood and addressed. To do so, flexibility appears to be key.

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The integration of minimally invasive surgery in surgical practice in a Canadian setting: results from 2 consecutive province-wide practice surveys of general surgeons over a 5-year period. ***J. Hallet, O. Mailloux, M. Chhiv, R.C. Grégoire, J.-P. Gagné.*** **From the Department of Surgery, Faculty of Medicine, Université Laval, the Department of Surgery, CHU de Québec, the Québec Centre for Minimally Invasive Surgery, the Department of Surgery, CHU de Québec — Hôpital Saint-François d'Assise, Québec, Que.**

Most surgeons have quickly embraced the practice of minimally invasive surgery (MIS). However, the introduction of advanced procedures appears more complex. The purpose of this study is to assess the evolution of MIS practice in Quebec over a 5-year period in order to identify needs for improvement in the modern surgical era.

We developed, test-piloted and sent a self-administered questionnaire to Quebec general surgeons in 2007 and 2012, to examine the parameters of surgical practice, stated MIS practice, MIS

training and barriers and facilitators to the use of MIS. Results from both time points were compared.

The response rates were 51.3% (251/489) in 2007 and 31.3% (153/491) in 2012. In 2012, a significant increase was observed for performance of most advanced MIS procedures, especially for colectomy for both benign (66.0% v. 84.3; $p <$ 0,001) and malignant diseases (43.3% v. 77.8%; $p <$ 0,001), and for rectal surgery for malignancy (21.0% v. 54.6%; $p <$ 0.001). More surgeons practised 3 or more advanced MIS procedures in 2012 (82.3% v. 64.3%, $p <$ 0,001). At multivariate analysis, the 2007 survey administration was associated with a lower proportion of surgeons reporting an advanced MIS practice (OR 0.13 [0.06–0.29]). The number of respondents stating to have gained their skills during residency was significantly higher in 2012 ($p = 0.028$).

From 2007 to 2012 there was a significant increase in the practice of advanced MIS procedures by general surgeons in Quebec. This technique now appears well established in the current surgical practice. The growing place of MIS in residency training seems to be a paramount part of this development over the last 5 years. Results from this study could be used as a baseline for studies focusing on ways to further improve the MIS practice in Quebec.

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Retrospective chart review on the efficacy of conservative management of microperforated diverticulitis. *D.A. Isa, D. Terterov, N. Ditkofski.* From the Memorial University of Newfoundland, St. John's, NL

With the more routine use of CT scan of the abdomen in the work-up of acute diverticulitis, microperforated diverticulitis emerged as a common radiologic diagnosis. Insufficient amount of evidence exists in the literature to help guide management decisions for this condition (e.g., conservative versus operative).

A total of 503 charts of patients presenting with acute diverticulitis from April 2008 to October 2012 at the General Hospital in St. John's, NL, were reviewed. Of these, 35 cases met criteria for microperforated diverticulitis. Demographic data, details of presentation, comorbidities, details of management, and outcomes for these patients were recorded. Univariate and multivariate analyses were used to determine potential predictors of failure of conservative management.

It was found that 29 of 35 (83%) of the cases were managed conservatively while 6 of 35 (17%) of patients were taken to the operating room (OR) immediately. Of the patients treated conservatively, 90% recovered and 10% required an operation within days after initial diagnosis. Univariate and multivariate analyses did not reveal statistically significant predictors of failure of conservative management. All of the patients taken to the OR had received a Hartmann procedure. The 2 statistically significant predictors of immediate operative management were evidence of distant foci of free air from the site of affected segment of colon and the attending surgeon (OR 7.2 and 5.3, respectively).

The conservative management of microperforated diverticulitis in an otherwise stable patient was shown to be a successful management option in this chart review. The success rates were shown to be comparable with a similar chart review from a European centre. The predictors of failure of conservative management are yet to be determined and will likely require a larger study population.

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The appropriateness of abdominal X-ray requests in surgical emergencies: an audit and reaudit following implementation of a local guideline. *J. Jhaj, S. Sinha, S. Patil, M. Puckett.* From the Torbay Hospital, Torquay, Devon, England, United Kingdom

Plain film abdominal X-rays (AXRs) are overutilized as an investigation for acute abdominal complaints. The majority of them are requested by junior doctors which results in unnecessary use of hospital resources and exposure to radiation. The Royal College of Radiologists (RCR) have published guidelines in order to minimise inappropriate requests.

The aim of this study was to assess the practice of requesting abdominal X-rays in the acute surgical setting and to evaluate the impact of implementing a local guideline.

The patient's case notes, X-ray request cards and the final abdominal X-ray report were retrospectively analyzed for all patients admitted to the acute surgical take at a district general hospital over a 4-week period in December 2011. The initial clinical diagnosis in the patient's notes was compared to that stated on the AXR request card to determine the validity of the request according to the RCR guidelines. Following the initial audit in December 2011, a local guideline was developed and circulated to all relevant departments. A reaudit was then carried out 3 months later in March 2012 to assess the degree of adherence to the local guideline.

In December 2011 (prelocal guideline implementation), 127 AXRs were requested, whereas in March 2012 (post–local guideline implementation) this number decreased to 114. The number of AXRs requested which did not meet the AXR guideline criteria decreased from 58% in December 2011 (prel–ocal guideline implementation) to 37% in March 2012 (post–local guideline implementation). The proportion of negative AXRs also decreased from 79% to 57%.

Implementing a specifically designed local guideline for the request of AXRs in surgical emergencies reduced the absolute number of requests and the rate of inappropriate requests.

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Competency-based undergraduate surgical education: CUSEC national project. *K. Joughin, CUSEC National Curriculum Working Group Members.* From the University of British Columbia, Vancouver, BC

The *Future of Medical Education in Canada* reports recommended that explicit goals of Canadian medical undergraduate and postgraduate training should shift from achievement of training objectives to achievement of clinical competencies. A competency is the observable ability to perform a workplace task, at a defined level of proficiency. The goal of the Canadian Undergraduate Surgical Education Committee (CUSEC) was to establish a national standard for competency-based undergraduate surgical education.

The CUSEC developed a set of competencies that it believes all Canadian medical students should achieve by graduation. This was achieved by consensus within a national working group, and

wider consultation with surgeons, generalists and curriculum experts. The CanMEDS roles as well as the Medical Council of Canada objectives for the qualifying examination were used as foundations for the work. The competencies were organized into 4 parts: part A) CanMEDS roles crosslinked with clinical presentations, part B) what students must be able to do given patients with a "classic" presentations of particular diseases or injuries, part C) competencies pertaining to perioperative care and trauma cases and part D) competencies pertaining to the performance of specific procedures.

Canadian medical schools will be able to incorporate the CUSEC surgical competencies into the requirements of own programs. Graduates will therefore have a known core set of abilities regardless of which medical school they attended. The identification of milestones representing the stages of learning through which students pass in acquiring the competencies and a repository of learning resources and assessment items matched to the competencies for use by all Canadian medical schools will follow.

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Would implementing a screening sigmoidoscopy model miss right-sided colon cancer? A risk analysis. ***X. Kang.*** **From the Department of General Surgery, McMaster University, Hamilton, Ont.**

What is the miss rate of proximal colon adenoma/neoplasia in an average risk population with screening sigmoidoscopy model (excluding cases with high risk criteria, symptoms and synchronous left sided lesion that would go on to have a colonoscopy and assume 100% detection rate)?

A retrospective chart review of patients with right colon (up to splenic flexure) adenoma/neoplasia was completed. Included are patients over 18 years old and confirmed on pathology. The risk factors collected include family history, inflammatory bowel disease, genetic history, personal cancer history, presenting symptoms, initial lab or imaging abnormality and prior or concurrent left sided neoplasm found on scope. This study is designed to have at least a power of 80% with a confidence interval of ± 5%.

In total, 410 patients out of 524 patients reviewed met inclusion criteria from January 2011 to September 2011. For main outcome measurements, 64 of 410 patients were average risk, asymptomatic and did not have a synchronous distal neoplasm. This translated to a miss rate of 16% by sigmoidoscopy screening model.

This risk model shows a lower miss rate for proximal colon adenoma/neoplasia using flexible sigmoidoscopy than what is reported in the literature. The study population focuses on patients with right sided colon neoplasm and aims for a higher sample size compared to a smaller subgroup from a screening colonoscopy population in literature. Patients who were diagnosed by imaging or intraoperative finding and not by endoscopy were also included. The result could be used to support and tailor sigmoidoscopy screening for colorectal cancer.

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Acute care surgical resident views on duty hour restrictions in Ontario. ***A. Kayssi, S.A. Chadi, G. Daoust-Lafond, M. Schellenberg, P. Farrugia, A.B. Nathens.*** **From the Division of General Surgery, Western University, London, Ont., the Division of General Surgery, University of Ottawa, Ottawa, Ont., the Division of General Surgery, Queen's University, Kingston, Ont., the Division of Orthopaedic Surgery, McMaster University, Hamilton, Ont., the Division of General Surgery, University of Toronto, and the Department of Surgery, Sunnybrook Health Sciences Centre, Toronto, Ont.**

The objective of this study was to determine perspectives on duty hour restrictions among acute care surgical specialty residents in general surgery (GS), orthopedic surgery (OS), and neurosurgery (NS) in Ontario and to identify resident characteristics associated with support for more restrictive duty hours.

Residents in GS, OS, and NS at 5 surgical residency programs across Ontario (Ottawa, Kingston, Toronto, Hamilton and London) were invited to complete an online questionnaire designed to assess baseline demographics, career goals, and views on duty hour restrictions. Logistic regression analysis was used to identify factors associated with favouring greater duty hour restrictions.

The overall response rate was 56%. Among the 282 respondents, the program distribution was 45% GS, 37% OS and 18% NS. Of the respondents, 67% were male, 93% were 25–35 years old, and 41% were in the first or second year of training. A total of 74% believed that current duty hour regulations allowed for sufficient clinical and operative exposure. Sixty-seven percent did not support any further work hour restrictions. Residents favouring more restrictive duty hours were more likely to be female, junior residents, or older compared to those satisfied with the status quo.

In summary, a strong majority of acute care surgery residents in Ontario felt that current duty hour restrictions were adequate. Policy-makers should focus on addressing the concerns unique to the residents likely to favour greater work hour restrictions rather than implement further restrictions that may have unwanted secondary effects.

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Local resection compared to radical resection in the treatment of T1N0M0 rectal adenocarcinoma: a systematic review and meta-analysis. ***B. Kidane, S.A. Chadi, S. Kanters, E. Boyce, B.M. Taylor, P.H. Colquhoun, M.C. Ott.*** **From Western University, London, Ont., Simon Fraser University, Vancouver, BC, the London Health Sciences Centre, London, Ont.**

Our objective was to assess, in adult T1N0M0 rectal adenocarcinoma patients, how local resection compares to radical resection, on patient-important outcomes of oncologic control (overall/disease-free/disease-specific survival and local recurrence), postoperative complications and need for permanent stoma.

A systematic review and meta-analysis was performed of studies between 1979 and 2012 comparing local and radical resection for T1N0M0 rectal adenocarcinoma. Two reviewers independently screened studies for inclusion, abstracted data and assessed for risk of bias. Meta-regression was used to assess the influence of tumour location on overall survival.

One randomized controlled trial (RCT) and 12 observational studies contributed 2855 patients for analysis. The RCT was

small and not powered to show any difference. Meta-analysis of nonrandomized studies showed that local resection was associated with significantly lower 5-year overall survival (72 more deaths per 1000 patients, 95% CI: 30–120 more deaths per 1000). Local resection was associated with lower 5-year disease-free & disease-specific survival and higher 5-year local recurrence. Local resection was also associated with lower rates of postoperative mortality (RR 0.31, 95% CI 0.14–0.71), major postoperative complications (RR 0.20, 95% CI 0.10–0.41) and need for permanent stoma (RR 0.17, 95% CI 0.09–0.30). Findings were robust in the face of multiple sensitivity analyses. Meta-regression suggests that the higher overall survival associated with radical resection may be explained by increased use of local resection on tumours in the lower third of the rectum, which have worse prognosis.

Local resection does not offer comparable oncologic control to radical surgery and is associated with lower 5-year survival and higher 5-year local recurrence. However, this may be driven by a higher prevalence of poorer-prognosis cancers in the local resection groups. Local resection is associated with lower postoperative complications, mortality and need for permanent stoma.

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Identification and evaluation of postcholecystectomy bile duct injuries: a single-centre experience. ***S.H.H. Kim, E.Y. Lee, J. D'Souza, F. Farrokhyar, M.J. Marcaccio, L. Ruo.*** **From the McMaster University, Hamilton, Ont.**

This study examines a single-centre experience with respect to clinical presentation, diagnostic approach, and management of bile duct injuries (BDIs) incurred at cholecystectomy.

A retrospective, cohort analysis of all BDIs referred to a tertiary referral centre was completed. We reviewed 54 BDIs that occurred from 1991 to 2011. Data were collected on patient factors, parameters related to cholecystectomy, clinical presentation, investigations, and management of BDIs.

Of the 54 BDIs, 16 were identified at the time of cholecystectomy (intraoperative), 11 during the same hospital admission as cholecystectomy (postoperative), and 27 following discharge postcholecystectomy (outpatient). Patients in the outpatient group were younger than the other 2 groups and were more likely to have injuries from elective cholecystectomy ($p = 0.02$). Abdominal pain was the only differing clinical feature between groups and occurred more frequently in the outpatient (92%) group compared with the postop (55%) group ($p = 0.02$). Ultrasound was most commonly used in the evaluation of the outpatient group ($p < 0.001$) while endoscopic retrograde cholangiopancreatography (ERCP) was utilized in both the postop and outpatient groups ($p = 0.002$). There was no difference in the use of intraoperative cholangiogram among the 3 groups. Magnetic retrograde cholangiopancreatography was not often employed in the assessment of BDIs. Nine of the 16 cases where an injury was identified intraoperatively were converted from laparoscopic to open. Most injuries were recognized within 7 days of cholecystectomy. Operative repair was more frequently performed in cases where the injury was identified intraoperatively, whereas those identified after cholecystectomy were more likely amenable to endoscopic management ($p = 0.05$).

The primary investigations for assessment of BDIs included ultrasound and ERCP. Patients with BDIs recognized at the time of cholecystectomy were submitted to operative repair.

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A 20-year single-centre analysis of cholecystectomy associated bile duct injuries. ***E.Y. Lee, S.H.H. Kim, J. D'Souza, F. Farrokhyar, M.J. Marcaccio, L. Ruo.*** **From the McMaster University, Hamilton, Ont.**

This study examined a single-centre experience withbile duct injuries (BDIs) related to cholecystectomy and possible risk factors for injury.

A retrospective cohort analysis was performed on all patients referred to a tertiary centre for management of BDIs from 1991 to 2011. Patient demographics, urgent indication for cholecystectomy, and surgeon experience were collected on 55 patients. Surgeon experience was defined by the year in which the Royal College of Physicians and Surgeons of Canada (RCPSC) certificate was issued. Data on all cholecystectomies performed over a calendar year between April 2010 and March 2011 served as a comparison group.

The proportion of patients with BDIs was similar to our comparison group when stratified by age and sex. For the BDI group, 31% were younger than 40 years old, 43% were between 40 and 69 years old, and 26% were 70 years and older. In the comparison group, 31% were younger than 40 years old, 53% were between 40 and 69 years old, and 16% were 70 years and older. Coincidentally, both BDI and comparison group were 67% female and 33% male. Of all BDIs, 59% of the cholecystectomies were elective, and the remaining 41% were urgent. Of cholecystectomies performed in the comparison group, 74% were elective and 26% were urgent. Among 55 patients with BDIs, 79% were referred by surgeons who were certified before 2000, whereas the remaining 21% of the cases were referred by surgeons certified after 2000. Of the 37 BDIs identified after 2000, 68% of the cholecystectomies were performed by a surgeon certified before 2000.

Potential risk factors for cholecystectomy related BDIs include urgent indication for cholecystectomy and surgeon experience.

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Variability in the diagnosis and management of acute appendicitis calls for creation of standardized best practice protocols. ***D. Li, J. Lee, R.S. McLeod, A.B. Nathens.*** **From the University of Toronto, Toronto, Ont.**

This study aimed to evaluate the differences in institutional practice patterns in diagnosing and treating acute appendicitis to better inform development of an evidence-based guideline.

A retrospective chart review was conducted of adult patients diagnosed with appendicitis in the emergency department (ED) of 5 academic hospitals, focusing on variability in the use of diagnostic imaging and nonoperative management (NOM). Alvarado score was used to operationalize level of clinical suspicion.

Our cohort included 246 patients. Of the 224 appendectomies performed, 95% were completed laparoscopically, 29% were perforated or gangrenous at operation. Preoperative imaging was performed for 98% of patients (CT 55%); the negative appendectomy rate was 4.5%. Time to admission was shorter for patients not imaged, but time to operating room (OR) was unaffected.

There were no significant differences between hospitals in patient age, sex, comorbidities, symptom duration, and use of NOM. However, hospitals differed significantly in the type of imaging modality used (ultrasound v. CT), availability of after-hours imaging, and ED to admission times. The median ED to OR time for all hospitals was 15 hours; this median ranged from 10 to 20 hours at different sites (χ^2[df] = 35.5 [4], $p < 0.0001$). Additionally, the median length of postoperative hospital stay was 23 hours, but ranged from 20 to 31 hours among different sites (χ^2[df] = 9.62 [4], $p = 0.0473$). Of the 22 patients treated nonoperatively, 18.2% experienced recurrence within a median follow-up time of 16 months.

Significant institutional variability exists in the use of imaging, time to operation, and length of postoperative hospital stay. Comparable to recent trial results, recurrence rate after NOM is high; this approach should be used selectively. Standardized institutional protocols are needed to identify target wait times, reduce unnecessary imaging and radiation exposure, expedite ED flow, and standardize postoperative care.

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Outcomes of surgical management of gallbladder disease in a tertiary care centre: predicting postoperative complications. ***S. Malik, J. Hopkins, S. Takahashi, C. Hall, A. Hayashi, A.A. Karimuddin.*** **From the Department of Surgery, University of British Columbia, Vancouver, BC, the Department of Emergency Medicine, University of British Columbia, Vancouver, BC, the Island Medical Program, Victoria General Hospital, Victoria, BC**

Laparoscopic cholecystectomy (LC) is the gold standard for surgical treatment of benign gallbladder disease but conversion rates (CR) to laparotomy are variable (2%–31%). Conversion to laparotomy predisposes to postoperative complications, lengthens hospital stays and effects convalescence. This study assessed the outcomes for LC and identified factors that predict complications.

Retrospective review of a prospectively collected LC database was performed for Aug. 1, 2009, to Aug. 31, 2011. Patients were excluded if their age was less than 18 years, or if the gallbladder malignancy required open cholecystectomy. Conversion to open cholecystectomy, length of hospital stay, complications, and mortality were analyzed; estimates include 95% confidence intervals.

A total of 1051 patients were identified; 2 were excluded due to incomplete data. The remaining 1049 underwent LC by 9 surgeons. The overall CR was 1.7% (95% CI 1.0–2.7); or 18 of 1049. There were 2 of 1049 (0.19%) iatrogenic injuries (colon, bile duct). Odds of conversion were [C1] further assessed by patient age (OR 1.5, 95% CI 0.7–2.3), presence of cholecystitis (OR 1.85, 95% CI 0.73–2.96) and for emergency cases (OR 2.5, 95% CI 1.0–3.9). Converted cases had longer hospital stay (mean 6.1 d v. 0.98 d) and significantly more postoperative complications (8 of 18 v. 35 of 1031; 41% difference; 95% CI 21.2–62.9). Postoperative complications were significantly different by age in years (OR 1.6, 95% CI 1.02–2.49), female sex (OR 0.47, 95% CI 0.23–0.93), previous abdominal surgery (OR 4.1, 95% CI 2.04–8.3), conversion to open (OR 8.3, 95% CI 2.69–25.49) and emergency surgery (OR 4.19, 95% CI 1.35–13.0).

Conversion rates from LC to open cholecystectomy were low but were associated with longer hospital stay and more complications. Postop complications can be predicted in aging patients, males, previous abdominal surgery, conversion to open cholecystectomy and emergency surgery

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Injury profile caused by the anti-personnel improvised explosive device. ***V. McAlister*****. From the Canadian Armed Forces Health Services, the Western University, London, Ont.**

The signature weapon of recent conflicts is the improvised explosive device (IED), which may target the occupants of vehicles (mounted) or individuals on the ground (dismounted). Anti-IED measures have caused perpetrators to remove metal components and to reduce the size of the device, by placing high-power explosives in plastic jugs. This strategy results in a shaped charge that targets a single individual. The goal of this paper is to describe the injury pattern suffered by the target of a dismounted anti-personnel IED, which was defined for this study as the patient with a traumatic amputation.

Information was collected regarding 100 consecutive patients with this injury who were treated at the Role 3 Multinational Medical Unit on Kandahar Airfield between January 2010 and July 2011. All but 1 of the victims were male, age 25 (18–44). Mortality was 18%, of whom 11 were dead on arrival and 7 died of wounds. Victims who were declared dead in the field were not included.

Traumatic amputation of a single limb occurred in 43 patients, but 57 suffered multiple amputations (double: 41; triple: 13; quadruple: 3) including the following: foot: 4, below knee: 73, above knee: 75, hip disarticulation: 2, unspecified lower limb: 15, digit: 4, hand: 10, below elbow: 9, above elbow: 7 and unspecified upper limb: 5. A typical injury occurred at the elbow where the boney joint was completely lost but the vascular and nerve supply to the forearm and hand was preserved anteriorly. Head, neck, tympanic membrane, chest and abdominal injuries were relatively rare (< 5%) with the exception of eye injuries (11%). Severe soft tissue injury with injection of contaminated soil along tissue planes well above entry sites was universal. Severe injury of the perineum was common (34%) with fracture of the pelvis occurring in 11%.

Personal protective equipment, which probably reduced eye, chest and abdominal injuries, should be extended to include the perineum. Application of pelvic binders by first responders may reduce blood loss. The complex elbow injury, probably related to flexion of the elbow for weapon carriage, will require innovative reconstruction to preserve function of the limb.

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Career plans and perceptions in readiness to practise of graduating general surgery residents in Canada. ***A. Nadler, S.M. Ashamalla, J. Escallon, F. Wright.*** **From the University of Toronto, Sunnybrook Health Sciences Centre, Mount Sinai Hospital, the University Health Network, Toronto, Ont.**

One-quarter of American general surgery (GS) residents identified not feeling confident performing some surgical procedures independently at graduation, which may contribute to 70% pursuing further training. The purpose of this study was to identify intended career paths of Canadian GS graduates, and perceived strengths

and weaknesses of training that would affect transition to early practice.

Surveys were distributed to graduating GS residents at a national review course as the initial cohort in a larger prospective study. Questions related to career plans, and perceived strengths and weaknesses for selected competencies.

Seventy-nine of 124 surveys were completed by graduating residents (64%). Fifty-six percent of respondents were female. Over 60% were entering a fellowship program upon graduation (50 of 79), with the majority in minimally invasive surgery (24%) or surgical oncology (16%). Most residents planned on completing subspecialty training to meet career goals (41 of 50), rather than feeling unprepared for practice (1 of 50). Most residents planned on practising in urban centres (77%) and academic hospitals (76%). Adrenalectomy, pancreatico- duodenectomy, gastrectomy, hepatectomy, thyroidectomy, abdominoperineal resection and neck dissection were perceived by residents as requiring assistance or further training to perform, for both open and minimally invasive approaches.

The majority of Canadian GS graduates plan to pursue fellowship training to meet career goals of working in urban, academic centres. This may present a challenge of job availability in major Canadian centres and a lack of work force in rural hospitals. Perceived areas of deficiency mirror areas in which further fellowship training was sought. Further analysis of this cohort may elucidate perceptions regarding competency as they progress forward in their early careers.

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A systematic review of enhanced recovery after surgery pathways: How are we measuring "recovery"? ***A. Neville, L. Lee, I. Antonescu, N. Mayo, M.C. Vassiliou, G.M. Fried, L.S. Feldman.*** **From the Steinberg–Bernstein Centre for Minimally Invasive Surgery, McGill University Health Centre, the Department of Surgery, McGill University, the Division of Clinical Epidemiology, McGill University Health Centre, and the School of Physical and Occupational Therapy, McGill University, Montréal, Que.**

Implicit in the term "Enhanced Recovery Pathway (ERP)" is that the aim of these pathways is to improve patient "recovery." Yet there is no accepted definition of recovery and a lack of validated measures of this complex process during which preoperative function and activity is regained. The goal of this review was to identify how recovery is measured in ERP studies and provide recommendations for the design of future studies. A systematic search of MEDLINE, EMBASE and Cochrane databases was conducted. Prospective studies evaluating ERPs published between 2000 and 2011 were considered. All reported outcomes were classified into categories: biologic status, symptom status, functional status, general health perceptions and quality of life (QOL). The phase of recovery measured was defined as baseline, intermediate (in-hospital discharge) and late (following discharge).

Twenty-two studies were included. Biological outcomes were reported in 21 (95%) studies and included return of gastrointestinal function (n = 13, 59%), pulmonary function (n = 5, 23%) and physical strength (n = 3, 14%). Patient reported symptoms, including pain (n = 12, 55%) and fatigue (n = 6, 27%) were reported less commonly. Functional status outcomes, including mobilization (n = 11, 50%) and ability to perform activities of daily living (n = 4, 18%) were similarly uncommon. Health aspects of QOL were reported in only 4 (18%) of studies. Length of follow-up was generally short with 18 (82%) of studies reporting outcomes within 30 days or less. All studies reported in-hospital outcomes (intermediate phase) while 11 (50%) reported postdischarge (late phase) outcomes other than complications or readmission.

Patient-centered outcomes like postdischarge functional status and QOL were uncommonly reported. Future studies of the effectiveness of ERPs should include patient-centered outcomes to better estimate their impact on recovery, particularly after discharge from hospital.

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Are we meeting clinical practice guidelines for gallstone pancreatitis? An institutional practice evaluation. ***D.D. Paskar, J. Racz, A. Nensi, T.S. Mele.*** **From Western University, London, Ont.**

Current practice guidelines for the management of gallstone pancreatitis (GSP) recommend early cholecystectomy (EC) upon patient stabilization and confirming bile duct clearance; preferably on the index admission. This study sought to evaluate our centre's recent management of GSP patients in light of these guidelines, and compare outcomes between those undergoing early versus delayed surgery.

For 2002 to 2009, all patients admitted to our institution with pancreatitis were identified retrospectively. The charts of these patients were reviewed and clinical, biochemical and radiographic criteria were used to confirm those with GSP and were eligible for EC. Data were then collected regarding demographics, admissions, use of endoscopic retrograde cholangiopancreatography (ERCP), timing of surgery and complications. Descriptive statistics were performed and a priori tests of statistical significance were attempted.

Of 843 pancreatitis patients, 230 were identified as having GSP and candidates for EC. On the index admission, 68 (29.6%) underwent ERCP and 7 (3.0%) received inpatient cholecystectomy. Of those not receiving an index cholecystectomy, 52 (23.3%) required a least 1 further hospital admission for recurrent symptoms. The median interval between index and repeat admission was 30 days. Overall, 146 (63.5%) patients went on to have a cholecystectomy in our institution, with 10 as inpatients (6.8%). Median time to cholecystectomy was 64.5 days. Planned analyses on the basis of early versus delayed surgery were underpowered due to low rate of early surgery.

For the era studied, our service was largely unable to provide timely definitive surgical care as recommended by current guidelines. Failure to perform EC frequently resulted in early readmission to hospital and further resource expenditure. Likely barriers included lack of operating room time and a dedicated acute care surgical (ACS) service.

A future study will assess if ACS adoption has resulted in improved care of those with GSP.

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Early experience with robotic pancreatic surgery. ***S. Piedimonte, Y. Wang, T. Vanounou, S. Bergman.*** **From the Jewish General Hospital, Montréal, Que.**

Pancreatic surgery has traditionally been associated to substantial

morbidity and mortality. Robotic technology was introduced in an attempt to improve technical aspects of the procedure and provide minimally invasive benefits. The purpose of the present study was to determine the safety and feasibility of robotic pancreatic surgery in the initial phase of our institutional learning curve.

We retrospectively obtained data on all patients who underwent robotic-assisted pancreaticoduodenectomy (RAPD) or robotic-assisted distal pancreatectomy (RADP) from July 2010 to November 2012. The primary outcome was 90-day complications and secondary outcomes were 90-day mortality, opioid use, and length of hospital stay.

Patients undergoing RAPD (n = 3) had a median operative time of 698 minutes (range 639–799), estimated blood loss of 300 cc (range 300-500) and median length of stay of 8 days (range 6–8). The 90-day complications included one grade A pancreatic leak and 2 grade B gastropareses that required readmission. In the RADP group (n = 4), the median operative time was 331 minutes (range 261–692), estimated blood loss was 600 cc (range 0–3000) and median length of hospital stay was 6.5 days (range 4–14). The 90-day complications for RADP included 1 wound infection with subsequent delirium, 2 grade B pancreatic leaks; all 3 progressed to intra-abdominal abscesses requiring readmission for percutaneous drainage. Negligible amounts of opioids were required by the end of postoperative day 7 in both groups and there were no reoperations or mortality within 90 days.

Robotic-assisted pancreatic surgery is safe and well tolerated, with morbidity and mortality comparable to the open approach, even at the beginning of the institutional learning curve.

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Initial assessment of patient handoff in accredited general surgery residency programs in the United States and Canada: a cross-sectional study. ***A. Saleem, M.C. Vassiliou, S. Parsons, J. Paulus.*** **From the McGill University, Montréal, Que., and Tufts University, Boston, Mass.**

Communication errors are considered 1 of the major causes that lead to sentinel events and consequently to patient harm. Our aim was to assess the process of patient handoff among junior surgical residents during shift change, to identify the factors that led to patient harm, and to determine ways in which to improve the process.

A nationwide survey was conducted that included all of the accredited general surgery residency programs in the United States and Canada. The online survey instrument had 6 sections, containing 41 questions.

Of the 244 US and 17 Canadian accredited surgical residency programs contacted, 65 (26.6%) and 12 (70.5%) participated in the survey, respectively. Of the US and Canadian surgical residents, 65.5% and 69.2% were postgraduate year 1, respectively, and 31.9% and 29.2% were postgraduate year 2, respectively. Of the US and Canadian surgical residents, 85 (77.3%) and 50 (96.2%), respectively, had not received any training about patient handoff before their surgical residency. Of the US and Canadian surgical residents, 27.1% and 64.2%, respectively, reported that the existing handoff system at their institution does not adequately protect patient safety. Moreover, 29.4% of the US surgical residents and 36.5% of the Canadian surgical residents thought that the existing handoffs do not allow continuity of care in patients. Of the US and Canadian surgical residents, 67.3% and 63%, respectively, reported receiving an incomplete handoff that resulted in minor patient harm. Only 6.2% of the US surgical residents and 6.5% of the Canadian surgical residents reported the occurrence of major harm as a consequence of problematic patient handoff. The most frequent factor reported by surgical residents to improve the patient handoff process was standardization of the verbal handoff so that all residents follow the same technique every time they sign out.

The current patient handoff system still contributes to patient harm. Further research is needed to develop a comprehensive model for patient handoff that ensures patient safety and continuity of care.

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Treatment and outcomes of small bowel obstruction in elderly patients. ***J.E. Springer, J.G. Bailey, P.J.B. Davis, P.M. Johnson.*** **From the Dalhousie University, Faculty of Medicine, Department of General Surgery, Halifax, NS**

Small bowel obstruction (SBO) is a common reason for emergency hospital admission in elderly patients. While management of these patients is challenging, very little research has examined treatment and outcomes in this patient population. The purpose of this research was to describe the morbidity and mortality associated with SBO in elderly patients.

All patients aged 70 years or older with an SBO who were admitted to an acute care surgery service at a tertiary care teaching centre between Jul. 1, 2012, and Sept. 30, 2103, were prospectively enrolled. Data were collected regarding presentation, investigations, treatment and outcomes. All patients or their designate were contacted by telephone 3 months after discharge to determine the patient's status, complications after discharge or readmission to hospital for any reason.

During the study period, 120 patients (median age 78, 45% male) were admitted for SBO. Sixty-two (52%) underwent surgery and 58 (48%) were managed nonoperatively. Three-month mortality was 8% in those who had surgery and 10.3% in those managed nonoperatively. Ten percent of patients treated nonoperatively were readmitted with an SBO within 3 months. Of the 62 patients who had surgery, 36% required small bowel resection and 64% had surgery without resection. Patients who underwent resection had a complication rate of 71% and a mortality rate of 14% compared to 70% and 5%, respectively, in those who did not require a resection. Of those who underwent surgery, the initial treatment was surgery in 26 of 62 and nonoperative management in 36 of 62. The rate of bowel resection was 38% among those taken for surgery immediately and 31% among those initially treated nonoperatively.

Small bowel obstruction requiring resection is associated with high mortality in elderly patients. The rate of resection was high among patients initially treated nonoperatively suggesting that decisions regarding the need for and timing of surgery may not have been optimal.

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Retrospective review of the modified early warning score (MEWS) in critically ill surgical inpatients at a Canadian hospital. ***A. Tessier, A. Fox-Robichaud, H. MacLeod.*** **From**

the Northern Ontario School of Medicine, Thunder Bay, Ont., the Hamilton General Hospital, Hamilton, Ont., the Thunder Bay Regional Health Sciences Centre, Thunder Bay, Ont.

Catastrophic deterioration of patients in hospital is often preceded by gross abnormalities in their vital signs. Despite the implementation by many hospitals of Medical Emergency Teams (MET), there has been no definitive evidence of their efficacy. The Modified Early Warning Score (MEWS) is a simple scoring tool using routine vital signs and has been previously validated as a predictor of catastrophic deterioration in medical and surgical inpatients. The goal of our study was to determine if the use of MEWS would have identified critically ill surgical inpatients prior to their assessment by the intensive care unit (ICU) outreach team.

A retrospective chart review was performed using audit charts from MET calls and electronic medical records (EMR) from prior MET calls and Code Blue events to the surgical wards from Jul. 1, 2010, to June 30, 2011. We assessed the vital signs and MEWS in the 48 hours preceding the call. Primary outcome was MEWS at the time of MET call or Code Blue. Secondary outcomes included time between initial MEWS of 5 or more and MET call or Code Blue, length of hospital stay, the number of ICU admissions resulting from MET calls and the 30 day in-hospital mortality rate.

A MEWS score 5 or greater was associated with an increased mortality rate (p = 0.026) and increased ICU admission rate (p = 0.008). A MEWS of 5 provided a sensitivity of 69.09%, specificity of 60.13%, positive predictive value of 38.38 and negative predictive value of 84.40. A total of 16.5% of patients demonstrated a MEWS of 5 or greater in the 12 hours prior to MET assessment and 10.5% of patients demonstrated a MEWS of 5 or greater in the 48 hours prior to MET assessment.

When compared with single-parameter "track and trigger" systems as currently utilized by MET, the MEWS offers a much improved sensitivity and specificity. Given the simplicity of the MEWS, this could be easily implemented into the MET calling criteria with little change in current nursing practices and could result in improved assessment of critically ill inpatients.

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Does increased time on the emergency OR booking board make a difference in laparoscopic cholecystectomy? ***W. Tu, D.R. Gill, M.A.J. Moser, J.M. Shaw.*** **From the College of Medicine, University of Saskatchewan, Saskatoon, Sask., the Department of Surgery, University of Saskatchewan, Saskatoon, Sask.**

Presently cholecystectomies are given low priority on the emergency operating room (OR) booking board (EBB). Many patients wait more than 24 hours for surgery and some even up to 4 days. The effect of this additional waiting time on the EBB when patients are otherwise ready to have surgery is not known. We sought to quantify the effects of increased wait time and to determine if a change in booking practices may be warranted.

All patients booked for laparoscopic cholecystectomy for acute cholecystitis between April 2009 and March 2012 at a university hospital (n = 202) were included in this retrospective chart review study. Patients were divided into 2 groups: those who had surgery within 24 hours of being booked on the EBB (ELC group) and those who were delayed for more than 24 hours (DLC group).

There was no difference in average postoperative hospital stay (2.1 d v. 2.4 d, p = 0.6), mean operating time (86 min v. 80 min, p = 0.2), complication rates or pathological severity of the gallbladder specimen between ELC and DLC groups. Analyses were repeated using multivariate and logistic regression analyses to help control for the usual confounding factors. While several factors came up as significant predictors of increased operating time, length of postoperative stay, and gallbladder severity, the time on the EBB was not significant for any of these.

Contrary to what was expected, our data suggests no difference in the outcome of cases that spent a prolonged time on the EBB versus those cases that were done sooner.

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Bridging the gap between open and minimally invasive pancreaticoduodenectomy: the hybrid approach. ***Y. Wang, S. Piedimonte, S. Bergman, T. Vanounou.*** **From the Department of General Surgery, Jewish General Hospital, Montréal, Que.**

Minimal access pancreatic surgery has evolved rapidly, but total laparoscopic pancreaticoduodenectomy is not widely performed due to its technical complexity. Hybrid laparoscopy-assisted pancreaticoduodenectomy (HLAPD) combines the safety of open surgery with the benefits of a minimally invasive approach. The aim of this study is to evaluate the hybrid approach as an intermediary procedure which can be adopted by hepatobiliary surgeons without extensive laparoscopic experience.

We retrospectively analyzed data of patients undergoing either HLAPD (n = 11) or open pancreaticoduodenectomy (OPD; n = 17) at our institution between September 2009 and January 2013. Demographic characteristics, surgical outcomes and oncologic markers were collected to compare outcomes between HLAPD and OPD.

There were no differences in patient demographics, comorbidities or surgical indications. The HLAPD group had significantly lower intraoperative blood loss (400 mL v. 1050 mL, p = 0.047) and shorter length of hospital stay (9 d v. 13.5 d, p = 0.022) compared to the OPD group. Operative time did not differ significantly between the 2 groups. There were no differences in postoperative analgesic requirements, Clavien grade I/II or grade III/IV complications, or 30- or 90-day mortality rates. Oncologic outcomes showed no significant differences in tumour size, R0 resection rate and lymph node harvest.

In selected patients, HLAPD is a safe and oncologically sound procedure with comparable outcomes to conventional open surgery. Wider adoption of HLAPD as an intermediary procedure will facilitate the transition towards minimally invasive pancreaticoduodenectomy without incurring additional risk to patients.

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Quality of thyroid referrals in Saskatchewan. ***K. Wanis, J. Oucharek, G. Groot.*** **From the University of Saskatchewan College of Medicine, the Department of Surgery, University of Saskatchewan, Saskatoon, Sask.**

A thyroid nodule is a common presentation for thyroid pathology. A low proportion of thyroid nodules harbour malignancy and

the investigation of these nodules should be performed in a cost-effective manner. The American Thyroid Association (ATA) has published guidelines who should aid physicians in performing the appropriate investigations.

The aim of this study was to determine the proportion of patients referred to thyroid surgeons in Saskatchewan with appropriate prereferral workup including a recent thyroid-stimulating hormone (TSH) and thyroid ultrasound, and to determine how frequently the initial ultrasound report guided investigations according to the ATA guidelines.

Data were retrospectively collected from the charts of all new thyroid referrals seen between June 8, 2011, and June 8, 2012, by 2 high-volume thyroid surgeons. In total, data from 196 patients (175 female, 21 male) was analyzed.

Recent TSH results were done and sent to the thyroid surgeon for 55.1% of referrals. A recent ultrasound was performed in 92.3% of referrals. Of patients with a high or normal TSH, radionuclide scan was inappropriately recommended in 11.5% of cases.

This study suggests that there is room for improvement in prereferral workup of patients with thyroid nodules in Saskatchewan in order to facilitate appropriate clinical decision-making in a cost-effective manner.

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Autologous fat grafting as a novel approach to parastomal soft tissue volume deficiencies. ***R.C. Wu, I. Yang, I. Maxwell, M.B. Jarmuske, R.P. Boushey.*** **From The Ottawa Hospital, University of Ottawa, Ottawa, Ont.**

To describe a novel approach in revising maladaptive soft tissue contour around an ileostomy.

A stoma patient with significant defects in abdominal soft tissue contour due to scarring and wound contraction underwent autologous fat grafting to achieve sealing of stoma appliance and improve cosmesis. The patient had a previous total proctocolectomy with end ileostomy for Crohn disease, and subsequently stoma repositioning, for a large parastomal hernia and abscess, developed uneven subcutaneous indentations. He suffered significant difficulties with stoma flange adhesion to the skin requiring appliance change every 3 days, despite the use of adaptive paste and adhesive tape. Persistent small bowel effluent leakage led to chronic chemical injury to skin and circumferential granulation tissue growth at the mucocutaneous junction.

In collaboration with a plastic surgeon, a sequential fat transfer process was carried out to repair parastomal soft tissue defects. Firstly, in an outpatient clinic, autologous adipose tissue from the right iliac crest zone was harvested, centrifuged and implanted to the inferior zones of the parastomal soft tissue. A 2-month observation period was used to assess the survival of fat transplant. Once deemed successful, a subsequent combined procedure was performed, where a small bowel resection for interim flare of Crohn ileitis was immediately followed by a second autologous fat transfer to smooth the contour around stoma. A complete seal of stoma appliance was accomplished at the end of fat implantation process.

A follow-up outpatient touch-up procedure was necessary at his 4-month appointment. At 6 months, the patient was very satisfied with stoma sealing and was able to change his appliance every 7 days with minimal skin excoriation.

Autologous adipose tissue transfer is a simple and effective approach to treat a subset of stoma patients with complex subcutaneous defects.

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Severity of distal disease as a risk factor for ileo-anal anastomotic leak post-pelvic pouch procedure. ***S. Zerhouni, R. Kirsch, A. Bakonyi, B. O'Connor, H. Huang, R.S. McLeod, Z. Cohen.*** **From the University of British Columbia, Vancouver, BC, the Department of Surgery, Mount Sinai Hospital, University of Toronto, Toronto, Ont., the Zane Cohen Centre for Digestive Diseases, Mount Sinai Hospital, Toronto, Ont., the Department of Pathology, Mount Sinai Hospital, University of Toronto, Toronto, Ont.**

Pelvic pouch procedure (PPP) carries significant postoperative complication risks including a 4%–14% risk of ileo-anal anastomotic (IAA) leak. The aim of this study is to evaluate the severity of disease at the IAA distal margin as an independent risk factor for IAA leak following PPP for patients with ulcerative colitis (UC).

A retrospective case–control study was undertaken. Patients were identified from the Inflammatory bowel diseases database from 1981 to 2011. Patients with IAA leak were matched to controls based on age at time of surgery, sex and year of surgery. Known patient and operation-related risk factors for IAA leaks were collected (i.e., age, gender, body mass index, alcohol, smoking, steroid use, malnutrition, diabetes, renal failure, ASA level, operative duration, blood loss, ileostomy and anastomotic tension). A blinded pathologist reviewed the distal margin for each patient and the degree of inflammation was scored using a modified histological activity index (mHAI). mHAI is a 0–5 graded scale with 5 representing the most severe disease characterized by ulcerations greater than 25% the depth of bowel wall.

Forty-nine patients with perioperative IAA leaks (mean 11 days ± 0.92) were identified and matched to controls. The case cohort had 33 males (67%) of mean age at time of surgery of 36.3 years (± 1.42) and mean ASA of 1.88 (± 0.09). The presence of a diverting ileostomy offered protection against IAA leaks with an OR of 0.24 on multivariate analysis ($p = 0.05$). On univariate and multivariate analysis grade 4 distal disease offered protection against IAA leak compared to grade 5 with OR of 0.09 ($p = 0.024$) and OR 0.09 ($p = 0.047$), respectively.

Less severe disease at the distal margin of an IAA in addition to a defunctioning ileostomy protects against IAA leak post-PPP. Studies with greater power will be required to confirm this understudied risk factor, which may influence preoperative management in patients with UC.

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Cost estimates of operating room supplies by nurses, residents, and surgeons. ***T. Zwiep, K. Leslie, C. Vinden.*** **From Western University, London, Ont.**

To obtain cost estimates from health care professionals for common items used in a general surgery operating room and compare them to actual costs.

We designed an online survey and distributed it to operating room nurses, general surgery residents, and general surgeons.

Participants were asked to provide cost estimates for all 53 items. The average response from each group was then compared to the actual cost. Items were grouped into sutures, intestinal stapling devices, meshes, and laparoscopic devices.

The response rate for nurses was 72.2%, residents 78.8%, and staff 43.8%. We had 46 participants in total. When divided by type of item, the groups overestimated the cost of sutures, intestinal stapling devices, and small meshes, and underestimated the cost of laparoscopic devices and large meshes. When divided by group, nurses were closest to the actual costs on the most number of items, followed by staff and then residents. The number of items for which the estimate was 50% or less than the actual cost was 6 for staff, 8 for residents, and 11 for nurses. The number of items for which the estimate was 150% or more than the actual cost was 12 for nurses, 13 for staff, and 20 for residents. A typical laparoscopic appendectomy case with 2 firings of the stapler, an endocatch bag, and disposable trocars is approximately $1128. The estimated cost was $757 for residents, $726 for staff, and $762 for nurses.

The costs of many items included in this survey are relatively unknown by the participants. There was a significant amount of over- and underestimation by the groups. With increased knowledge of the costs, we hope to prevent waste and change practice to help decrease health care costs.

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Trainee and staff knowledge and attitudes toward the teaching of professionalism in Canadian residency programs. ***A. Di Labio, S.A. Chadi, K. Leslie, M.C. Ott.*** **From Western University, London, Ont.**

As 1 of the CanMEDS roles, there has been an increasing focus on professionalism education in residency. Our objective was to explore the opinions and attitudes toward this topic in surgical and nonsurgical specialties. Ultimately, we aim to provide data on how professionalism is being taught and specialty specific recommendations for the teaching of professionalism.

A survey was constructed in a Delphi fashion on the knowledge and attitudes of postgraduate professionalism teaching. The survey was piloted to assess various survey metrics. This was then distributed to staff and residents across multiple specialties in Canada. Survey results were analyzed with a focus on level of training and surgical versus nonsurgical disciplines. Reminders were sent every 2 weeks for a total of 6 weeks of circulation.

A total of 299 residents (23.7%) and 184 staff (25.2%) completed the survey. Residents were more aware of the presence of a formal professionalism curriculum and specific curriculum objectives than staff (57.4% v. 34%). Residents and staff shared similar attitudes the teaching and evaluation of professionalism. Surgical residents (67.9%) and staff (41.1%) were more aware of a formal curriculum than nonsurgical residents (51.4%) and staff (29.6%). Surgical and nonsurgical residents favoured using daily clinical activities (78.2%) as the preferred teaching method followed by small group discussions (51.4%) and case-based learning (47.2%). Both surgical (90%) and nonsurgical (93%) residents felt strongly that sessions on professionalism would be best taught by physicians within their respective specialty.

Knowledge of how professionalism is being taught and evaluated in Canadian residency programs varied between consultant staff and residents as well as surgical and nonsurgical trainees. Importantly, attitudes towards professionalism teaching were similar across all groups, highlighting the importance of professionalism teaching across disciplines.

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Implementation and evaluation of the American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP) at a Canadian academic hospital. ***T.D. Jackson, D.R. Urbach, F.A. Quereshy, L.E. Rotstein, A. Okrainec.*** **From the University of Toronto, Toronto, Ont.**

The American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP) collects reliable, valid data on patient risk and outcomes after surgery for benchmarking and targeted quality improvement. ACS-NSQIP has resulted in measurable reductions in surgical complications and cost savings at participating hospitals in the United States. We sought to assess the feasibility of implementing ACS-NSQIP in a Canadian academic hospital and measure its impact on surgical quality.

After completion of the ACS-NSQIP enrollment process (site licenses, data sharing agreements, training), procedure targeted data collection of general surgery cases was initiated in March 2012. The program maintains a large prospective, multi-institutional, observational database collecting clinically rich data using trained reviewers and standardized definitions. Cases are selected based on inclusion/exclusion criteria defined by the hospital using an 8-day systematic sampling process.

A total of 883 general surgical cases were entered into ACS-NSQIP in the first year of participation (March 2012–March 2013) with 98.7% 30-day follow-up. The rate of postoperative occurrences (adverse events) was 8.5%. Review of unadjusted outcomes data with comparison to other hospitals identified colorectal surgical site infections and readmission rates as potential areas for targeted quality improvement. Risk-adjusted outcomes data provided through a semiannual report (SAR) benchmarked performance against 358 other participating centres. Overall mortality and morbidity was comparable to matched institutions with observed to expected ratios of 1.02 (95% CI 0.62, 1.66) and 0.88 (95% CI 0.61, 1.26), respectively. Participation in the Canadian Collaborative allows for comparison of outcomes to other Canadian hospitals. The program may be adapted to collect additional information at the local level including patient-centered outcomes and hospital efficiency measures.

Participation in ACS-NSQIP at a Canadian academic hospital is feasible and represents an opportunity to improve care. Within the first year of participation, high quality outcomes data from ACS-NSQIP have enabled our hospital to identify several areas for data-driven targeted quality improvement.

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Identification of inferior quality of surgical care of elderly patients in the emergent setting: a pilot study. ***H. Zakrzewski, M.Y. Li, N. Sourial, M. Monette, F. Hamadani, D. Teasdale, S. Bergman, S.A. Fraser.*** **From the Department of General Surgery, Division of Gastroenterology, Jewish General Hospital, McGill University, the Solidage-McGill University, Université de Montréal Research Group on Frailty and Aging, Centre for**

Clinical Epidemiology and Community Studies, Lady Davis Institute for Medical Research, Jewish General Hospital, McGill University, Montréal, Que.

The provision of effective surgical care to elderly patients who undergo emergent surgical interventions is challenging. This pilot study aimed to determine the feasibility of assessing quality of surgical care in the emergent setting and to compare the quality of surgical care received by elderly and nonelderly patients.

A retrospective cohort study of 148 (39 elderly [age ≥ 65] and 109 nonelderly) adult patients who underwent emergent major abdominal surgery at a single, university-affiliated institution was conducted. Patient characteristics, including age, gender, diagnosis, comorbidity (as per Cleveland Clinic incontinence [CCI]), and physiological status (as per P-POSSUM), were recorded (see Table). The main outcome was quality of surgical care, which was assessed by measuring adherence to 10 perioperative surgical quality indicators and quantified by calculating a patient quality score (no. quality indicators passed/no. quality indicators eligible × 100%). Secondary outcomes evaluated were length of stay, occurrence of complications, and discharge destination. Nonparametric bivariate analyses were performed.

The mean age of the elderly cohort was 76.2 ± 9.0 years and that of the nonelderly cohort was 42.0 ± 13.2 years. The elderly cohort had a significantly higher median (IQR) CCI and P-POSSUM score as compared to the nonelderly cohort. The median (IQR) patient quality score of the elderly cohort was significantly lower than that of the nonelderly cohort (55.6% [19.6%] v. 57.1% [21.4%], $p = 0.031$). Elderly patients also had significantly longer lengths of stay, greater occurrence of complications, and were less likely to be discharged home (Table).

This study describes a feasible approach to assessing quality of surgical care in the emergent setting. Elderly patients received poorer quality of surgical care than nonelderly patients in the emergent setting.

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Characteristic	Group; no. (%) or median [IQR]*			
	Overall *n* = 148	Elderly *n* = 39	Nonelderly *n* = 109	*p* value
Age, mean (SD)	51.0 (19.5)	76.2 (8.98)	42.0 (13.2)	< 0.001
Sex, male	81.0 (54.7)	20.0 (51.3)	61.0 (56.0)	0.617
Diagnosis				0.002
Appendicitis	49 (33.1)	5 (12.8)	44 (40.3)	
Biliary disease	33 (22.3)	7 (17.9)	26 (23.9)	
Small bowel obstruction	15 (10.1)	7 (17.9)	8 (7.34)	
CCI	0.00 [2.00]	2.00 [4.00]	0.00 [1.00]	< 0.001
P-POSSUM	1.30 [2.64]	4.73 [14.4]	1.08 [1.14]	< 0.001
Patient Quality Score	57.1 [24.4]	55.6 [19.6]	57.1 [21.4]	0.031
Surgical outcome				
Occurrence of complications	22 (14.9)	13 (33.3)	9 (8.26)	< 0.001
LOS, d	3.0 [8.0]	8.0 [11.0]	2.0 [5.0]	< 0.001
Discharge to home	137 (92.6)	31 (79.5)	106 (97.2)	0.001

CCI = chondrocyte implantation; IQR = interquartile range; LOS = length of stay; P-POSSUM = Portsmouth Physiological and Operative Severity Score for the Enumeration of Mortality and morbidity; SD = standard deviation.
*Unless otherwise stated.

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A novel approach to thoracic surgery workforce planning: Are we training too many or too few? ***J. Edwards, I. Datta, J.D. Hunt, K.J. Stefan, C.G. Ball, E. Dixon, S.C. Grondin.*** **From the University of Calgary, the Department of Civil Engineering, University of Calgary, the HBA Specto Incorporated, Calgary, Alta.**

To predict thoracic surgery workforce requirements using a novel supply–demand model. Using Canadian census microdata files and the Canadian Community Health Survey, data on 300 000 individuals was used to develop a microsimulation model representing the total national population. The demand component simulates the incidence of lung cancer taking into account population demographics, immigration/emigration, non–lung cancer mortality, geographic location, smoking status, radiologic imaging and socioeconomic status. The supply component simulates the number of practising thoracic surgeons, including age distribution, retirement plans, number of new graduates and demographic distribution. The full model predicts outcomes based on varying numbers of graduates per year.

From 2011 to 2030, the national population will increase from 33 to 43 million. Lung cancer incidence rates will rise until 2030, then plateau and decline. The rate of increase varies substantially by region (12.5% western Canada, 37.2% in eastern Canada) and is less pronounced in major cities (10.3%). Minor fluctuations in yearly thoracic graduation rates (4–8) dramatically impact the future number of practising surgeons (116–215). The rates of operable lung cancer will vary from 35.0 to 64.9 cases per surgeon per year. Training 8 surgeons per year maintains the current rate of operable lung cancer per surgeon per year (32–36); however, this increased rate of training will outpace lung cancer incidence as it declines after 2030.

Our model predicts that the number of thoracic surgeons being trained in Canada until the year 2030 is adequate to meet the changing incidence of operable lung cancer. Minor changes in the number of trainees may result in dramatic imbalances to the workforce as lung cancer incidence declines after 2030. A national strategy is necessary to ensure an appropriate number of surgeons are being trained to meet the future needs of the Canadian population.

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Impact of short neoadjuvant hemithoracic intensity modulated radiation therapy (IMRT) followed by extrapleural pneumonectomy (EPP) on survival in malignant pleural mesothelioma. ***M.E. de Perrot, R. Feld, N.B. Leighl, A. Hope, B.C.J. Cho.*** **From the Toronto General Hospital, the Princess Margaret Hospital, Toronto, Ont.**

We hypothesize that intraoperative tumour spillage occurs during extrapleural pneumonectomy (EPP), suggesting possible benefit with neoadjuvant radiation. We developed a new and unique protocol with short neoadjuvant hemithoracic intensity modulated radiation therapy (IMRT) followed by EPP. In this study, we analyzed the impact of this new therapeutic approach on survival.

Patients with resectable clinical T1-3N0M0 histology proven, previously untreated malignant pleural mesothelioma were eligible for the study. Twenty-five Gy in 5 daily fractions over 1 week was delivered to the entire ipsilateral hemithorax by IMRT with concomitant boost of 5 Gy to volumes at high risk based on CT and PET scan findings. Extrapleural pneumonectomy was performed 1 week after the end of radiation. Adjuvant chemotherapy was offered to patients with ypN2 on final pathology.

Thirty-four patients were accrued between November 2008 and February 2013. Patients had a median age of 64 years (range 45–75), 28 (80%) were males and 29 (83%) had right-sided tumours. All patients completed IMRT and EPP, as intended. IMRT was well tolerated with no grade 3 to 5 toxicity. Extrapleural pneumonectomy was performed 6 ± 2 days after completion of IMRT. All patients survived the surgery and were discharged from hospital alive. One patient (3%) died from treatment related complication (empyema) during follow-up. All but 1 patient had stage III (n = 13) or IV (n = 20) disease on final pathology. Histology subtype was epithelial in 23 (66%) cases and biphasic in 11. After a median follow up of 11 months (range 1–51), 9 patients died from tumour recurrence. The overall survival reached 61% at 3 years and was significantly better in epithelioid compared to biphasic pathologic subtypes (84% survival at 3 yr v. 18%, respectively; p = 0.001).

Short neoadjuvant hemithoracic IMRT followed by EPP is feasible and could improve survival in selected patients with epithelial subtype.

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Is VATS too expensive? A single institution cost analysis of thoracoscopic versus open lobectomy. ***D. French, D. Bethune, H. Henteleff, M. Johnston, G. Buduhan.*** **From the Dalhousie University, Halifax, NS**

Video-assisted thoracoscopic (VATS) lobectomy is being performed more frequently in thoracic centres, but cost is a concern. Earlier studies have shown increased intraoperative but lower postoperative costs over open thoracotomy, but to date there are no published Canadian cost analyses. The objective of this study is to compare the total cost of VATS and open lobectomy in a Canadian tertiary care hospital.

A retrospective cost analysis was done comparing 78 VATS to 151 open lobectomies performed over 32 month period. Intraoperative (disposables, operating time) and postoperative costs (days in intensive care, intermediate care and ward units, days requiring acute pain service [APS], readmission) were compared, as well as hospital stay and complication rates. Logistic regression analysis adjusting for age, sex, tumour size and stage was performed.

Mean costs of the first and second 39 VATS lobectomies were compared.

The mean intraoperative, postoperative and total costs for VATS and open lobectomy were $4770 and $2166 ($p$ = 0.01), $3929 and $5604 ($p$ < 0.0001), and $8499 and $7771 ($p$ = 0.3), respectively. Median hospital stay for VATS and open lobectomy were 4 and 5 days (p < 0.0001), respectively. There was no significant difference in complication rates between the 2 approaches, or between unadjusted and adjusted costs on length of stay. Mean intraoperative costs of VATS lobectomy in the first and second 39 VATS lobectomies were $4894 and $4246 ($p$ = 0.003), respectively.

The total costs of VATS and open lobectomy are equivalent. Increased disposables cost and longer operating time account for higher intraoperative cost of VATS; shorter hospital stay and less requirement for APS reduce the VATS postoperative costs. The intraoperative costs of VATS lobectomies decreases with experience.

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The management of dysphagia in esophageal adenocarcinoma patients undergoing neoadjuvant chemotherapy: Can invasive tube feeding be avoided? *J. Cools-Lartigue, D. Jones, T. Zourikian, M.C. Rousseau, J. Spicer, E. Eckert, T. Alcindor, L.E. Ferri*. From the McGill University Health Centre, the Department of Surgery, McGill University, Montréal, Que.

Neoadjuvant chemotherapy is an accepted standard for locally advanced esophagogastric adenocarcinoma. However the dysphagia frequently associated with this condition may interfere with patient tolerance of neoadjuvant chemotherapy. Surgical or endoscopic invasive tube feeding (ITF), including stents, is a commonly employed strategy to maintain nutritional support; however, it can cause significant morbidity in its own right. We sought to determine if an approach of careful dietary counselling and fast-tracked neoadjuvant chemotherapy can obviate the need for ITF.

Patients undergoing neoadjuvant chemotherapy (docetaxel, cisplatin and fluorouracil [DCF] or epirubicin, cisplatin and fluorouracil [ECF] Q3 weeks × 3 or fluorouracil/leucovorin, oxaliplatin, and docetaxel Q2 weeks × 4) for locally advanced (cT3 and/or N+) esophageal or esophagogastric junction adenocarcinoma at a single institution from 3 of 7 to 9 of 12 were identified from a prospective database. All received dietary counselling and were closely monitored for signs/symptoms of malnutrition with serial (baseline/presurgery) BMI, albumin, dysphagia scores (DS: 0 best–4 worst), and quality of life (FACT-E). We assessed the response of dysphagia and nutritional status to neoadjuvant treatment and the need for ITF. Data are presented as median (Interquartile Range) or median (± SD); paired t test or Wilcoxon signed ranks test determined significance (*p = 0.05).

Of 130 patients undergoing neoadjuvant chemotherapy, 78 had dysphagia scores of 2 or greater, most of whom received DCF (91%). Overall, the dysphagia improved in 75 of 78 (96%) from a DS of 3 (2–4) to 0 (0–1). This was associated with an increase in FACT-E QoL scores (117 ± 23 to 140 ± 20). Weight (kg) (70 ± 22:69 ± 24), BMI (24.5 ± 8 to 23.9 ± 7) and Albumin (40 ± 5 to 37 ± 4) were maintained. Only 1 patient required a stent, and none a jejunostomy or gastrostomy.

Appropriately timed neoadjuvant chemotherapy with a highly effective regimen rapidly restores normal swallowing, maintains nutritional status, and obviates the need for stenting or invasive tube feeding in patients with significant dysphagia from esophageal adenocarcinoma.

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Functional outcomes and quality of life after proximal gastrectomy for tumours of the cardia and proximal stomach. *S. Gowing, U. Ronellenfitsch, A. Andalib, R. Perera, M.C. Rousseau, D.S. Mulder, L.E. Ferri.* From the McGill University Health Centre, Department of Thoracic Sur-gery, Montréal, Que.

Proximal gastrectomy (PG) is considered oncologically equivalent to total gastrectomy for adenocarcinoma of the cardia and fundus. There are concerns PG is associated with significant reflux and poor quality of life (QoL). We sought to evaluate functional outcomes after PG.

Patients who underwent PG from September 2005 to June 2012 were identified from a prospectively entered institutional database. Symptom scores (0 = best, 4 = worst) for reflux symptoms, dysphagia, and dumping as well as QoL (functional assessment of cancer therapy scale: higher = better) were assessed in patients with no evidonce of tumour recurrence during early (1–6 mo) and late (> 6 mo) postsurgery follow-up (FU). Data are presented as median [interquartile range]. Wilcoxon signed rank test determined significance.

A total of 40 patients (27:13 m:f; 67 [62–74] yr) underwent PG. The PGs with minimal esophageal resection (1–4 cm) were performed by laparotomy alone (20 of 40:50%), left thoracoabdominal incision (18 of 40:45%), or laparotomy and left thoracotomy (2 of 40:5%). The QoL scores did not differ from preoperative to early FU, but increased compared to both at late FU (preoperative = 127 [114–140], early FU = 122.5 [94–142], late FU = 148 [133–159]; p = 0.01). At early/late FU, 7 of 30 and 6 of 21 patients reported reflux symptoms. Score for reflux symptoms was 0 (0–0) of 0 (0–0.25). Endoscopic signs of esophagitis were found in 5 of 20 patients, but only 1 of these reported reflux symptoms. One of 7 patients with reflux symptoms had esophagitis on endoscopy. Dumping symptoms were reported by 3 of 29 and 1 of 23 patients at early/late FU. At early/late FU, score for dysphagia symptoms was 0 (0–1)/0 (0–0).

Quality of life is not reduced early postoperatively after PG, and is increased at long-term FU. Although reflux symptoms are reported, most are mild and there is little correlation with endoscopic esophagitis. Dysphagia and dumping are rare. Proximal gastrectomies should remain a viable option in the management of proximal gastric tumours.

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Esophagectomy in esophageal perforations: a necessary therapeutic option in selected cases: a statistical analysis. *S. Abu-Daff, J. Ivanovic, P.J. Villeneuve, S. Gilbert, D.E. Maziak, R.S. Sundaresan, A.J.E. Seely, F.M. Shamji.* From the Thoracic Surgery Unit, The Ottawa Hospital, Ottawa, Ont.

To study the risks and impact of urgent esophagectomy for the treatment of esophageal perforations. A retrospective review of all

esophageal perforations treated at the Ottawa Hospital from January 1984 to January 2012 was performed. Compiling demographics, cause and site of perforations, time to presentation, comorbidities, radiological tests, the length of perforation, the hemodynamic status of the patient, type of treatment required and outcomes. Univariate, multivariate and Cox regression analyses were conducted.

Of 127 cases of esophageal perforation, it was spontaneous in 44 (35%), iatrogenic in 53 (44%), foreign body ingestion in 22 (17%) and 7 (6%) cases of traumatic perforation. Overall, 85 of the 127 (67%) patients were managed operatively, while 35 (27.6%) patients were treated conservatively, 7 (6.3%) patients were treated by endoscopic stent placement. Of the 85 patients that were managed operatively 21 (16.5%) required esophagectomies; 13 (15.3%) had esophagectomy with immediate reconstruction, 5 (5.9%) patients had esophagectomy followed by delayed reconstruction and 3 (3.5%) patients failed primary repair and required an esophagectomy as a secondary definitive procedure. Multivariate analysis revealed that esophagectomy in esophageal perforations was associated with the presence of benign or malignant esophageal stricture ($p = 0.001$) and a perforation greater than 5 cm ($p = 0.001$). Mortality was mainly associated with the presence of a benign or malignant esophageal stricture ($p = 0.04$).

The presence of pre-existing benign or malignant stricture, or large perforation (> 5 cm) are associated with the need for an urgent esophagectomy with or without immediate reconstruction. Performing and esophagectomy was not found to be a significant prognosticator for mortality.

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Neoadjuvant chemoradiation and surgery compared to definitive chemoradiation in the treatment of Stage IIIA N2 non–small cell lung cancer. ***F. Li, D. Patsios, A.G. Wallis, C. Massey, G.E. Darling.*** **From the Division of Thoracic Surgery, Department of Surgery, Faculty of Medicine, University of Toronto, the Department of Medical Imaging, Faculty of Medicine, University of Toronto, Toronto, Ont.**

The objective of this study was to compare survival and treatment related outcomes in patients with stage IIIA N2 non–small cell lung cancer (NSCLC) treated with chemoradiation or neoadjuvant therapy plus surgery.

A retrospective analysis of 240 patients with stage IIIA N2 NSCLC treated with curative intent between 1998 and 2007 identified 91 patients who had surgically resectable disease. Outcomes were compared in regression models to which a measure of the likelihood of having surgery (the propensity score) was included to adjust for differences in patient and tumour characteristics between patients with and without surgery. Propensity scores were calculated from a logistic regression model in which the probability of receiving surgery was related to age at diagnosis, cell histology, the Eastern Cooperative Oncology Group performance status (0 v. 1+) and sex. Overall survival was compared using a Cox proportional hazards model, while time to recurrence outcomes were compared using the proportional subdistribution hazards regression model.

The median age of the 91 patients was 62 years, 42% were female, and 60% had adenocarcinoma. There were 42 patients treated with neoadjuvant therapy plus surgery of whom 35 had a lobectomy; and 49 treated with chemoradiation. Patients in the surgery group compared to chemoradiation had decreased local recurrence (HR 0.45, 95% CI 0.20–0.99, $p = 0.047$), decreased locoregional recurrence (HR 0.44, 95% CI 0.22–0.90, $p = 0.02$), and increased median survival (4 yr v. 1.7 yr, 95% CI 0.30–1.01, $p = 0.054$). Distant recurrence and treatment related mortality was similar between the 2 cohorts. Treatment related toxicity was higher in the chemoradiation group ($p = 0.057$).

For select patients with surgically resectable stage IIIA N2 NSCLC, neoadjuvant therapy plus surgery reduces locoregional recurrence and improves survival.

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A rapid access and management program for lung cancer patients enhances the quality of thoracic surgery services. ***W.C. Hanna, A. Salvarrey, K. Yasufuku, S. Keshavjee, G.E. Darling, M.E. de Perrot, M. Cypel, T.K. Waddell.*** **From the Division of Thoracic Surgery, University of Toronto, Toronto, Ont.**

Diagnostic assessment programs for lung cancer have become widespread, but with little analysis of their impact, especially on high quality programs. Moreover, wait times are often not measured for the overall path from referral to surgery. We hypothesized that our Rapid Access and Management Program (LungRAMP^R) would shorten overall wait times and improve staging.

In a high-volume tertiary care centre, patients having lung cancer surgery before and after LungRAMP^R (control: January 2008–December 2009, RAMP: January 2010–December 2011) were compared. Neoadjuvant patients were excluded. Prospectively entered databases were mined for demographics, disease characteristics, staging variables, and intervention times. Two cohorts ($n = 233$ each) were created using 1:1 matching for age, gender, and pathological stage and compared using the Student t test and χ^2 test.

More patients in the RAMP group met our program goal of 42 days from referral to surgery (66% v. 55%, $p = 0.02$). Time from referral to surgery was shorter in the RAMP group (59 ± 39 d v. 67 ± 46 d [mean ± SD], $p = 0.03$). Similar benefits were seen in all phases of the patient journey. Time from referral to consultation was shorter in the RAMP group (14 d ± 11 d v. 17 d ± 20 d, $p = 0.05$). Improvements in wait times may have been due to increases in system efficiency. For example, at first consultation, more patients in the RAMP group had an adequate chest CT (97% v. 69%, $p < 0.0001$), PET scan (40% v. 18%, $p < 0.0001$), and brain MRI (81% v. 50%, $p = 0.03$). More importantly, at the time of surgery, more RAMP patients had complete staging: PET scan (90% v. 75%, $p < 0.0001$) and a brain MRI (83% v. 79%, $p = 0.001$).

A RAMP further enhances the quality of already outstanding thoracic surgery services with shorter wait times and more complete staging. Such programs will facilitate attainment of mandated wait time and quality targets.

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Long-term outcome after en bloc resection of non–small cell lung cancer invading the pulmonary sulcus and spine. ***S. Collaud, T.K. Waddell, K. Yasufuku, A.F. Pierre, G.E. Darling, M. Cypel, Y.R. Rampersaud, S.J. Lewis, F.A. Shepherd, N.B. Leighl, J. Cho, A. Bezjak, M. Tsao, S. Keshavjee, M.E. de Perrot.*** **From the Divisions of Thor-**

acic Surgery, Orthopedic Surgery, Medical Oncology, Radiation Oncology and Pathology, University Health Network, University of Toronto, Toronto, Ont.

Lung cancer invading the spine historically has been considered unresectable; however, considerable surgical progress has been made since the 1990s, potentially allowing their resection. Here, we describe our surgical experience and long-term results.

All patients who underwent en bloc resection of non–small cell lung cancer (NSCLC) invading the pulmonary sulcus and spine between 1991 and 2012 were retrospectively reviewed.

Forty-eight patients were included. Induction therapy consisted mostly in 2 cycles of cisplatin-etoposide and 45 Gy of concurrent radiation. All tumours were resected en bloc, including the lung, spine and chest wall. Total, hemi- and partial vertebrectomy was required in 10 (21%), 31 (64%) and 7 (15%) patients, respectively. Complete resection occurred in 42 patients (88%). Postoperatively, 18 (38%) patients stayed in the intensive care unit (ICU) for a median of 15 (1–140) days. Thirty-day and in-hospital mortality was 6%. Pathologic response to induction treatment was complete (n = 18) or near complete (n = 6) in 24 patients (50%). After a median follow-up of 26 (0–151) months, 24 patients are alive without recurrence. Overall 5-year survival was 61%. Response to induction therapy (complete/near complete v. other, p = 0.012), resection margin (R0 v. R1/R2, p = 0.009) and length of ICU stay (p = 0.003) appeared as significant prognostic factors in univariate analysis. Response to induction was maintained as prognostic factor in a multivariable analysis (p = 0.048).

En-bloc resection of the lung, chest wall and spine for NSCLC invading the pulmonary sulcus and spine is feasible with excellent long-term outcome in carefully selected patients. Response to induction appeared as an independent significant prognostic factor.

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Thoracic outlet syndrome (TOS) seen from a complexity perspective: the role of subcutaneous lidocaine infusions and stellate ganglion blocks. ***B. Nelems, S. Sharam, W. Senner, M. Humer.*** **From the University of British Columbia, Interior Health Authority, Kelowna, BC**

Thoracic outlet syndrome (TOS) and its associated anomalous anatomy is poorly understood. When seen from a complexity perspective, the myogenic pain, the sympathetically mediated symptoms (when present), the emotional profile associated with neuropathic pain, the consequences of chronic sleep deprivation, work loss and social isolation make the management of this population challenging. In keeping with the principles of complex adaptive engineering, incremental changes made to 1 aspect of the complex whole can often have emergent outcomes that provide unexpected benefits. By administering three weekly subcutaneous lidocaine infusions, half of the patients with moderate to severe pain were rendered mostly pain free. Patients come off neuropathic pain medications, return to work, sleep, socialize and emote better. The lidocaine dose was 18–24 mg/kg body weight. This has reduced the need for surgery by 50%. The most frequent cause of lidocaine infusion nonresponsiveness, is the concurrent presence of sympathetically mediated symptoms (coldness, pallor, rubor, swelling, hyperhidrosis) and the presence of skin hypersensitivity and allodynia. This cluster of symptoms and signs constitute the entity of complex regional pain syndrome (CRPS) complicating TOS. Diagnostic stellate ganglion block in CRPS yields subgroups of sympathetically mediated pain (SMP) and sympathetically independent pain (SIP). SMP patients often respond to first rib resection with cervical sympathectomy. The SIP patients cannot be cured by surgery and require ongoing neuropathic pain management.

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Development of thoracic surgery quality indicators using modified Delphi process. ***G.E. Darling, R.A. Malthaner, A.J. Dickie, L. McKnight, C. Nhan, A.R. Gagliardi, R.S. McLeod.*** **From the Toronto General Hospital, University of Toronto, Toronto, Ont., the London Health Sciences Centre, Western University, London, Ont., the Lakeridge Health, Oshawa, Ont., the Cancer Care Ontario and the Amber Hunter Cancer Care Ontario, Toronto, Ont., the Mount Sinai Hospital, Toronto, Ont.**

The purpose of this study was to develop a set of quality indicators of surgical decision-making for non–small cell lung cancer (NSCLC) patients.

A modified Delphi process was used by a multidisciplinary expert panel of 16 physicians to identify quality indicators evaluating processes of care in patients with NSCLC. Potential indicators were identified by a systematic review of the literature and were rated on actionability, validity, usefulness, discriminability, and feasibility in 2 rounds of questionnaires. The first questionnaire was completed by the expert panel as well as the thoracic surgery community of practice. The expert panel completed the second questionnaire and then attended an in-person meeting to review the results of the questionnaires and identify the final list of indicators by consensus.

A total of 41 potential indicators were identified. An additional 16 indicators were suggested: 13 in the 2 rounds of questionnaires and 3 as a result of discussion at the in-person meeting. One further indicator was identified following the in-person meeting. Seventeen indicators were chosen from 7 domains: preoperative assessment, staging, surgery, pathology, adjuvant therapy, surgical outcomes and miscellaneous.

Using a modified Delphi process, 17 indicators to assess the quality of processes of surgical care for patients with NSCLC in Ontario were developed.

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Digital versus analogue (DiVA) pleural drainage study phase 1: prospective evaluation of interobserver reliability in assessment of pulmonary air leaks. ***A. McGuire, S. Gilbert, W. Petrich, T. Ramsay, A.J.E. Seely, D.E. Maziak, R.S. Sundaresan, F.M. Shamji.*** **From the Division of Thoracic Surgery, The Ottawa Hospital, the Ottawa Hospital Research Institute, Ottawa, Ont.**

The ability to accurately characterize a pulmonary air leak (PAL) is an essential skill for those caring for thoracic surgery patients. The objective was to evaluate interobserver reliability in PAL assessments using analogue (Pleurevac®, Teleflex) and digital (Thopaz®, Medela) pleural drainage systems.

Lung resection patients with a PAL were prospectively evaluated by at least 1 thoracic surgeon, 1 surgical resident, and 1–2 nurses using a standardized questionnaire. Each patient was

assessed at the bedside first with the analogue system and then the digital system. The thoracic surgeon evaluation was considered the reference standard for comparison. Analogue air leak severity was classified using the Robert David Cerfolio (RDC) system. κ Statistics were used to quantify agreement between observers.

A total of 128 PAL evaluations were completed in 30 patients (thoracic surgeon = 30, nurse = 56, resident = 30, physiotherapists = 12). Mean (SD) time between analogue and digital assessment was 2.16 (1.66) hours. For PAL severity, the overall level of observer agreement using the analogue system was slight (κ = 0.03 [CI –0.04, 0.11]; $p = 0.40$). Agreement overall using the digital system was substantial (κ = 0.61 [CI 0.49, 0.73]; $p < 0.01$). Across all subcategories of allied health professionals, a consistent increased level of agreement in air leak severity assessment using the digital chest drainage was observed.

With the analogue drainage systems, there was poor interobserver reliability in quantifying PAL severity. Digital pleural drainage technology improves consistency between thoracic surgeons and other members of the allied health care team in bedside evaluation of PAL.

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Predicting malignancy using echographic lymph node characteristics during endoluminal ultrasound. ***E. Goudie, J. Kazakov, M. Khereba, M. Tahiri, P. Ferraro, V. Thiffault, M. Liberman.*** **From the Centre hospitalier de l'Université de Montréal, the CHUM Endoscopic Tracheobronchial and Oesophageal Centre (CETOC), the Division of Thoracic Surgery, Université de Montréal, Montréal, Que.**

Endobronchial ultrasound (EBUS) and endoscopic ultrasound (EUS) have become extremely important in lung cancer and esophageal cancer staging. We believe that endoluminal ultrasound lymph node (LN) characteristics may predict LN malignancy. This may allow for reduction in the number of biopsies required and increased precision in LN biopsy. We aimed to establish a scoring system using these characteristics to predict the probability of LN malignancy.

The study consisted of a prospective cohort trial (clinicaltrials.gov identifier: NCT01329575). All patients scheduled to undergo EBUS and/or EUS with a confirmed or suspected cancer diagnosis were eligible. During the endoscopic intervention, LN characteristics (echogenecity, echogenic aspect, echogenic pattern, borders, shape, dimensions, and vascularization) were prospectively recorded. The data were then compared to cytological and pathological results from LN biopsies. A scoring system was developed using a generalized estimating equation (GEE) model.

One hundred and three patients were recruited over a 4-month period. Two hundred and ninety-nine LNs were evaluated (mean LN per patient: 2.9 ± 1.3). The scoring system was developed based on the GEE model and is based on the presence or absence of characteristics predictive of malignancy: low echogenecity, homogenous pattern, sharp borders, round, and long LN axis. The predictive values of the final scoring system for predicting LN malignancy based on echographic properties alone has a sensitivity of 63.2% and a specificity of 61.1%.

The scoring system is simple to use and helps predict mediastinal LN malignancy using echographic properties of LNs. It may contribute to reduced time, cost and morbidity secondary to its ability to guide endoscopists in selective LN biopsy.

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Initial implementation of a multidisciplinary lung cancer screening program within a Canadian community hospital. ***K. Irshad, M. Ossip, N. Ganguli, J. Singh, P. Chiasson, D. Jones, W. Gregory, A. Dance, J. Fairbrother.*** **From the William Osler Health System, Brampton, Ont.**

Recent published trials have demonstrated a benefit of low dose CT scans (LDCT) in detecting early stage lung cancer when compared to chest radiographs. All trials have been based in academic centres and have been primarily run by radiologists. We describe our initial experience in implementing a screening program as a collaboration between the departments of radiology and thoracic surgery within a community hospital.

Between February 2012 and April 2013, 487 high risk patients were enrolled in the William Osler Health System Early Detection of Lung Cancer Program. Patients were between 55 and 74 years of age, and had a minimum 30 pack per year history of smoking. A clinical nurse navigator ensured compliance with the entry criteria and seamless flow of patients through the practice algorithm. An LDCT (Siemens, 120 kV, 20 quality reference mAs, Caredose) was performed with 3.0 mm reconstruction. The LDCTs were reported using a standardized template. Any LDCT that demonstrated a solid or semisolid nodule greater than or equal to 6 mm was deemed positive and the patients were referred to the thoracic surgeons. Difficult cases were discussed at multidisciplinary rounds.

Mean age of participants was 65 years, 291 male, 196 female. Of the participants, 56 (11.5%) had a positive baseline LDCT and were referred to thoracic surgery. Nine patients (1.8%) were referred for a CT-guided needle biopsy and 3 patients (0.6%) for bronchoscopy. The malignancy rate for the biopsies was 83%. Overall, malignancy prevalence was 2.1%. Of the malignancies, there were 7 adenocarcinomas and 2 squamous cell and 1 small cell carcinoma. Eight resections were performed and 6 were stage 1A, 3 were stage 1B (1 patient had a synchronous lesions). Eighty-eight percent of resections were performed using a video-assisted approach.

Our results suggest that lung cancer screening programs can succeed in a Canadian community and benefit from the involvement of both the radiologists and the thoracic surgeons.

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Lung and liver resection for colorectal metastases: a survival analysis. ***S.M. Coughlin, K.P. Croome, R.A. Malthaner, R. Hernandez-Alejandro.*** **From Western University, London Ont.**

Metastasectomy for colorectal liver and lung metastases has been used to improve patient survival. We compared patients who underwent liver and lung resections for colorectal metastases to those with only liver metastases to determine if these patients had significantly worse survival.

We identified all patients at our centre between 2002 and 2011 that underwent liver resection for colorectal liver metastases. We then identified a subset of these patients who also underwent lung resection for metastases. Survival was compared in patients with

lung and liver resection to those with only liver resection using a Cox proportional hazards model adjusting for age, number of liver metastases, and presence of an R0 liver resection.

A total of 175 patients underwent liver resection for colorectal metastases. Of these, 17 also had lung metastases and underwent lung resection. The mean survival for liver resection group was 63.0 months (95% CI 55.8–70.1) and 51.3 months (95% CI 36.6, 65.9) for lung and liver resection. There was not a significant difference in survival between the 2 groups (HR 0.689 [favours liver resection only] 95% CI 0.229–2.078; $p = 0.509$).

We did not identify a significant difference in survival in patients undergoing metastasectomy for lung and liver lesions compared to those only requiring liver resection. Although this suggests that patients requiring lung resection in addition to liver resection for colorectal metastases do comparably to those undergoing only liver resection, the confidence interval for the hazard ratio was quite wide and would include clinically significant survival differences.

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Implementation and verification of a synoptic operative report for lung cancer. ***M. Alabdulmohsin, F. Farrokhyar, F. Schneider, C. Schieman, Y. Shargall, J. Goffin, P. Ellis, C. Finley.*** **From the McMaster University, Hamilton, Ont.**

The goal of this project was to implement and verify a synoptic operative report electronic-based interface for lung cancer resection based on previous template work by the Canadian Association for Thoracic Surgeons and demonstrate its accuracy by assessing interobserver reliability.

In the past, surgical reporting has taken a narrative approach, relying on the surgeon to remember all pertinent details and communicate them clearly for transcription. Narrative style reports are often incomplete and unreliable. Led by pathology departments, the adoption and implementation of a newer synoptic style of reporting is attracting much interest in the medical community, where personnel complete a prescribed set of data fields that capture key information about the procedure. Synoptic reporting allows for the standardization of information across surgeons and institutions, while typically prompting users to include necessary information. Surgical reporting, especially in cancer surgery, is moving toward adopting this synoptic style of reporting.

The design of the report applied a 3-step Delphi process with an expert panel to produce a synoptic operative report suitable for lung cancer resection. Subsequently, staff thoracic surgeons and thoracic surgery fellows at St. Joseph's Hospital in Hamilton were asked to independently complete the synoptic operative report at the completion of applicable cases to assess interobserver reliability. A writeable PDF version of the report was created for this purpose while the electronic interface was under development. Interobserver reliability was measured using the κ statistic for categorical items.

Forty PDF versions of the synoptic reports were completed by both a staff surgeon and a surgical fellow for 20 lung resections at St. Joseph's Hospital over a 1-month period; these included 10 lobectomies, 2 bilobectomies, 1 segmentectomy, and 7 wedge resections. With respect to overall variables, answers matched 90.0% of the time. When isolating and comparing preoperative staging variables with intraoperative variables, the answers matched in 82.1% and 90.9% of the cases respectively.

Completion of the PDF synoptic operative report was demonstrated to be an efficient, reproducible, easily implemented, and concise method of lung cancer surgery operative reporting. This is consistent with the advantages of synoptic reporting documented in other surgical disciplines.

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Use of intraoperative steroids reduces major respiratory complications after pneumonectomy. ***B. Kidane, M. Plourde, F. Manji, B. Ellis, S.A. Chadi, D. Fortin, R.I. Inculet, R.A. Malthaner.*** **From Western University, the London Health Sciences Centre, London, Ont.**

Limited evidence suggests that intraoperative steroids may reduce postpneumonectomy pulmonary edema. Our objective was to determine if use of intraoperative steroids reduces the incidence of major respiratory complications (defined by the composite outcome of in-hospital mortality, respiratory failure and Acute Respiratory Distress Syndrome [ARDS]) in adult patients undergoing pneumonectomy.

Retrospective cohort study of consecutive pneumonectomies performed at a tertiary hospital between 2003 and 2011. Bioequivalent steroid doses were calculated & categorized into 3 groups: none, low, high. Multivariable logistic regression was performed to adjust for demographic variables, lung function, comorbidities, postoperative fluid balance, preoperative radiation or chemotherapy and era of treatment.

Intraoperative steroids were used in 32 (23%) of the 140 pneumonectomies. Steroids used were hydrocortisone (dose range 100–250 mg), methylprednisolone (125 mg) and dexamethasone (dose range 4–10 mg). Higher bioequivalent doses of steroids were usually achieved with methylprednisolone. The rate of major respiratory complications was 34% ($n = 47$). Adjusted analyses showed that having a left rather than a right pneumonectomy (OR 0.33, 95% CI 0.15–0.75, $p = 0.008$) and use of higher-dose steroids intraoperatively (OR 0.07, 95% CI 0.006–0.94, $p = 0.04$) were independent predictors of reduced major respiratory complications. There were 3 (2%) bronchopleural fistulae; none were associated with use of intraoperative steroids ($p = 1.00$).

The use of higher-dose steroids intraoperatively is associated with decreased major respiratory complications.

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Closed video-assisted thoracoscopic surgery (VATS) is a viable alternative to thoracotomy to resect pulmonary metastases: nine years of experience at a single institution. ***R.V. Anantha, D.A. Bottoni, D. Fortin, R.I. Inculet.*** **From Western University, London, Ont.**

Thoracotomy has long been advocated as the approach of choice to resect pulmonary metastases. At our institution, we developed a closed video-assisted thoracoscopic surgery (VATS) technique, using CO2 insufflation instead of a utility incision. We sought to compare our closed VATS technique to thoracotomy for the resection of pulmonary metastases.

We retrospectively analyzed all patients who underwent resection of pulmonary metastases between August 2003 and August 2011. Survival curves were calculated according to the Kaplan–Meier method and differences between VATS, thoracotomy, and converted groups were analyzed by Kruskal–Wallis test.

We identified 98 patients who underwent 120 surgeries (55 thoracotomies, 41 VATS operations and 24 cases converted from VATS to thoracotomy. Reasons for conversion included inability to identify the metastases [33%], close proximity to major vascular structures [25%], limited lung deflation [38%], and inability to tolerate single-lung ventilation [4%]). Groups were similar with respect to age and gender, but the thoracotomy group had more metastases per case (2.17 v. 1.65 for VATS v. 1.52 for the converted group, $p = 0.038$). Mean hospital stay was significantly shorter ($p < 0.0001$) for VATS (3 d) compared to thoracotomy (6.5 d), and associated with fewer complications (7% v. 29% for the thoracotomy group, $p = 0.035$). Recurrences at the previous lung resection sites occurred in 15% and 20% of thoracotomy and VATS patients, respectively ($p = 0.61$). Median survival for VATS patients (51 mo) was higher than the thoracotomy group (38 mo) but not statistically significant ($p = 0.63$), while median tumour recurrences were similar (18 mo for VATS and thoracotomy groups, $p = 0.90$).

Overall, we show that our closed VATS approach is a viable alternative to conventional thoracotomy to resect pulmonary metastases, with shorter hospital stay, fewer complications, and comparable long-term overall survival.

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Smoking cessation counselling by surgical and nonsurgical residents: opportunities for health advocacy education. ***S.R. Turner, H. Lai, E.L.R. Bédard*. From the University of Alberta, Edmonton, Alta.**

Cigarette smoking is the leading cause of preventable death in North America. Counselling by residents can be an effective means of helping patients to quit smoking, and with the introduction of the Accreditation Council for Graduate Medical Education and CanMEDS competency frameworks, health advocacy is an increasingly important part of residency training. However, past studies have found that smoking cessation counselling by residents, and in particular surgical residents, is lacking.

The objective of this study was to examine the attitudes and practices of residents at our institution regarding smoking cessation counselling, comparing surgical and nonsurgical residents and seeking to identify barriers to resident counselling.

An Internet-based questionnaire was distributed to all residents at the University of Alberta in the fall of 2012. Items examined residents' attitudes and practices related to smoking cessation counselling and barriers to counselling.

While almost all residents believed that smoking cessation was important and that counselling was part of their job as a resident, a minority routinely practised the counselling behaviours examined. Surgical residents were significantly less likely to perform counselling and more likely to think that counselling was not part of their job. Surgical residents were also more likely to identify obstacles to counselling such as a lack of time and formal training.

Residents, and surgical residents in particular, may be missing opportunities to help their patients quit smoking and improve their health. Given their positive attitudes toward counselling, it may be possible to improve their counselling practices through simple means. By identifying obstacles to counselling and tools that may increase residents' tendency to perform counselling, this study can help to guide training programs aimed at improving resident competency in health advocacy.

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Transtracheal thoracic natural orifice translumenal endoscopic surgery (NOTES) in a swine model. ***M. Khereba, E. Goudie, M. Tahiri, V. Thiffault, H. Heon, R. Hadjeres, M. Razmpoosh, P. Ferraro, M. Liberman.* From the CHUM Endoscopic Tracheobronchial and Oesophageal Centre (CETOC), Division of Thoracic Surgery, University of Montréal, Montréal, Que.**

Natural orifice transluminal endoscopic surgery (NOTES) has the potential to be the final frontier in minimally invasive procedures in thoracic surgery. In order for thoracic pleural NOTES to one day be ready for clinical trials; each step of a potential NOTES procedure must be independently evaluated for both safety and efficacy. The aim of this study was to evaluate the trachea as a portal of entry for thoracic NOTES.

Eight 40 kg swine underwent right thoracic pleuroscopy in a survival model. All procedures were performed under general anesthesia with right lung isolation. In order to avoid inadvertent injury to the superior vena cava, curvilinear endobronchial ultrasound was employed to select the appropriate location of airway incision. A 7 mm linear incision was then performed at the chosen location using an endoscopic electrocautery needle knife through a therapeutic flexible videobronchoscope. The mediastinal fat and parietal pleura were then dissected with electrocautery and complete right pleuroscopy was performed. The tracheal and mediastinal portal of entry was then sealed with 1 to 2 cc of fibrin sealant.

The pigs were kept alive for 21 days postoperatively. Postmortem diagnostic bronchoscopy was performed to assess tracheal healing. All tracheal specimens underwent histologic examination for healing and signs of mediastinal infection.

Thoracic NOTES procedures on all 8 pigs were successful. Procedural times ranged between 44 and 141 minutes. There were no intraoperative complications except for 1 minor bleeding episode within the mediastinal dissection site, which stopped spontaneously. Two pigs demonstrated excessive anxiety in the early postoperative period and died from laryngospasm. Six pigs survived for 21 days postprocedure and experienced uneventful postoperative courses. Postmortem examination demonstrated complete tracheal healing with appropriate scarring in all pigs.

The trachea is a safe portal of entry for thoracic NOTES procedures in a swine model. Tracheal incisions sealed with fibrin sealant, healed rapidly and without signs of mediastinal infection.

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Severity of complications following minimally invasive and open esophagectomy: a propensity-matched comparison. ***S. Gilbert, A. Martel, A. Alain, D.E. Maziak, A.J.E. Seely, F.M. Shamji, P.J. Villeneuve, R.S. Sundaresan.* From the Ottawa Hospital Research Institute, Ottawa, Ont.**

Comparisons of minimally invasive esophagectomy (MIE) and open esophagectomy (OE) have previously focused on MIE with cervical anastomosis. Our goal was to compare perioperative outcomes following MIE and OE with thoracic anastomosis.
Retrospective review of esophagectomy patients matched 1:1 using propensity scoring for age, sex, histology, neoadjuvant therapy, and pathologic stage. All patients had a thoracic, esophagogastric anastomosis.

From 2002 to 2012, a total of 60 patients were successfully matched (MIE 30; OE 30). Stapled anastomoses were more frequent in MIE patients (100% v. 16.7%; $p < 0.001$). Median lymph node yield was 28 ± 13 after MIE and 11 ± 8 after OE ($p < 0.001$). Complete resection rates were similar (MIE 73%; OE 76.7%; $p = 0.52$). Most incomplete resections (89%) were due to focally positive, microscopic radial margins. The proportion of patients who experienced at least 1 complication was similar (MIE 20 of 30 [66.7%]; OE 25 of 30 [83.3%]; $p = 0.23$). On average, MIE patients had significantly less complications (MIE 1.6 ± 0.2; OE 2.2 ± 0.2; $p = 0.01$). Respiratory complications were equally common in both groups (MIE 36.6%; OE 33.3%; $p = 1.0$). There was a trend toward a lower anastomotic leak rate in the MIE group (MIE 6.7%; OE 23.3%; $p = 0.07$). There was no operative mortality and no significant difference in the severity (grades I–V) of complications (Table). Mean hospital stay was significantly shorter after MIE (11 d ± 1.1 d v. 18 d ± 2 d; $p = 0.005$).

An MIE was associated with a decreased number of complications and shorter hospitalization. Both MIE and OE appear equally safe and effective approaches to esophagectomy with thoracic anastomosis. Prospective data are needed to determine which approach, if any, is associated with optimal perioperative outcomes.

Table, abstract 97

	Group; no. (%)		
Complication grade	MIE, $n = 30$	OE, $n = 30$	p value
I, no treatment	2 (6.7)	3 (10)	
II, medical treatment	9 (30)	10 (33.3)	
III, surgical treatment			
No anesthesia	6 (20)	6 (20)	
General anesthesia	6 (20)	9 (30)	
IVa, single organ failure requiring ICU	4 (13.3)	5 (16.7)	
Patients with complications*	27	33	
Patients with ≥ 1 complication	20	25	0.23

ICU = intensive care unit; MIE = minimally invasive esophagectomy; OE = open esophagectomy.
*Some patients experienced more than 1 complication.

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The 18F-FDG-PET features of pulmonary sclerosing hemangioma. ***R. Razzak, J. Veenstra, K.C. Stewart, J. Abele, E.L.R. Bédard.*** **From the Division of Thoracic Surgery, Department of Surgery, Royal Alexandra Hospital, the Department of Radiology & Diagnostic Imaging, University of Alberta, Edmonton, Alta.**

Pulmonary sclerosing hemangioma (PSH), or pneumocytoma is a benign tumour presenting predominately in females in the fifth decade of life. Prevalence in North America is poorly understood given their often incidental discovery. Histologically they comprised 4 types: solid, papillary, sclerotic and hemorrhagic. Given the rarity of PSH, a consensus with regards to imaging characteristics has not been achieved. 18 Fluorine-fluorodeoxyglucose (FDG) positron emission tomography (18F-FDG-PET) constitutes a critical tool in the evaluation of suspected intrathoracic malignancy. A correlation between size and SUVmax has been previously believed, thereby being a potential source of false-positives on 18F-FDG-PET examination. We therefore sought to investigate the PET features of PSH, and to further evaluate whether other patient or tumour factors are associated with their FDG uptake values.

A systematic review was conducted of the literature identifying articles containing PET images in patients with histologically confirmed PSH. We collected PET SUVmaxvalues as well as detailed patient and tumour characteristics. We further reviewed our experience with PSH and will present a case from our institution.

From a total of 15 sources, 35 individual cases were obtained containing the required data. Three cases acquired from our institution were also included in the review resulting in 38 combined cases describing the 18F-FDG-PET imaging characteristics of SH. Ninety-three percent of cases with a SUVmax of greater than or equal to 2.5 had a size greater or equal to 2 cm. However, 61% of patients with SUVmax less than 2.5 had a size of greater or equal to 2 cm. A poor linear correlation between tumour size and their respective SUVmax was found ($r = 0.285$).

We have conducted the largest review to date evaluating the 18F-FDG-PET characteristics in PSH. Our results cast doubt on the previously assumed relationship between tumour size and SUVmax. Other potential tumour factor or patient factor relationships were not observed, creating further uncertainty in the diagnostic utility of 18F-FDG-PET in the setting of suspected pulmonary sclerosing hemangioma.

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Updated evaluation of epidermal growth factor receptor targeted gold nanoparticles for the in vivo radiation treatment of non–small cell lung cancer. ***R. Razzak, R. Löbenberg, A. McEwan, L. Guo, W. Roa, E.L.R.*** **Bédard. From the Division of Thoracic Surgery, Department of Surgery, University of Alberta, the Faculty of Pharmacy and Pharmaceutical Sciences, University of Alberta, the Department of Oncology, Cross Cancer Institute, University of Alberta, the Division of Thoracic Surgery, Department of Surgery, Royal Alexandra Hospital, Edmonton, Alta.**

The unique properties of nanomaterials has led to their use in a range of biomedical applications such as imaging agents, biosensors, drug delivery vehicles and therapeutic agents. Gold nanoparticles (GNPs) in particular have demonstrated potential as a novel radio-enhancing agent due to their strong photoelectric absorption coefficient, resulting in local dose amplification. Furthermore, GNPs are capable of forming covalent bonds, enabling the creation of novel "targeted" agents. The goal of this study is to evaluate the in vivo radiation enhancing effects of a nanoparticle targeted against the epidermal growth factor receptor (EGFR) using the clinically utilized monoclonal antibody cetuximab covalently bound to 50 nm GNPs.

Radiation experiments were conducted on balb-c nude mice bearing a SKMES-1 (NSCLC cell line) flank xenograft. Radiation experiments were conducted on 3 groups: 1) radiation only, no nanoparticles, 2) GNP-polyethelene glycol (GNP-PEG), GNPs stabilized by bound PEG and 3) GNP-Cetux, GNPs bound with cetuximab and stabilized with PEG. Four weekly tumour irradiations were conducted 3 days after intravenous

administration (3 total injected doses) of the various GNP groups, with timing based on biodistribution evaluation in the same animal model. Biweekly tumour volumes were measured assessing the local tumour effect.

The GNP-PEG group displayed enhanced intratumour GNP concentration as compared to the tumour targeted GNP-Cetux during biodistribution evaluation. After 4 weeks, the GNP-PEG group demonstrated the greatest reduction in mean tumour growth as compared to radiation alone group (52 mm^3 ± 10 mm^3 v. 180 ± 11 mm^3, $p < 0.01$). Tissue histology demonstrated increased radiation induced tumour necrosis within the GNP groups.

In this study we demonstrate the in vivo potential of GNPs in the treatment of NSCLC. Despite the previously presented superiority of GNPs bound to cetuximab in vitro as a radiation enhancer, the favourable tumour biodistribution profile of GNP-PEG likely accounted for the reduced tumour growth kinetics observed in vivo. The future utility of targeted nanoparticles requires further investigation in light of these findings.

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Video-assisted lobectomy is safe and associated with a decreased length of stay: experience with 100 consecutive cases from a community teaching hospital in East Toronto. ***W. Chung, A. Kayssi, C. Simone, R. Zeldin, N. Safieddine.*** **From the University of Toronto, Toronto, Ont.**

Little is known about the safety and associated morbidity or mortality of video-assisted thoracoscopic surgery (VATS) lobectomies performed outside a major academic institution. The clinical impact of an enhanced recovery after thoracic surgery (ERATS) pathway in this context is also unknown. A retrospective review of 100 consecutive cases was undertaken to determine the outcomes of an ERATS pathway after VATS lobectomies at Toronto East General Hospital.

A single-institution retrospective study was performed on all patients who underwent a VATS lobectomy from January 2011 to January 2013. Reviewed patient clinical variables included age, pathology, stage, length of stay (LOS), and complications. Data are expressed in terms of mean and/or median, standard deviation and absolute range.

One hundred patients were included in our study. The mean age was 67.2 years (range, 46–84 yr) consisting of 51 males (51%) and 49 females (49%). There were 2 deaths (2%) where both were related to respiratory failure secondary to pneumonia. Sixty-nine patients (69%) did not have postoperative complications. Blood transfusion was required in 2 patients (2%). The ERATS patients (77 of 100) had a median LOS of 3.00 ± 4.39 days (mean, 4.70) and 35% of these patients were discharged by postoperative day (POD) 2. For non-ERATS patients (23 of 100), the median LOS was 6.00 ± 2.83 days (mean, 5.87) and 4.5% of these patients were discharged by POD 2. Conversion to a thoracotomy occurred in 5 patients (5%); 4 were due to bleeding, and 1 due to poor visualization. The most common complications were pneumonia (8%), arrhythmia (7%), urinary retention (5%), and prolonged air leak (4%).

Video-assisted lobectomy performed at a community teaching hospital has similar outcomes compared to an academic hospital in a tertiary care setting. Furthermore, the implementation of an ERATS pathway has improved the LOS at our institution compared to a conventional postoperative course.

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Novel dynamic swallowing computed tomography versus water-soluble contrast swallow in the detection of esophageal perforation or anastomotic leak complicating esophagogastrectomy. ***W. Chung, A. Kayssi, C. Simone, R. Zeldin, N. Safieddine.*** **From the University of Toronto, Toronto, Ont.**

The morbidity and mortality of an esophageal perforation and esophagogastric anastomotic leak is significant. The sensitivity and specificity of the conventional water-soluble contrast swallow (WSCS) has been questioned in previous studies. A retrospective analysis comparing a novel dynamic swallowing CT technique called CT esophagram (CTE) to WSCS was undertaken in patients suspected of esophageal perforation or anastomotic leak.

A single-institution retrospective chart review was performed on all patients from June 2009 to December 2010 who underwent both a CTE and WSCS to rule out an esophageal perforation or leak. Patient background, demographic data, and medical comorbidities were recorded. McNemar's test was employed to assess statistical significance.

Thirty patients were included in our study. Ten patients were suspected to have an esophageal perforation. Twenty patients underwent esophagogastric surgery, including esophagectomy with gastric pull up ($n = 16$), esophagectomy with colonic interposition ($n = 2$), or total gastrectomy and distal esophagectomy with Roux-en-Y esophagojejunostomy ($n = 2$). All 30 patients completed both the CTE followed by WSCS. Findings from studies were positive for esophageal perforation (5 of 10) or anastomotic leak (5 of 20) in 10 patients and were negative in 20 patients. WSCS confirmed a perforation or leak in 6 of the 10 patients (60%) with positive CT findings. Disconcordance was observed in 4 of the 10 patients (40%) where CTE detected signs of extravasation, while WSCS reported normal findings. All patients who had negative results on CTE also had negative findings during WSCS. A statistically significant difference was not observed between the 2 imaging modalities ($p = 0.125$).

The CTE is a promising imaging modality and further studies will assess its diagnostic strength in detecting an esophageal perforation or leak. The ancillary findings of CTE can also provide an alternative diagnosis if present.

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Evolution of approach to esophagectomy. ***B. Kidane, C. Russell, A.F. Pierre, S. Keshavjee, T.K. Waddell, M.E. de Perrot, K. Yasufuku, M. Cypel, G.E. Darling.*** **From the University of Toronto, Toronto, Ont.**

To evaluate outcomes of esophagectomy as approach evolved from open (OE) to video-assisted thoracoscopic surgery (VATS)-assisted to completely minimally invasive esophagectomy (MIE). A retrospective study of a prospective database of consecutive esophagectomies (2009–2012) was performed. Fisher exact, ANOVA and Kruskal–Wallis tests were used.

Of 84 esophagectomies performed, 34 (40.5%) were OE, 34 (40.5%) MIE and 16 (19%) partial MIE. There was no difference between groups in mean age ($p = 0.57$), sex ($p = 0.22$), BMI ($p = 0.12$), American Society of Anesthesiologists class ($p = 0.73$) and tumour pathology ($p = 0.35$). Neoadjuvant chemoradiation was used in 62.5% to 70.6% of patients with no difference between

groups (p = 1.00). In-hospital mortality rate was 0% for MIE, 2.9% (n = 1) for OE and 6.2% (n = 1) for partial MIE (p = 0.48). Anastomotic leaks occurred in 5.9% (n = 2), 6.2% (n = 1) and 8.8% (n = 3) of OE, partial MIE and MIE patients, respectively. There were no significant differences in leaks (p = 1.0) or leaks requiring intervention (p = 0.52). Chylothorax occurred in 5.9% (n = 2), 18.8% (n = 3) and 8.8% (n = 3) of OE, partial MIE and MIE patients, respectively (p = 0.39). Recurrent laryngeal nerve injury occurred in 2.9% (n = 1), 12.5% and 8.8% (n = 3) of OE, partial MIE and MIE patients, respectively (p = 1.0). Complications requiring endoscopic/operative intervention occurred in 22.2% (n = 8), 18.8% (n = 3) & 17.6% (n = 6) of OE, partial MIE and MIE patients, respectively (p = 0.94). Having a proximal/mid-thoracic tumour was the only independent predictor of complications requiring endoscopic/operative intervention (adjusted OR 1.82, 95% CI 1.07–333.33, p = 0.04). Lymph node sampling was 26 (IQR 21–30), 28.5 (IQR 19–36.5) and 25 (IQR 21–33) for OE, partial MIE and MIE patients, respectively (p = 0.67). Median hospital length of stay (LOS) was significantly less with MIE (12 d, IQR 7–22) (p = 0.02).

There were no significant differences in morbidity & mortality between OE, partial MIE and MIE. An MIE appears to reduce LOS.

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A completely closed VATS technique appears to be superior to thoracotomy for the resection of primary lung cancers: a single-institution experience. ***J. Choi, R.V. Anantha, D.A. Bottoni, D. Fortin, R.I. Inculet, R.A. Malthaner.*** **From Western University, London, Ont.**

Video-assisted resection of lung cancer has well-demonstrated advantages compared to thoracotomy. At our institution, we developed a completely closed thoracoscopic technique (CO2VATS) using CO2 insufflation without need of a utility incision. We compared this approach to thoracotomy for resection of primary lung cancers. We retrospectively analyzed all patients who underwent resection of primary lung cancer by CO2VATS between 2003 and 2011, and compared them to age- and sex-matched patients undergoing thoracotomy. Patients who underwent conversion from CO2VATS to thoracotomy were excluded. Continuous and dichotomous data were analysed using Mann–Whitney U test and Pearson χ^2 test respectively. Survival curves were calculated according to the Kaplan–Meier method and differences between groups were compared by log-rank test. There were 144 patients in each group, with similar comorbidity profiles. Over 70% of patients in both groups underwent lobectomies, and 25% of CO2VATS patients underwent wedge resections compared to 1% in the thoracotomy group (p < 0.0001). Compared to the thoracotomy group, the CO2VATS group had shorter anesthesia time (p < 0.0001), similar operative duration (p = 0.6035), smaller tumours (p < 0.0001) with fewer lymph nodes (p < 0.0001), and less intraoperative blood loss (169 mL versus 320 mL for thoracotomy, p < 0.0001). While both groups had similar respiratory complications, the CO2VATS group had significantly fewer cardiac complications (p = 0.039) and shorter hospital stay (p < 0.0001). The CO2VATS group also demonstrated a survival benefit compared to the thoracotomy group (p = 0.03). A completely closed CO2VATS approach appears to be superior compared to thoracotomy for resection of lung cancers.

Canadian Hepato-Pancreato-Biliary Association

Canadian Hepato-Pancreato-Biliary Association

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Initial experience with associating liver partition and portal vein litigation for staged hepatectomy (ALPPS) in a Canadian centre: a new approach in liver resections. ***K.A. Bertens, K.P. Croome, L. VanHouwelingen.*** **From the Division of General Surgery, Western University, London, Ont.**

A small future liver remnant (FLR) following extended hepatectomy can result in liver failure, which carries a high mortality. Associating liver partition and portal vein ligation for staged hepatectomy (ALPPS) has recently demonstrated accelerated liver growth and increased FLR. The present study reports the initial Canadian experience with ALPPS.

Between April 2012 and March 2013, patients undergoing extended liver resections for colorectal liver metastases with a FLR less than 30% were considered for ALPPS. During the first stage, the liver was mobilized, the right portal vein was ligated, and liver partition performed. After demonstrating sufficient FLR with volumetric studies, resection of the deportalized hemiliver was completed in the second stage of the procedure.

An ALPPS was successfully performed in all 7 patients in whom it was attempted. The interval between the 2 stages was 7–10 days. Liver hypertrophy of the FLR was achieved with a mean volume gain of 90.5%. Six patients underwent right trisegmentectmy and 1 required left lateral segment resection with right hepatectomy. All resections were R0. No evidence of recurrence was demonstrated at a mean of 8 months follow-up. Morbidity and mortality rates were 42% and 0%, respectively. The average hospital stay was 21 days. Six of 7 patients restarted chemotherapy within 9 weeks from the second stage ALPPS procedure.

The ALPPS induces sufficient FLR hypertrophy within 1 week allowing R0 resections in patients otherwise considered unresectable because of a small FLR. With no perioperative mortality and acceptable morbidity, the procedure has been shown to be safe in the hands of experienced surgeons. Further experience is needed to determine the advantages of this technique over other approaches, such as portal vein embolization to eradicate large or diffuse liver tumours that are not amenable to a single surgical resection.

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Toward an assessment of preoperative planning: consistency among expert surgeons. ***N. Zilbert, L. St-Martin, G. Regehr, S. Gallinger, C.-A. Moulton.*** **From the Wilson Centre, University of Toronto, Toronto, Ont., The Centre for Health Education Scholarship, University of British Columbia, Vancouver, BC, the Department of Surgery, University of Toronto, Toronto, Ont.**

Assessment of surgical judgment is challenging. Previous work suggests that the ability to construct an appropriate preoperative plan is a component of expert judgment. As a first step toward the development of an assessment tool for preoperative planning this study explored how hepato-pancreatico-biliary (HPB) surgeons develop their preoperative plans for distal pancreatectomy based on preoperative imaging.

After brief training in the "think aloud" method, 11 HPB surgeons were asked to think aloud while viewing 4 preoperative CT scans of patients with distal pancreas lesions. Each case had specific nuances with implications for resection. Sessions were audiotaped and transcribed. A complete list of imaging features noted by the participants was prepared as a questionnaire that asked participants to rate the extent to which each feature would cause deviation from their routine approach to distal pancreatectomy using a 7-point scale. Eight HPB surgeons completed the questionnaire for each of the 4 cases.

The 11 participants were consistent in their identification of the imaging features (mean features per case: 6.45–7.45; Cronbach α range: 0.79–0.82). For example, "the tumour is invading the kidney" (case 3) was mentioned by 11 of 11 participants. The second group of 8 participants were consistent in their ratings of the CT feature importance in 3 of 4 cases (Cronbach α: 0.74, 0.84, 0.87) and less consistent in the remaining case (Cronbach α: 0.63). For example, the mean importance rating for the relationship between the tumour and kidney in case 3 was 6 out of 7 (range 2–7).

These results suggest consistencies in the extent to which HPB surgeons identify and account for imaging features when planning pancreas surgery. Future work will identify expert–trainee differences in constructing preoperative plans. These efforts will further inform the development of an assessment tool for preoperative planning.

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Does selective use of intraoperative radiofrequency ablation as an adjunct to hepatic resection affect the pattern of recurrence in patients undergoing hepatic resection for metastatic colorectal cancer. ***K. Eltawil, N. Boame, H. Alobaid, R. Mimeault, R. Fairfull-Smith, T. Asmith, D. Jonker, F. Balaa, G. Martel.*** **From the Division of Medical Oncology, The Ottawa Hospital, University of Ottawa, the Liver and Pancreas Unit, The Ottawa Hospital, University of Ottawa, Ottawa, Ont.**

The purpose of this study was to analyze the patterns of disease recurrence following intraoperative radiofrequency ablation (RFA) combined with hepatic resection for patients presenting with colorectal liver metastasis (CLM).

From January 2003 to December 2009, 175 patients underwent liver resection for CLM; 150 had resection only and 25 patients underwent a combined resection and intraoperative RFA. Rates and patterns of disease recurrence were observed retrospectively in the two groups with serial imaging studies over a 3 year follow-up period.

The overall recurrence and intrahepatic recurrence rates were,

respectively, 70% and 42% in the hepatectomy group compared to 84% and 52% in the RFA group. A total of 41 lesions were treated with RFA with a mean tumour diameter of 1.8 cm and a median disease-free interval of 13.3 months. In the RFA group, a total of 21 intrahepatic recurrent metastatic lesions were identified. The pattern of first recurrence included 2 (9.5%) in the site of previous ablation, 4 (19%) in the surgical resection margin and 15 (71%) in a new location in the liver. Among the 2 patients with RFA site recurrence, 1 had a combined RFA and new site recurrence and the other had only RFA site recurrence.

Intraoperative ablation therapy appears to be a highly effective therapy when combined with liver resection for CLM with low recurrence rates at ablated sites.

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Initial experience and outcomes with a novel technique of analgesia following open liver resection: medial, open transversus abdominis plane (MOTAP) catheters. ***R. Behman, P. McHardy, J. Sawyer, P. Karanicolas.*** **From the Sunnybrook Health Sciences Centre, Toronto, Ont.**

Effective pain management after open liver resection is critical for patient well-being and to minimize complications including atelectasis, pneumonia, and cardiovascular events. Placement of transversus abdominis plane (TAP) catheters has recently emerged as an alternative to epidural catheterization or intravenous opiods. We have developed a modification of this technique termed medial, open TAP (MOTAP) catheter analgesia, which involves placement by the surgeon intraoperatively. Our objective was to assess the safety and efficacy of our initial experience with this technique.

We reviewed data from 16 consecutive patients who received MOTAP catheters following open liver resection. Patients were evaluated for pain using the numeric rating scale (NRS-11) upon movement/coughing every 4 hours for three days postoperatively. Patients were also evaluated for complications associated with the MOTAP catheter.

Median pain scores decreased on each postoperative day from 2.25 out of 10 on postoperative day (POD) 0 to 1.75 on POD 1, 1.00 on POD 2, and 0 on POD 3. The first 4 patients, given patient-controlled intravenous (IV) opioids, used them minimally and IV opioids were discontinued in subsequent patients. Nine of the 12 remaining patients (75%) were treated exclusively with MOTAP catheter and oral agents. One MOTAP catheter failed. There were no complications associated with the catheter or its placement.

The MOTAP catheters are a safe, simple, and effective alternative to intravenous or epidural analgesia following open liver resection.

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Loss of heterozygosity as a molecular "second hit" in familial pancreatic cancer: integrative genomics and gene discovery. ***Z. Kanji, S. Serra, A. Borgida, S. Holter, T. McPherson, H. Kim, A. Smith, R. Grant, G. Zogopoulos.*** **From the Toronto General Hospital, Toronto, Ont., the Zane Cohen Centre for Digestive Diseases, Toronto, Ont., the Samuel Lunenfeld Research Institute of Mount Sinai Hospital, Toronto, Ont., the McGill University, Montréal, Que.**

Familial pancreatic cancer (FPC) displays an autosomal dominant mode of inheritance, with over 80% of its genetic cause yet to be discovered. We hypothesize that a high-density DNA microarray analysis of formalin-fixed paraffin embedded (FFPE) FPC tumours combined with germline exome sequencing initiatives will yield novel regions of genomic loss harboring disease causing FPC genes.

A total of 158 FFPE FPC tumour specimens with matched normal tissue were reviewed by a pancreatic pathologist and tumours with over 70% neoplastic cellularity were selected. Tumours with less than 70% neoplastic cellularity underwent laser capture microdissection. We extracted DNA from a total of 74 samples, whole genome amplified and processed on the Affymetrix 660K Oncoscan DNA Microarray. Copy number analysis was performed using Nexus Version 6.1 software employing the SNP-FASST2 segmentation and allele-specific copy number analysis of tumours (ASCAT) algorithms. The genomic identification of significant targets in cancer (GISTIC) algorithm was used to identify the most frequently lost loci, which were then cross-referenced with data from 33 germline FPC cases sequenced on the Illumina Genomic Analyzer IIx platform.

A pair-wise analysis of 55 FPC samples with matched normal tissue was performed. Recurrent regions of loss of heterozygosity (LOH) were known loci of importance in pancreatic tumourigenesis, including CDKN2A, p53 and SMAD4. Copy neutral/gain LOH was observed throughout the genome and may account for >35% of chromosomal loss. Subgroup analysis of 2 FPC siblings elucidated shared loss regions spanning 2 novel regions. Cross referencing of LOH regions including high-frequency calls identified by GISTIC with germline deep sequencing exome data filtered for shared rare inactivating variants identified 8 novel putative tumour suppressor genes. Sanger sequencing of these genes confirmed the germline variants in 4 of 8 loci.

By combining next generation sequencing with microarray technology, we have identified potential novel genes involved in FPC. Confirmation of LOH by fluorescence in-situ hybridization is ongoing and will provide further evidence as to the importance of these genes.

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Comparison of techniques for volumetric analysis of the future liver remnant: implications for major hepatic resections. ***G. Martel, R. Huang, A. Belblidia, M. Dagenais, R. Lapointe.*** **From the CHUM — Hôpital Saint-Luc, Université de Montréal, Montréal, Que.**

The objective of this work was to evaluate the accuracy and variability of methods used to estimate liver remnant volumes prior to major hepatic surgery.

A cohort of patients who underwent major liver resection for colorectal liver metastases (2004–2011) was reviewed retrospectively. Volumetric data on the future liver remnant (FLR), total liver volume (TLV), FLR/TLV and tumour volume were generated prospectively for clinical use on liver CT scans or MRI prior to surgery. Predicted FLR and TLV derived from hand measurements were compared for accuracy to formulae-based measurement techniques (e.g., Vauthey). A difference of ± 5% in standardized FLR (sFLR) between techniques was considered clinically meaningful.

A total of 73 patients (69% males) were reviewed. The mean BMI was 27.2. All patients underwent major liver resection

(3–4 segments: 60%; 5–6 segments: 40%) and 62% underwent portal vein embolization after volumetric analysis. On initial scans, the mean difference between measured and calculated (Vauthey) TLV was 112 cc (p = 0.0020), while the mean FLR difference was –1.25% (p = 0.0632). By linear regression, TLV calculated by formulae was only moderately predictive of TLV measured by hand (R^2 = 0.47). Analysis of the distribution of differences between measured and calculated FLR demonstrated that the formula yielded an overestimation or underestimation of FLR of at least 5% in 29% of patients. Other existing formulae yielded a similar pattern of differences in 29%–59% of patients.

Clinically significant differences in FLR can be demonstrated between hand measurement and formulae-based techniques in 29% to 59% of patients. Caution is warranted with the clinical use of formulae-based volumetry. External validation of these data is necessary.

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Outcomes of pancreatico-enteric anastomosis at pancreatico-duodenectomy: a quasi-experimental propensity score–matched analysis. ***J. Abou Khalil, S. Dumitra, M. Jamal, P. Metrakos, P. Chaudhury, J. Barkun.*** **From the McGill University Health Centre, Montréal, Que.**

Pancreatic fistula (PF) is the leading cause of morbidity following Pancreatico-duodenectomy (PD), and the ideal technique for pancreatico-enteric anastomosis remains a matter of debate as a result of publication bias, varying definitions of PF, small study sizes and discrepancies with randomized trials (McKay, 2006). Two grading schemes for PF severity have been proposed: the International Study Group on PF (ISGPF) (Bassi, 2005) and Strasberg (Strasberg et al., 2006). The performance of the 2 grading system has not been compared in the literature.

This study aims to compare the risk of PFs and surgical complications following PD at the McGill University Health Centres (MUHC) wherein patients are assigned in a quasi-experimental setting to pancreaticogastrostomy (PG) or pancreaticojejunostomy (PJ). We also compared the performance of the 2 PF grading schemes.

We used the MUHC hepato-biliary-pancreatic database supplemented with chart review for 213 patients undergoing PD between 1999 and 2011, of which 109 (51%) were PJ and 104 (49%) PG. We performed a propensity score–matched multivariate logistic regression.

Pancreatic fistulas occurred in 21% (95% CI 13–29%) of PGs and 17% (95% CI 10–25%) of PJs (p = 0.49). In-hospital mortality was 8% and 5% (p = 0.3) for PG and PJ, respectively. Baseline variables associated with reconstructive options were smoking (21% PG and 38% PJ, p = 0.04), operative time (273 min PG and 326 min PJ, p < 0.001), diagnosis of cholangiocarcinoma (8.9% PG and 2.7% PJ, p = 0.11) or IPMN (12% v. 4%, p = 0.04) and dyslipidemia (23% v. 13%, p = 0.06). The development of a PF was associated with perioperative transfusions (OR 2.3, 1.1–5), tumour size (OR 0.65, 0.5–0.94), soft pancreatic texture (OR 23, 2.6–203) and pancreatic duct diameter (OR 0.4, 0.2–0.9). Propensity score–matched multivariate logistic regression failed to identify an effect of type of reconstruction on the odds of PF. Patients with PF grade C on the Bassi classification (27) had Strasberg grades between IIIA (requiring radiologic intervention) to V (death). Patients with and without PF experienced 14.6% and 4.1% mortality (p = 0.01).

Pancreaticogastrostomy and PJ reconstructions had comparable outcomes. The Strasberg classification captures a wider spectrum of complications experienced by patients with PF.

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Quality of life after resection of intra- and extrahepatic metastases from colorectal adenocarcinoma in a multicentre prospective phase II trial. ***P.E. Serrano, N.G. Coburn, K.S. Devitt, C.-A. Moulton, S.P. Cleary, C.H. Law, P.D. Greig, S. Gallinger, A.C. Wei.*** **From the Toronto General Research Institute, University Health Network, University of Toronto, Toronto, Ont., the Sunnybrook Research Institute, Sunnybrook Health Sciences Centre, Toronto, Ont.**

The concept of combined resection of intra- and extrahepatic metastases (IHM and EHM) from colorectal cancer (CRC) is evolving. This study evaluated the quality of life (QOL) of patients with IHM and EHM from CRC undergoing complete metastasectomy.

Participants of a phase-II multi-institutional trial with any number of CRC IHM and up to 3 foci of EHM, resectable with R0 intent completed QOL questionnaires (EORTC-QLQ C30, EORTC-LMC 21 and FACT-Hep) at baseline, prior to surgery and at 4, 8 and 12 months following complete metastasectomy. Mean scores were compared to baseline. Change greater than 10% was considered a minimally important clinical difference (MICD).

There were 25 participants with median age 57 (32–84) years. Protocol surgery was completed in 72%, 18 of 25. Median disease-free survival was 6 (0–17) months. The EORTC-QLQ C30 global QOL remained statistically and clinically unchanged compared to baseline at 4 and 8 months but had a clinically significant decline at 12 months (–15.3, p = 0.25). The FACT-Hep Total (–8.3, p = 0.03) and Trial Outcome Index (–6, p = 0.03) score were statistically lower at 4 months postsurgery, without reaching a MICD. At this time point there was a transient increase (statistically and clinically significant) in symptoms according to the EORTC-LMC 21 (fatigue, +17.7, p = 0.004), the EORTC-QLQ C30 (appetite loss, +12.8, p = 0.02) and a decrease in social (–22.4, p = 0.004) and role (–12.6, p = 0.002) functioning. All subscales returned to baseline levels at 12 months. There was no difference in any of the subscales analyzed in regards to sex, age or perioperative complications.

Despite early disease recurrence after aggressive metastasectomy of multi-site CRC, there was no significant deterioration of global QOL as a result of treatment. There was a transient increase in symptoms (fatigue and loss of appetite) and a decrease in functioning scores (role and social) at 4 months from surgery, improving by 12 months.

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Do patients' symptoms improve after hepatic resection for focal nodular hyperplasia? ***K. DeGirolamo, S.W. Chung.*** **From the Department of Surgery, University of British Columbia, Vancouver, BC**

Focal nodular hyperplasia (FNH) is benign liver tumour usually discovered on imaging for other indications and often requires no

treatment. However, some patients with abdominal pain and found to have FNH are considered for treatment by a hepatic resection. Unfortunately, there are no specific clinical features or investigations that can determine if the FNH is the etiology of the symptoms.

This study endeavoured to determine whether there are predictive factors for outcomes of hepatic resection for patients with abdominal pain and FNH.

Eighteen patients undergoing hepatic resection for a histologically confirmed diagnosis of symptomatic FNH performed at the Vancouver General Hospital from 2005 to 2011 were reviewed. The Fisher exact test was used to analyze predictors of outcomes.

Thirteen of 18 patients undergoing hepatic resection were symptom-free at follow-up time frames ranging from 12 to 84 months. Of the 5 patients who had persistent symptoms, all had a previous diagnosis of an abdominal pain syndrome including irritable bowel syndrome, polycystic ovarian syndrome, endometriosis, gastroesophageal reflux disease, fibromyalgia or reflex sympathetic dystrophy. Four patients with pre-existing abdominal pain syndromes were symptom-free. All patients without prior pain syndromes ($n = 9$) were asymptomatic at follow-up ($p = 0.02$).

Hepatic resection for symptomatic FNH patients improves symptoms in patients without prior pain syndromes. Caution should be used in patients with preexisting pain syndromes.

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The development of a classification system for biliary complications following orthotopic liver transplantation (OLT). ***A. Neville, M. Boutros, E. Rahme, J. Barkun.* From the Division of General Surgery, McGill University Health Centre, the Department of Surgery, McGill University, the Division of Clinical Epidemiology, McGill University Health Centre, and the School of Physical and Occupational Therapy, McGill University, Montréal, Que.**

The estimated incidence of biliary complications after orthotopic liver transplantation (OLT) ranges from 10% to 40%, but the absence of a standardized classification system prevents accurate documentation. We propose a structured classification for biliary complications following choledocho-choledochal anastomosis (CCA) at nonliving-related OLT. The classification is based on 3 major components and anatomic location: strictures (intrahepatic, common hepatic or anastomotic), leaks (anastomotic, nonanastomotic) and filling defects. The initial steps in proposing this classification are to test its reliability and validity.

The study population consisted of OLT recipients from the McGill University Health Centre who underwent transplantation between 2004 and 2011. Reliability was determined using formal reliability testing including inter-rater reliability and test-retest reliability. The classification scheme was validated by analysis of the relationship between classification elements and important clinical outcomes (including diagnostic studies, need for revisional surgery, repeat transplantation, number of posttransplant hospital admissions, the total number of hospital admission days and graft and patient survival).

A total of 189 patients, including 76 patients with biliary complications, were included. The proposed classification components showed a strong relationship with the selected clinical outcomes. The relationship between the stricture components of the classification and days of hospital admission provide an appropriate illustration of this relationship. The median number of posttransplant hospital admission days in patients without complications, with anastomotic strictures, common duct strictures and intrahepatic strictures were 1, 25, 42 and 47, respectively ($p < 0.01$).

The proposed classification of biliary complications shows good construct validity. The significant difference in clinical outcomes between different classification components demonstrates the appropriateness of the chosen components. The classification components reflect the relative severity of the different complications, further supporting validity.

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Transfusion requirements in orthotopic liver transplantation. ***T. Chan, M. Segedi, A.K. Buczkowski.* From the University of British Columbia, Vancouver, BC, the University of Toronto, Toronto, Ont.**

Increased blood product transfusion requirements and major blood loss have been found to have adverse effects in many patient populations, including trauma. However, consensus on this in the area of liver transplantation is lacking. Furthermore the choice of surgical technique (inferior vena cava [IVC] interposition, side-to-side piggyback, hepatic vein piggyback) may impact transfusion requirements but remains to be better defined.

To compare the perioperative complication rates between low and high transfusion volume liver transplant recipients and stratify outcomes by surgical technique.

We included all adult deceased and living-related liver transplant recipients from January 2007 to January 2012. Total volume of blood products transfused during the surgery (OR) and during the initial 24 hours after transplant including packed red blood cell (pRBC), plasma (FFP), cryoprecipitate, platelet, factor VII, tranexamic acid, cell-saver transfusion volume was assessed. Age-controlled univariate and multivariate linear and logistic regression was performed using Stata64 10.1 analysis software. Primary outcomes assessed included in hospital mortality, 1-year mortality and length of intensive care unit stay (LOS).

Preliminary analysis on 32 patients revealed an average age of 53.4 years (95% CI 49.5–57.4 y), Child Pugh score of 9.6 (95% CI 8.9–10.3), and MELD of 17.4 (95% CI 14.8–20.1). Average volume of pRBC transfused in OR was 5.62 units (95% CI 3.4–7.9 units), and average volume of crystalloid transfused in OR was 4048.3 mL (95% CI 3494.7–4601.9 mL). In-hospital mortality was 3 (9.4%) with average initial intensive unit LOS of 5.23 d (95% CI 17.8–39.2 d). Massive transfusion, defined as more than 10 units of pRBC was given to 3 (9.4%) patients within the first 24 hours, and was not associated with increased risk of mortality (Chisq = 0.40, $p = 0525$) or length of stay (OR 3.1, $p = 0.50$). Of the 6 reoperations within 48 hours, 4 were for treatment of bleeding. Those 4 patients all received massive transfusions within their first 24 hours of transplant, 3 of which did not require transfusions during surgery, but rather postoperatively.

This preliminary analysis of 32 patients in our 5-year cohort shows no effects of massive blood transfusion volume on overall mortality. However, more analysis will be performed to compare transfusion requirements between liver transplant techniques, as well as subgroups of patients who had postoperative hemorrhage, massive transfusion and need for reoperation.

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Liver resection after chemotherapy and tumour downsizing in patients with initially nonresectable colorectal cancer liver metastases. ***Z. Kanji, N. Devaud, N. Dhani, R. Grant, H. Shoushtari, P.E. Serrano, S. Nanji, P.D. Greig, I. McGilvray, C.-A. Moulton, A.C. Wei, S.P. Cleary.*** **From the University of British Columbia, Vancouver, BC, the Toronto General Hospital, Toronto, Ont., the Princess Margaret Hospital, Toronto, Ont., Queen's University, Kingston, Ont.**

Among patients with initially nonresectable colorectal liver metastases (CLM), a subset is rendered resectable following administration of systemic chemotherapy.

All liver resections for CLM performed at the Toronto General Hospital over a 10-year period were considered. Patients confirmed initially unresectable and given systemic therapy were included for analysis. Survival and perioperative outcomes were analyzed. Between January 2002 and July 2012, 754 liver resections for CLM were performed. Twenty-four patients met inclusion criteria. Bilobar CLM were present in 95.8% of patients. Median tumour number was 7 (range 2–15) and median tumour size was 7 cm (range 1–12.8) before systemic therapy. All patients received oxaliplatin or irinotecan based chemotherapy. Fourteen received combined treatment with bevacizumab.

Definitive resection was accomplished in 91.6%. Postoperative morbidity was 41.6% with no perioperative mortality. Recurrence rate was 81.8%, with median time to recurrence of 8.41 (range 1.94–55.39) months. Disease-free survival at 2 and 5 years was 21.7% and 11.6%, respectively. Two- and 5-year overall survival was 65.2% and 48%. Outcomes among patients treated with bevacizumab showed no significant differences.

Liver resection of initially unresectable CLM can be performed with acceptable morbidity and zero mortality in patients who respond to systemic chemotherapy, although with high disease recurrence.

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Impact of epidural analgesia and fluid resuscitation on major adverse events following pancreaticoduodenectomy. ***R. Behman, S. Hanna, N.G. Coburn, C.H. Law, D. Cyr, J. Truong, J. Lam-McCulloch, P. McHardy, J. Sawyer, C. Idestrup, P. Karanicolas.*** **From the Sunnybrook Health Sciences Centre, Toronto, Ont.**

Pancreaticoduodenectomy remains a major undertaking with substantial perioperative morbidity and mortality. Adverse events may be related to perioperative management, including fluid administration and analgesia. We sought to assess the relationship between perioperative fluid management, epidural analgesia, and clinical outcomes in patients undergoing pancreaticoduodenectomy.

We reviewed data from a single institution, prospective database of patients undergoing pancreaticoduodenectomy over a 10-year period (2002–2012). Patients were compared for technique of analgesia (epidural vs. intravenous opioid), perioperative fluid balance and postoperative outcomes using χ^2, t tests, and Mann–Whitney U tests as appropriate.

We included 251 patients, of whom 81% received thoracic epidural as their primary method of pain control. Major adverse events (Clavien grade 3 or higher) were associated with higher positive fluid balance on postoperative day zero (1638 mL v. 2375 mL, $p < 0.001$), postoperative day 1 (2290 mL v. 3076 mL, $p = 0.001$), and postoperative day 2 (803 mL v. 1400 mL, $p = 0.002$). Epidural analgesia was not associated with increased perioperative fluid or adverse events.

Increased early perioperative fluid resuscitation is associated with major adverse events in patients undergoing pancreaticoduodenectomy. More restrictive fluid administration may improve postoperative outcomes.

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Patient attitudes regarding surveillance following resection of pancreatic adenocarcinoma: a qualitative study. ***E. Cheng, R. Deobald, Y.-J. Ko, F. Wright, P. Karanicolas.*** **From the Department of Surgery, University of Toronto, the Department of Medicine, University of Toronto, the Division of Surgical Oncology and Medical Oncology, Sunnybrook Health Sciences Centre, Toronto, Ont.**

Pancreatic carcinoma is the twelfth most common cancer in Canada and the fourth leading cause of cancer death. Following surgical resection, most patients will develop cancer recurrence within 2 years. Surveillance practices vary widely among centres and the impact of intensive surveillance following resection on survival is unknown. We sought to qualitatively assess patients' perspectives and attitudes toward follow-up and the associated benefits and challenges.

We designed an interview guide for semistructured qualitative interviews. Purposive sampling identified patients from a hepatopancreaticobiliary cancer centre who had undergone resection of pancreatic cancer and were in active surveillance or had developed recurrence. Three pilot interviews were completed and transcribed verbatim; the interview guide was then adjusted to ensure all appropriate data was collected. A further 9 interviews were conducted by a single interviewer and transcribed. Themes were derived using standard qualitative methods and summarized by the research team.

Twelve patients were interviewed a median of 296 days following surgery (range 41–1140). Eleven patients had undergone chemotherapy and 7 patients had undergone radiation. Of the 12 patients, 2 had a recurrence prior to the interview. The average interview time was 28 minutes (range 14–47). The main themes included 1) limited understanding of disease prognosis, 2) reassurance through follow-up, 3) desire to know if/when recurrence occurred, 4) challenging treatment, 5) minimal difficulties with the follow-up protocol and 6) limited role of family doctors in pancreatic cancer follow-up.

Patients had a limited understanding of their overall disease prognosis but were reassured by surveillance. Patients stated a preference to be made aware of cancer recurrence even in the absence of effective treatment.

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Minimally invasive versus open liver resection: a comparative analysis of short-term outcomes. ***Y. Wang, S. Piedimonte, S. Bergman, T. Vanounou.*** **From the Department of General Surgery, Jewish General Hospital, Montréal, Que.**

Minimally invasive liver resection (MILR) has gained increasing

acceptance, but concerns remain whether it is an effective alternative to open liver resection (OLR), particularly for major resections. This study compares the outcomes of MILR versus OLR to assess the safety, feasibility and oncologic integrity of the minimally invasive technique.

We retrospectively analyzed data of patients undergoing either minimally invasive or open liver resection (MILR, n = 20; OLR, n = 54) at our institution between September 2009 and January 2013. The MILR group encompasses laparoscopic, hand-assisted and hybrid liver resections. Demographic characteristics, perioperative data and oncologic outcomes were compared between MILR and OLR.

The groups were similar in terms of patient demographics, comorbidities and surgical indications. The OLR group had a significantly greater proportion of major hepatic resections (81.5% v. 45.0%, p = 0.003). The MILR group had significantly lower intraoperative blood loss (500 v. 650 mL, p = 0.028), shorter duration of opioid requirement (4 v. 5 d, p = 0.010) and shorter length of stay (6 d v. 8 d, p = 0.024) compared to the OLR counterparts. There were no differences in operative times, incidence of Clavien grade I/II or grade III/IV complications, or 30- or 90-day mortality rates. Oncologic outcomes were conserved, with no significant differences in tumour size, R0 resection rate and lymph node harvest.

In selected patients, MILR is safe and feasible for minor and major hepatic resections, with comparable surgical and oncologic outcomes to OLR.

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Current practices of liver-related surgery in Canada: a survey. ***J. Truong, D. Cyr, S.P. Cleary, J. Lam-McCulloch, P. Karanicolas.*** **From Western University, London, Ont., the University of Toronto, Toronto, Ont., the University Health Network, Toronto, Ont., Sunnybrook Health Sciences Centre, Toronto, Ont.**

This survey aimed to assess current Canadian practice patterns for the surgical treatment of malignancies of the liver.

We created a web-based survey (using SurveyMonkey) focusing on scope of surgical practice, pre- and postoperative measures and practice patterns for liver and biliary surgery. We piloted the survey for clarity among 3 surgeons and made changes as needed. All members of the Canadian Hepato-Pancreatico-Biliary Association were invited to participate. Descriptive statistics were used to analyze the results.

The survey was sent to 69 surgeons and 36 (52%) completed the survey in its entirety. Preoperative chemotherapy before liver resection was preferred by the majority of surgeons (59.4%). Most surgeons defined resectability of metastases based on adequate remnant liver volume (100%), ability to achieve R0 resection (91.4%) and absence of extrahepatic disease (62.9%). Use of blood conservation strategies was variable, including low central venous pressure anesthesia (100%), autologous blood donation (18.1%), acute normovolemic hemodilution (47.0%), cell-saver (33.3%) and tranexamic acid (29.0%) used selectively by surgeons. Postoperative analgesic technique was also variable with epidural analgesia (50%) and intravenous patient-controlled analgesia (35.3%) nearly equally preferred.

There is variability in the techniques and approaches used by hepatobiliary surgeons across Canada. Future research focusing on these areas of apparent uncertainty would be valuable.

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Implementing an evidence-based clinical pathway for patients undergoing pancreaticoduodenectomy: outcomes of a pilot project. ***A.C. Wei, K.S. Devitt, M. Ahmed, S. McCluskey, S.S.J. Ladak, B. Barretto, A. Kacikanis, J. De Romkana, S. Gallinger.*** **From the Division of General Surgery, University Health Network, Toronto, Ont., the Division of Anesthesia, University Health Network, University of Toronto, Toronto, Ont.**

Pancreaticoduodenectomy (PD) is complex surgery that requires specialized expertise to perform. Perioperative care of these patients remains highly variable. Clinical pathways (CPW) are quality improvement tools that improve quality of care by standardizing the processes of care. They also facilitate early identification of complications that are identified by failure to meet CPW targets. We implemented an evidence-based CPW for PD and report the outcomes of this pilot project.

An evidence-based CPW was implemented at a high volume hepato-pancreato-biliary (HPB) centre over a 3-month period. Consecutive patients who underwent PD were included. A multidisciplinary CPW was implemented using a targeted strategy that included a needs assessment, production of a CPW tailored to local needs and staff education sessions. At the end of the pilot period CPWs compliance and ability to of patients to achieve prespecified CPW targets was assessed. Demographic, surgical, process measures and length of stay (LOS) data were recorded. A staff satisfaction survey was used to measure CPW acceptability and impact on end users.

Clinical pathways was initiated in 15 of 17 patients. Evidence of CPW use was not documented in 2 of 17. Five patients were compliant to all CPW targets. Ten of 17 patients were unable to meet CPW targets; 2 patients were taken off CPW by physician order and 8 of 10 CPW was discontinued for unknown reasons. The majority of patients unable to meet CPW targets had complications that resulted in deviation from routine care. Patients adherent to CPW had a significantly shorter LOS than patients who were unable to unable to meet CPW goals LOS 6 days (6–7) versus 14 day (7–33; p = 0.031).

We have successfully implemented a CPW for PD. The CPW has a positive impact on LOS and is able to discriminate between patients whose perioperative course deviates from expected. These results will be used to develop an implementation strategy to introduce CPW for PD at other centres throughout Canada.

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Clinical factors associated with perioperative mortality after pancreaticoduodenectomy: a decade in review at a high-volume tertiary care hepatobiliary centre. ***P.E. Serrano, K. Leung, S.P. Cleary, P. Kim, P.D. Greig, I. McGilvray, M. Cattral, B. Langer, D.R. Grant, C.-A. Moulton, S. Gallinger, A.C. Wei.*** **From the University of Toronto, Toronto, Ont.**

To evaluate the 90-day/in-hospital morbidity and mortality after pancreaticoduodenectomy (PD) and to determine which complications are associated with perioperative mortality.

This is a retrospective cohort study of patients who underwent PD from 2000 to 2010 at a high-volume tertiary care hepatobiliary centre. Clinical, demographic, pathological and operative factors after PD were evaluated. Multivariate analyses were performed to determine factors associated with perioperative morbidity and mortality.

There were 635 patients undergoing PD with a median age of 63 years (17–84), 41% of which were female. Median length of hospital stay was 10 (4–332) days. The most common indication for PD was pancreatic adenocarcinoma (258 of 635, 40.7%). Median estimated blood loss was 700 (500–6500) mL and median operating room (OR) time was 432 (274–830) minutes. Overall perioperative morbidity was 44% (278 of 635) and the major complication (Clavien–Dindo ≥ class 3) rate was 17.5% (109 of 635). The most common complications were pancreatic leak, 12% (77 of 635); intra-abdominal abscesses, 14.3% (88 of 635); wound infection, 11% (67 of 635); and delayed gastric emptying, 8.4% (52 of 635). The reoperation rate was 3.4% (21 of 635). The 90-day/in-hospital mortality was 1.4% (9 of 635). After multivariate analysis, factors associated with perioperative mortality were pancreatic leak (p = 0.01), pneumonia (p = 0.03) and prolonged OR time (p = 0.002). In patients with pancreatic cancer, long-term survival was not affected by perioperative morbidity (22 mo v. 23 mo, p = 0.5) or major complications (17.5 mo v. 23 mo, p = 0.19).

Rates of overall and major complications after PD for benign and malignant diseases are high. In contrast, a very low 90-day/in-hospital mortality rate can be achieved in this patient population. Early recognition of major complications might be key to reduce mortality after PD.

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Population-based study of pancreatic cancer referral rates and outcomes in Nova Scotia. ***S. Hurton, G. Porter, R. Urquhart, C. Kendell, M. Jorgenson, M. Cox, M. Molinari.*** **From the Dalhousie University, Halifax, NS, Cancer Outcomes Research Program, Cancer Care Nova Scotia, Halifax, NS**

Pancreatic cancer (PC) is a common gastrointestinal malignancy and there are limited population-based studies examining the quality of treatment and its impact on survival and resource utilization. In related literature, patients with PC are subject to low referral rates for both surgical resection and chemotherapy. The primary aim of this study was to analyze the treatment patterns and overall outcomes of patients diagnosed with PC over a period of 10 years. We hypothesized that PC patients in Nova Scotia were not receiving an appropriate quality of care.

A retrospective population-based cohort study was performed by including all patients identified with PC in Nova Scotia between Jan. 1, 2001, and Dec. 31, 2011. Identification of the cohort was obtained through the Nova Scotia Cancer Registry and subsequently linked with administrative databases for demographic, oncology assessment and survival data. As a marker of quality of care, the referral rate for adjuvant and palliative chemotherapy was assessed.

A total of 1161 patients were included. Median age at the time of diagnosis was 72.5 years (SD 11.9). Among 279 patients (24.0%) who presented with locoregional disease, 165 (14.2%) underwent surgical resection with curative intent. Palliative surgery was performed on 246 (25.2%) patients. Of those who were resected with curative intent, 98 patients (60.1%) were referred to medical oncology, whereas among patients who did not undergo resection, 361 patients (37.4%) were referred for palliative chemotherapy. The all-cause 1- and 5-year survival were 58.9% and 17.6% for resected patients, and 10.3% and 1.5% for unresected patients.

Preliminary administrative data shows resection rates and overall survival of PC patients in Nova Scotia are comparable to outcomes reported in the current scientific literature, despite their limited access to adjuvant therapies. The rationale and clinical implications of these findings are currently under further investigation.

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Multispecialty liver tumour rounds (LTR) facilitate access to treatment pathways at domain expert consensus (DEC) point of care. ***A.K. Buczkowski, M.S. Bleszynski, S.W. Chung, C.H. Scudamore, Z. Erb, A. Harris, D. Liu, D. Klass, S. Ho.*** **From the Department of Surgery, Division of HPB and Liver Transplantation, Division of Hepatology, Department of Radiology, Interventional Radiology, Vancouver General Hospital, BC Cancer Agency, University of British Columbia, Vancouver, BC**

Multiple modalities available for treatment of liver cancer have increased both the complexity of diagnostic process and the time required to identify the optimal choice of modality matching patients' cancer stage. Multidisciplinary rounds aim to balance this. British Columbia provincial expert group functions as liver tumour rounds (LTR) meeting once a week for 1 to 2 hours, consisting of 3 hepato-pancreato-biliary (HPB) surgeons, 1 hepatologist, 4 interventional radiologists, 2 radiation oncologists and 4 GI oncologists representing experts in the province. Patients are presented and treatment selection is based on consensus discussion.

Review of prospectively collected data was based on the quality improvement gaging workload, patient demographics and consistency of decision to treat. The British Columbia LTR panel reviewed 810 cases during 46 sessions in 2012. Patients included first review of 43.2% cases, follow-up review in 20.4%, recurrent or more than 2 follow-up reviews in 46.4% cases. Referrals to LTR were introduced by HPB surgeons in 50.3% cases, 31.4% by hepatologists, 8.4% by British Columbia Cancer Agency (BCCA) oncologists and 6.4% by liver transplant program. Suggestion to treat was based on CT scan in 69.3%, MRI scan in 25.1% with the remainder requiring ultrasonography or combined imaging. Most of imaging was done at Vancouver General Hospital (42%) and at BCCA (11.2%). Hepatocellular carcinoma presented in 52.1% patients with chronic viral liver disease, in 11% cases without risk factors and in 4.2% with alcoholic cirrhosis. Colorectal metastases were in 17.5% cases. Most utilized treatment was transcatheter arterial chemoembolization (175 cases), followed by radiofrequency ablation (145 cases), resection (86 cases), chemotherapy (48 cases) and stereotactic body radiation therapy (19 cases). Repeat imaging was requested in 151 cases. In 46 cases, disease was considered outside treatment options.

The data indicates a growing role of domain expert consensus approach in the care of liver cancer patients. It streamlines the

diagnostic process, provides guidance to long-term care, improves clinical efficiency and changes the functional roles of medical and surgical specialists.

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Intraoperative ultrasound during resection of colorectal liver metastases: impact on surgical strategy, negative resection margins and perioperative blood loss. ***S. Knowles, K.P. Croome, R. Hernandez-Alejandro.*** **From the Division of General Surgery, Western University, London, Ont.**

Liver resections with negative margins improve survival in patients with colorectal liver metastases (CRLM). In a recent study, 5-year survival was up to 63% when R0 resection was achieved, compared to less than 28% with positive margins. Intraoperative ultrasound (IOUS) is a valuable tool during liver surgery. We hypothesize that the use of IOUS can 1) detect additional lesions and change surgical strategy to ensure complete resection which subsequently improves disease free survival and 2) minimize blood loss by visualizing the tumour in relation to adjacent vascular structures.

A retrospective chart review of patients who underwent a liver resection for CRLM from March 2009 to December 2012 was performed in order to determine the impact of IOUS.

A total of 103 patients had a hepatic resection for CRLM. An IOUS was performed in 72 cases and no IOUS in 31 cases. Surgical strategy changed in 30 (41.7%) of the cases with IOUS, compared to only 1 (9.7%) with no IOUS ($p < 0.001$). The most common reason for change in surgical strategy was detecting a different number of lesions as compared to preoperative imaging, which occurred in 21 (29.2%) of cases. Intraoperative blood loss was about 616.9 mL ± 676.6 mL in the IOUS group, compared with 355.5 mL ± 289.8 mL in the no IOUS group ($p = 0.041$). Achieving a negative resection margin was comparable between the 2 groups: 59 (86%) with IOUS and 26 (87%) with no IOUS ($p = 0.88$). However, there was a trend toward improved disease free survival in the IOUS group.

This study demonstrates the value of IOUS in detecting a different number of lesions or giving new information about these lesions that ultimately changes the operative plan. The improved disease-free survival is likely due to the ability of the IOUS to assist in identifying and removing all viable tumours. A higher proportion of parenchymal preserving (nonanatomic) liver resections were performed in the IOUS group, which may account at least in part for the higher blood loss observed.

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Using oncolytic virus therapy against colonic dysplagia. ***F.A. Angarita, H. El-Zimaity, S. Zerhouni, K. Ottolino-Perry, N. Tang, S.A. Acuna, J.A. McCart.*** **From the Division of Experimental Therapeutics, Toronto General Research Institute, University Health Network, the Institute of Medical Science, University of Toronto, the Division of Pathology, Toronto General Hospital, University Health Network, the Division of General Surgery, Department of Surgery, Mount Sinai Hospital and University of Toronto, Toronto, Ont.**

Colorectal cancer screening targets adenomatous polyps because they harbour dysplasia, a precursor of adenocarcinoma. Noninvasive therapies are needed for polyps not amenable to standard treatment. Oncolytic virotherapy uses attenuated viruses that selectively kill tumours. The histopathological and molecular features that facilitate oncolytic vaccinia virus (VV) infection of tumours are also present in colonic dysplasia; therefore, we hypothesize that VV will kill dysplastic cells in a similar manner.

Colorectal carcinogenesis was induced in mice with a single intraperitoneal (IP) injection of azoxymethane, followed a week later by a 7-day course of dextran sodium sulfate in drinking water. When polyps developed, mice received IP or intracolonic (IC) 109 plaque forming units (pfu) of vvDD-RFP, a VV deleted of its thymidine kinase and vaccinia growth factor gene and expressing a red fluorescent protein (RFP), or control. Infection was assessed by fluorescent microscopy, histological assessment of paired slides stained with hematoxylin and eosin or anti-VV antibody, and viral titres. Efficacy was evaluated by comparing the surface area of dysplasia and time-to-sacrifice between groups.

Viral RFP signal appeared at 24 hours postvirus infection (pvi), peaking at 72 hours (IC) and 120 hours (IP) pvi. vvDD infected high-grade (HGD) more than low-grade dysplasia (LGD) at 120 hours pvi (IC: 14.4% ± 4.5% v. 5.5% ± 4.2% and IP: 12.9% ± 7.7% v. 2.0% ± 2.9%, both $p < 0.01$). Normal mucosa was insignificantly infected (< 0.01 ± 0.02%). Viral titres peaked earlier and higher with IC (72 h pvi, 2.7×107 pfu/mm^2) than IP (120 h pvi, 3.9×106 pfu/mm^2) delivery. Intracolonic vvDD–treated mice had less dysplasia than mock-treated (43.8% ± 1.2% v. 53.7% ± 6.7%, $p < 0.01$), which prolonged survival (median: 102 v. 56 days, $p < 0.01$).

vvDD specifically infects and replicates in dysplastic colon mucosa, leading to prolonged survival in mice. These results suggest that oncolytic virotherapy may have a role in the treatment of precancerous lesions.

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Practice patterns in the management of patients with thyroid cancer in Ontario Canada 2000–2008. ***S. Hall, J. Irish, P. Groome, D.R. Urbach.*** **From the University of Health Network, Toronto, Ont., the Division of Cancer Care & Epidemiology, Queen's Cancer Research Institute, Kingston, Ont.**

To describe the patients and the patterns of practice including the investigations, the extent of surgery and the use of radioactive iodine-131 (RAI 131), for all patients with thyroid cancer (TC) treated Jan. 1, 2000, to December 2008 across Ontario, Canada.

Population-based study of all patients who had a therapeutic surgical procedure for TC based on the Institute for Clinical Evaluative Sciences data holdings linking the Ontario Cancer Registry (diagnosis, demographics) to the Ontario Health Insurance Plan (dates of surgery, diagnostic radiology, radioactive iodine, fine needle aspirate biopsy) and to the Canadian Institutes of Health Information (dates of hospital procedures and inpatient radioactive iodine). The analysis will include all patients as well as comparisons between health care utilization/geographic regions (LHINs) and treating specialties.

The caseload increased 112% over the 9 years, creating a final study population of 12 957 patients. Seventy-nine percent of patients had fine needle aspiration. Initial (index) surgery was less than total thyroidectomy in 37.6%. A total of 63.4% of the patients who had total thyroidectomy as an index surgery went on to adjuvant radioactive iodine therapy. However there was enormous variation in all aspects of patient care across the province, between LHINs, between the LHINs of the Toronto region versus the rest of the province and between surgical specialties.

In Ontario, there is no agreement on most aspects of the management of TC and, as TC is increasing at epidemic rates in females, these data provide a foundation for the urgently needed processes toward consensus as well as future research.

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Surgical stress attenuates pre-existing antitumour immunity resulting in postoperative metastases and local recurrence in a murine model. ***A.A. Ananth, L.-H. Tai, K.A. Parato, C. Tanese de Souza, J. Pol, B. Bridle, D.F. Stojdl, H.L. Atkins, B.D. Lichty, J.C. Bell, R.A. Auer.*** **From the Department of Biochemistry, Microbiology and Immunology, University of Ottawa, Ottawa, Ont., the Centre for Innovative Cancer Research, Ottawa Hospital Research Institute, Ottawa, Ont., the Department of Pathology and Molecular Medicine, Centre for Gene Therapeutics, McMaster University, Hamilton, Ont., the Department of Pathobiology, Pathobiology Animal Health Laboratory, University of Guelph, Guelph, Ont., the Apoptosis Research Centre, Children's Hospital of Eastern Ontario, Ottawa, Ont., the Department of Medicine, Division of**

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Surgical resection is essential in the treatment of solid malignancies, but surgical stress has been shown to promote the formation of metastases. Most studies focus on surgery-induced impairment of innate immunity, but its impact on adaptive immunity is poorly understood. In the present study, we demonstrate that surgical stress abrogates pre-existing antitumour CD8+ T-cell immunity promotes metastases and local recurrence and significantly decreases survival.

To generate antitumour immunity, C57/B6 mice were immunized with an adenovirus expressing human dopachrome tautomerase (AdhDCT), a melanoma-associated antigen. Surgical stress was induced by left abdominal nephrectomy. In our prophylactic model, mice were immunized on day zero and B16F10lacZ melanoma cells were injected intravenously (IV) or subcutaneously (SQ) prior to surgery on day 7. In our therapeutic model, B16F10wt cells were injected SQ on day zero, immunized on day 7 with AdhDCT, and underwent tumour resection with residual positive margin and nephrectomy on day 14.

In the IV-B16 model, AdhDCT conferred protection against lung metastases (3-fold decrease compared to phosphate buffered saline, $p < 0.05$) which was ablated by surgery (5-fold increase compared to AdhDCT, $p < 0.01$). In the SQ-B16 model, surgery reduced survival compared to nonsurgically stressed mice, who were all cured of their tumours with AdhDCT ($p < 0.001$). Surgery also decreased the proportion of spleen DCT-specific IFN-gamma+ CD8+ T cells by over 2-fold ($p < 0.001$). In the therapeutic vaccine model, AdhDCT-immunized mice undergoing resection with residual positive margin and nephrectomy had decreased survival (16.5 d) compared to mice which underwent resection alone (30 d, $p < 0.001$).

Our results demonstrate that surgical stress ablates tumour antigen-specific CD8+ T-cell immunity, indicating that perioperative immune stimulants may be an effective strategy against surgery-induced immune suppression and subsequent tumour recurrence and metastases.

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Combination of gastrectomy, radiation and chemotherapy improves survival for metastatic gastric cancer: results of a population-based study. ***M. Dixon, A.L. Mahar, L.K. Helyer, J. Vasilevska-Ristovska, C.H. Law.*** **From the Department of Surgery, Maimonides Medical Centre, Toronto, Ont., the Department of Community Health and Epidemiology, Queen's University, Kingston, Ont., the Department of Surgery, Dalhousie University, Halifax, NS, the Sunnybrook Research Institute, Toronto, Ont., the Odette Cancer Centre, Sunnybrook Health Sciences Centre, Toronto, Ont.**

Metastatic gastric cancer (GC) is highly fatal. The purpose of this study was to describe and compare survival across combinations of treatment strategies and to examine the effect of specialist volume on survival.

A population-based retrospective cohort study of M1 GC in Ontario between Apr. 1, 2005, and Mar. 31, 2008, was performed. Treatment strategies were defined as 1) no treatment/radiation, 2) chemotherapy, 3) chemotherapy and radiation, 4) surgery alone, 5) surgery plus chemotherapy or radiation and 6) all treatments. Survival analysis was performed using Kaplan–Meier methodology and the log-rank test. Multivariate analysis (MVA) was performed using Cox proportional hazard regression.

A total of 1433 M1 patients were included. On MVA, increasing age, male sex, increasing number of metastatic sites, and carcinomatosis and/or ascites were associated with worse prognosis. Significant variation existed by tumour location and geographic region. Thirty-seven percent of patients received no treatment or radiotherapy alone; 10% of patients were treated with all 3 modalities and had median survival of 23.7 months (95% CI 19.7–30.2). Following adjustment for other independent predictors of survival, receiving a gastrectomy and both chemotherapy and radiation was associated with an 80% reduction in the rate of death (HR 0.20, 95% CI 0.15–0.25). Receipt of care from a high-volume specialist was associated with a 15% reduction in rate of death (HR 0.85, 95% CI 0.75–0.98).

In a subset of patients, receipt of surgery, chemotherapy and radiation was associated with markedly better survival. Significant selection bias likely exists. Further studies should attempt to define which patients may benefit from aggressive treatment strategies.

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Do visible lymph nodes on preoperative staging abdominal CT scans predict metastatic nodal disease in patients undergoing colonic resection for colon cancer? ***A.R. Lehr, J.-F. Latulippe, M. Poirier, Y. Bendavid, F. Heyen, M. Henri.*** **From the Department of Surgery, University of Montréal, Montréal, Que.**

In patients with rectal cancer, radiological findings will determine the need for neoadjuvant chemoradiation for patients with locally advanced tumours. In patients with locally advanced colon cancer, the advantage of neoadjuvant treatment remains unclear. Can we rely on preoperative abdominal CT scan for lymph node staging in these patients?

Radiology reports, surgery reports and pathology reports of all patients who underwent surgery for colon cancer in our tertiary care centre between January 2009 and December 2011 were reviewed. Those who had concomitant hyperthermic intraperitoneal chemotherapy for peritoneal carcinomatosis, or received chemotherapy prior to surgery were excluded. We analysed radiological reports of preoperative abdominal CT scans for absence of visible mesenteric lymph nodes or presence of lymph nodes of more (radiologically significant) or less (radiologically nonsignificant) than 10 mm in size, and compared them to the pathological analyses of surgical specimens.

Two hundred and twenty-seven colon resections were included. The median lymph nodes per specimen was 15. Pathology examination revealed 84 with lymph node metastases. Of these, 36 (42%), and 20 (24%) had CT scans with under 10 mm lymph nodes, and no visible lymph nodes, respectively. Moreover, 48% of patients with nodes greater than 10 mm and 60% of patients with nodes less than 10 mm had pathologically negative nodes. The positive predictive value, negative predictive value, sensitivity and specificity of lymph nodes greater than 10 mm were 52.9%, 67.2%, 32.1% and 82.9%, respectively. If nodes less than 10 mm

were taken into account, the statistics changed to 44%, 75%, 75% and 68%, respectively.

Preoperative staging CT scan has poor value in predicting lymph node disease in patients undergoing colonic resection for colon cancer.

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An Internet-based 2-step multidisciplinary conference (MDC) for rectal cancer greatly influences surgeon treatment plans. ***V. Francescutti, A. Coates, M. Cadeddu, S. Forbes, V. Grubac, S. Kelly, W.J. Stephen, S. Tsai, M. Simunovic.*** **From the Department of Surgery, McMaster University, the Department of Radiology, McMaster University, Hamilton, Ont.**

In most jurisdictions, resource and geographic constraints are barriers to the prospective discussion of every rectal cancer case in an multidisciplinary conference (MDC) setting. We piloted a 2-step MDC in rectal cancer to overcome these barriers in Local Health Integration Network 4 (LHIN4; population 1.3 million).

Surgeons working at any of the 10 hospitals in LHIN4 were invited to participate. For step 1, surgeons completed a 1-page form, indicating if the surgical plan included preoperative radiation, if the plan was straight to surgery or if the plan was uncertain. Forms also included relevant clinical details (e.g., evidence of tumour fixation). Over a secure Internet link with audio and visual capability, relevant imaging (CT or MRI scans) and case details were reviewed by the referring surgeon and a 2-step MDC surgeon. Following review, surgical plans could change or remain the same. Major changes were defined as recommendations that redirected patients to preoperative radiation, away from preoperative radiation (straight to surgery) or to concurrent review by a surgeon and radiation oncologist at the regional cancer centre. Minor changes were defined as changes in the type of neoadjuvant therapy or requests for additional tests (pelvic MRI or PET scans). Step 2 was the potential execution of step 1 recommendations.

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Treatment plan	*n* = 57	Straight to surgery	Radiation therapy	Refer to regional cancer centre	More investigations
No change	27	Dec 27	15/27	0/27	0/27
Change	30	Dec 30	May 30	May 30	Aug 30

From September 2011 to February 2013, 20 surgeons (7 academic and 13 community) prospectively reviewed 57 rectal cancer cases. Prior to review the percentage of surgical plans that were preoperative radiation, straight to surgery or uncertain were 42%, 35% and 23%, respectively. Following step 1 reviews, there were 21 major (37%) and 9 minor (16%) changes to surgical plans, with details provided below. In a large geographic region an Internet-based 2-step MDC for rectal cancer was feasible and influenced surgeon treatment plans in 53% of cases.

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Diagnosis of venous thromboembolism postdischarge for major abdominal and pelvic oncologic surgery: implications for a change in practice. ***H. AlSubaie, A. McKay.*** **From the University of Manitoba, Winnipeg, Man.**

Venous thromboembolism (VTE) prophylaxis continuing after hospital discharge following cancer surgery has been shown to reduce the incidence of VTE; however, there remain unanswered questions and this practice has not been universally adopted. The purpose of this study was to determine the proportion of patients diagnosed with symptomatic VTE within 90 days after hospital discharge. If this number is significant, it could support the argument to adopt extended VTE prophylaxis.

All patients who underwent major abdomino-pelvic cancer surgery in Manitoba between 2004 and 2009 were identified from the Manitoba Cancer Registry. The proportion of patients diagnosed with VTE during their initial hospital stay was identified by accessing the hospital separations abstracts. The proportion of patients diagnosed with VTE after hospital discharge was determined by examining repeat admissions within 90 days and by accessing Drug Programs Information Network records for newly prescribed anticoagulants. Detailed tumour and treatment-specific data allowed calculation of predictors of VTE in these patients.

A total of 6906 patients were included. Of these patients, 1.55% (107 patients) had VTE diagnosed during the initial stay and 1.43% (99 patients) presented after discharge with VTE. Of these patients who developed deep vein thrombosis (DVT) after discharge, 51% had a pulmonary embolism, 38% had a DVT and 11% had both. Predictors of developing VTE within 90 days of discharge following surgery included advanced stage of disease, the presence of other complications, increased hospital resource utilization, primary tumours of noncolorectal gastrointestinal origin and age younger than 45. The development of VTE was an independent predictor of decreased 5-year overall survival.

The cumulative incidence of VTE within 90 days of major abdominal/pelvic oncologic surgery is 2.98%. A total of 1.43% of patients were diagnosed with VTE after initial hospital discharge. Presumably, these are patients might have benefited most from extended thromboprophylaxis and this should be considered for such patients.

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Pathological and psychosocial outcomes in patients undergoing prophylactic total gastrectomy for hereditary diffuse gastric cancer syndrome. ***J. Muir, M. Aronson, M.-J. Esplen, A. Pollett, C.J. Swallow.*** **From the Mount Sinai Hospital, the Familial Gastrointestinal Cancer Registry, the Toronto General Research Institute, Toronto, Ont.**

Hereditary diffuse gastric cancer syndrome (HDGC) is caused by mutations in the *CDH1* gene, and carries a lifetime gastric cancer risk of approximately 80%. No effective screening method exists, so adult patients with *CDH1* mutations are offered prophylactic total gastrectomy (PTG).

Pathologic outcomes for Ontario patients undergoing PTG from 2008 to 2013 were collected. Patients enrolled after 2010 completed a preoperative (T1) survey which included standardized measures of quality-of-life, body image, regret, decisional conflict and psychological distress. Similar surveys were administered at 2 to 4 weeks (T2), 6 months (T3), 1 year (T4) and 2 years

postoperatively (T5). Patients declining or deferring surgery completed a modified T1 survey exploring reasons for their choice (T0).

Twelve of 13 patients undergoing surgery had microscopic foci of T1 invasive adenocarcinoma. No patients had lymph node metastases. Thirty-nine surveys were returned from 17 patients (T0 = 4, T1 = 7, T2 = 8, T3 = 6, T4 = 7, T5 = 7). Most global health scores tended to decrease at T2, climb to baseline by T3/T4, then decrease again at T5. There were no patterns for function and symptom subscales. Body image and symptoms of depression/anxiety remained relatively unchanged, and most patients expressed little regret. Patients deferring surgery tended to have greater decisional conflict.

Almost all patients had microscopic cancer foci. Self-reported quality-of-life varied with time following surgery, but few patients regretted their decision to have surgery or experienced negative impacts on body image or psychological status. Qualitative investigation would further elucidate specific issues surrounding decision-making and recovery.

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Cytoreductive surgery for adenocarcinoma of colorectal or appendiceal origin: survival difference between mitomycin C versus oxaliplatin for hyperthermic intraperitoneal chemotherapy. ***J.Y. Lam, Y.J. McConnell, L.A. Mack, W.J. Temple.*** **From the University of Calgary, Calgary, Alta.**

Peritoneal carcinomatosis can arise from colorectal or high-grade appendiceal adenocarcinoma and, historically, had a dismal prognosis. With systemic chemotherapy (SC) and cytoreductive surgery with hyperthermic intraperitoneal chemotherapy (CRS+HIPEC), survival has improved. Debate remains regarding the optimal agent for HIPEC–mitomycin C (MMC) or oxaliplatin (Oxali). At the University of Calgary these HIPEC agents have been used in sequential prospectively collected cohorts. Here we compare their overall and recurrence-free survival (OS and RFS).

From 2001 to 2011, 93 patients with either colorectal (n = 69) or high-grade appendiceal (n = 24) adenocarcinoma were treated with CRS+HIPEC using either MMC (n = 37) or Oxali (n = 56). Median follow-up was 27 months. Demographic and clinical parameters were extracted from an existing database. Overall survival and RFS were analyzed using Kaplan–Meier curves and log-rank testing. Cox proportional hazards modelling was used for multivariate analysis.

In both HIPEC groups, patients had a median age of 55 years and 46% were female. There were no differences in lymph node involvement (77.4% v. 64.3%, p = 0.15), peritoneal cancer index (PCI; median 14 for both, p = 0.6) or postoperative SC (40.0% v. 53.5%, p = 0.18). The Oxali group had more preoperative SC (60.7% v. 36.4%, p = 0.02) and the MMC group experienced more grade III/IV complications (43.2% v. 19.6%, p = 0.01). Overall survival and RFS did not differ between HIPEC regimens (p = 0.72 and p = 0.89, respectively). The 1- and 3-year OS and RFS rates were 86% and 50%, and 38% and 21%, respectively for MMC patients. The rates were 91% and 46%, and 57% and 6%, respectively for Oxali patients. On multivariate analysis, only PCI independently predicted OS and RFS.

In this study, OS and RFS did not differ between colorectal and high-grade appendiceal adenocarcinoma patients treated with CRS+HIPEC using MMC versus Oxali. The MMC protocol has a higher complication rate, making Oxali the preferred agent for HIPEC in these patients.

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The video feedback module: a novel approach to teaching the clinical breast exam. ***K. Kulasegaram, N. Woods, F. Wright, K. Knicke, T. Cil.*** **From the University of Toronto, Toronto, Ont.**

A thorough knowledge of clinical exam skills such as the breast exam is vital for all general surgeons in training and practice. However, the intimate nature of these exams makes it difficult to provide formal training at the undergraduate level due to student anxiety and patient privacy. The purpose of this study is to examine the knowledge, skills and experiences of medical students about the clinical breast exam (CBE). We developed a video feedback module (VFM), which served as a novel learning tool, providing additional exposure to the CBE and expert consensus on best practice.

The VFM was developed based on expert knowledge and skills regarding the CBE. This customized computer program consisting of 3 videotaped CBE vignettes illustrated average, exemplary, and poor CBEs. Undergraduate medical students at the University of Toronto participating in the study viewed each of the vignettes and provided a critique of each scenario. Participant responses were scored on a 7-point Likert scale by expert raters. A mixed-methods survey to evaluate student experiences with clinical exam skills was also administered.

Scores were collected from 29 participants. Participants' performance improved from the first video (mean [SD] of 3.91 [0.98]) to the second and third videos (4.66 [1.1] and 4.54 [0.85], respectively, $F_{2,54}$ = 13.1, p < 0.001). Students performed or observed an average of 2 breast exams in their training. Previous experience observing and performing the breast exam did not correlate with performance.

Learning skills such as the CBE can be variable and inconsistent for many medical students. An innovative approach to this problem includes the development of alternative educational tools outside of the traditional clinical arena. We present a novel learning instrument, the video feedback module, as a method of increasing exposure to and learning of sensitive physical exam skills.

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"Getting my life back": complex abdominal wall hernias as a barrier to quality of life in cancer survivors. ***R. Nenshi, C. Bensimon, F. Wright, A.J. Smith, F. Brenneman.*** **From the University of Toronto, the Sunnybrook Health Sciences Centre, Toronto, Ont.**

Increasingly more cancer patients achieve long-term survival following multimodal, complex therapeutic regimens involving extensive surgery as well as chemoradiotherapy. This has increased the number of cancer survivors living with complex abdominal wall hernias (CAWH). Incisional hernias following surgery are common and can occur in up to 20% of patients. Hernias are known to have significant physical, social and emotional repercussions on patients.

This qualitative study proposes to explore cancer survivors'

experiences before and after the repair of CAWH. Our primary goal is to offer insight into the impact of CAWH on the quality of life of cancer survivors with the view of identifying and addressing gaps in cancer survivorship care.

Data was collected through one-on-one in-depth semistructured interviews. Ten preoperative and 11 postoperative patients were interviewed. Participants met the following inclusion criteria: completed surgery and/or multimodal therapy for cancer; had the presence of a postoperative abdominal wall hernia, were English-speaking and able to provide consent. Analysis of interviews via comparative analysis techniques and coding strategies were used to identify themes.

Participants' views were organized according to the following emerging themes: 1) struggling to find a sense of normalcy post–cancer treatment — life is described as being restricted/interrupted/on hold/hell, 2) feeling abandoned and having few resources or supports to help them manage living with a hernia and 3) experiencing distress, loss of self-confidence, feeling hopeless about their situation and hopeful for their future after successful hernia repair.

Our findings demonstrate the all-encompassing impact of hernias on the life of cancer survivors. This strongly suggests that hernia management should be viewed as a part and parcel of cancer treatment to improve quality of life in cancer survivors.

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Economic evaluations in surgical oncology: a systematic review. ***S. Brar, I. Datta, F.A. Quereshy.*** **From the University of Calgary, Calgary, Alta., the University of Toronto, Toronto, Ont.**

Innovations within oncology have led to improvements in quantity and quality of life, but can be associated with significant costs. Economic evaluations are needed to assess both clinical outcomes and costs of new surgical oncology interventions. The methodological quality of the existing literature in economic evaluations of surgical oncology is unknown.

A systematic review of all economic evaluations involving surgical interventions in oncology between 2005 and 2011 was completed using the Tufts Medical Center Cost-Effectiveness Analysis Registry and the National Health Service Economic Evaluation Database. Quality assessment of studies was completed using a 35-point checklist developed for economic evaluations.

The literature search yielded 47 economic evaluations that were included for analysis. For study design, 23 were cost–utility analyses: 21 cost-effectiveness analyses and 2 cost–benefit analyses. Quality assessment scores ranged from 44–94%. In measuring outcomes, 35% of studies have design and results from a single-study described and 46% described the method of synthesis of multiple studies. Of the cost–utility studies, 83% stated the methods of valuing health states. For costing, methods for the estimation of quantities and unit costs were described in 85% of studies, though only 17% reported quantities and unit costs separately and only 20% included productivity changes. For analysis, the time horizon was stated in 78% of studies and only 50% stated a discount rate for costs and/or benefits. A total of 78% of studies reported a sensitivity analysis along with their economic evaluations.

Economic evaluations in surgical oncology are of variable methodological quality. Improvements in methodology and adherence to established standards are of paramount importance. Further work is necessary to adapt economic evaluations to the assessment of surgical interventions.

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Comparison of survival between patients with peritoneal carcinomatosis from colon and rectal origin treated with cytoreduction and heated intraperitoneal chemotherapy. ***J. Rivard, Y.J. McConnell, W.J. Temple, L.A. Mack.*** **From the University of Calgary, Calgary, Alta.**

Cytoreductive surgery (CRS) and hyperthermic intraperitoneal chemotherapy (HIPEC) are increasingly used to treat peritoneal carcinomatosis from colorectal cancer. One small study has suggested that patients with rectal cancer have a worse prognosis following CRS+HIPEC than those with colon cancer.

Between February 2003 and October 2011, 68 consecutive patients (58 colonic [CA], 10 rectal adenocarcinoma [RA]) who underwent CRS+HIPEC at the University of Calgary were identified from a prospective database. Demographic and clinical factors were compared between CA and RA. Kaplan–Meier survival analysis for overall survival (OS) and recurrence-free survival (RFS) were performed, with log-rank testing of differences between groups.

Age (median 50 yr v. 55 yr, $p = 0.79$), sex (70% male v. 52% male, $p = 0.28$), and peritoneal cancer index (PCI; median, 12 v. 14, $p = 0.68$) were similar between RA and CA patients, respectively. Median follow-up was 24 (range 2–88) months among survivors. Median OS was 33 (range 5–52) versus 30 (range 2–88) months for the RA and CA patients, respectively ($p = 0.14$). Median RFS was 9 (range 4–36) versus 11 (range 22–88) months for the RA and CA patients, respectively ($p = 0.49$). The 3-year OS was 25% versus 50% ($p = 0.21$) and 3-year RFS was 0% versus 7% ($p = 0.74$) for the RA versus CA patients, respectively.

CRS+HIPEC appears to result in similar survival outcomes for rectal and colonic cancer patients. Rectal origin should not be used as an exclusion criteria for CRS+HIPEC based on current data.

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Prognosis and survival of operative breast cancer in Saudi Arabia. ***B. Alabdulkarim, H. Alkarji, H. Alzuhair, D. Alkarji, R. Alruqiae, N. Alruqiae, A. Alsaif, A. Bokhari, M. Hassanain.*** **From the King Saud University, the King Khalid University Hospital, Riyadh, Saudi Arabia**

Breast cancer is the single most commonly diagnosed cancer in Saudi Arabian women. Its incidence, while growing, is still significantly lower than in the United States. There is an ongoing efforts to investigation the potential unique epidemiological characteristics of our population and associated survival rates. In this study we report our data and compare to to those reported in SEER in 2012.

There were 224 operated breast cancer patients at our centre between April 2005 and February 2012. Patients were divided into 2 age groups with a cut-off of 50 years. Data related to patients characteristics, cancer stage, receptor expression and survival were collected. Patients were followed up for 5 years.

One hundred and thirty-nine (61.7%) patients were under

50 years old. Stage II was predominant in both age groups, representing 54.7% and 55.9%, respectively. Estrogen receptor (ER) and progesterone receptor (PR) cases were nonsignificantly higher in the older age group, with 76.8% of ER and 69.5% for PR compared to 62.6% and 56.9%, respectively, for the younger group. No significant differences were found in HER2 receptor expression. ER/PR positivity were significantly correlated were the age of menarche and duration of breast feeding ($p < 0.005$ and < 0.01, respectively). Multivariate analysis was only significant for the duration of breast feeding ($p < 0.006$). Mean oversall survival (OS) and disease-free survival (DFS) were 7.2 and 7.5 years, respectively. Age of the patients had the greatest significance on DFS ($p < 0.001$). Stage I had 100% OS and DFS. Stage IV had the lowest OS and DFS with 75% and 50%, respectively.

Comparing our results, median age was younger (47 yr v. 61 yr) in the US population. A total of 62.7% of our patients were younger than 50 versus 34.2% over 50 years old. Early breast cancer presented only in 9.41% in our under-50 population compared to 60% of the over-50 population. There were no differences in OS and DFS; however, we had a smaller sample size.

There are differences in the epidemiological status of our patients with breast cancer, yet the impact of this difference on survival has yet to be determined.

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Value of positron emission tomography (PET) scan in stage III cutaneous melanoma: a systematic review and meta-analysis. ***H. Alabbas, A.M.R. Rivera, A. Ramjaun, A.N. Meguerditchian.*** **From the McGill University, Montréal, Que.**

The objective of this study was to review the collective experience of fludeoxyglucose positron emission tomography (FDG-PET) scan in the detection of systemic metastases in patients with stage III cutaneous melanoma.

MEDLINE and EMBASE electronic databases were systematically searched for relevant studies published between Jan. 1, 1990, and Nov. 23, 2012. We included English-language studies that evaluated cutaneous melanoma patients with stage III disease, with at least 10 patients per study, and collected statistical data to assess FDG-PET in the detection of distant metastases. SIGN was used to evaluate methodological quality and a meta-analysis was performed using STATA statistical software to quantify the clinical utility of the FDG-PET scan.

The systematic search strategy yielded 9 studies (2 prospective and 7 retrospective) eligible for inclusion in quantitative analyses, with a total of 623 patients. On a 9-point scale, the median quality score was 4 (3–9). The collective mean age of patients across the studies was 56.6 years (16–93). Initial stage was reported T1-4N1-3M0 in 84.8% (528 of 623) and T1-4N1-2M0 in 15.2% (95 of 623) of patients. The overall sensitivity of FDG-PET in detecting systemic metastases was found to be 89.42% (95% CI: 65.07–97.46), and specificity was 88.78% (77.04–94.91). The pooled positive likelihood ratio was 7.97 (3.58–17.71) and the negative likelihood ratio was 0.12 (0.03–0.47). The area under the summary receiver operating curve was 0.94 (0.92–0.96) and the diagnostic odds ratio was 66.84 (10.66–418.89). A change in stage and/or management was noted in 22% (126 of 573) of patients when FDG-PET was utilized.

The findings of this review indicate that FDG-PET may be useful in detecting distant metastases in patients with stage III cutaneous melanoma. For this group of highly selected patients, PET has a high sensitivity, specificity and performance frequently leading to a change in treatment plan.

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The number of lymph nodes retrieved as a quality indicator for axillary and inguinal lymph node dissections for clinically palpable disease in melanoma. ***D. Berger-Richardson, M. Ernjakovic, D.R. McCready, W.L. Leong, M. Reedijk, A.M. Easson.*** **From the University of Toronto, Toronto, Ont.**

Lymph node dissections (LNDs) are the most effective treatment for node positive melanoma. However, there is no consensus on how to measure the quality of a lymph node dissection. A recent Australian study, not yet duplicated, suggested using the number of lymph nodes retrieved as a quality indicator, defined as the number of nodes retrieved (10 axillary, 7 superficial groin and 14 ilioinguinal) for over 90% of the dissections. We wanted to see how we compared.

We performed a retrospective chart review for all patients who had nodal dissections for melanoma for clinically palpable nodes between 2000 and 2010. Fifty-six patients had 60 LNDs.

There were 29 axillary dissections with a mean lymph node retrieval rate (LNRR) of 26.0 nodes (median 24.0, range 9–43). Of the cases, 97% had 10 nodes or more. There were 26 superficial inguinal dissections with a mean LNRR of 13.0 (median 13.5, range 5–21). A total of 88% of cases had 7 nodes or more. Five ilioinguinal dissections had a mean LNRR of 14.0 (median 14.0, range 10–20). Sixty percent of cases had 14 nodes or more. The ratio of positive to total nodes was 19% in the axillary dissections, 21% in the superficial dissections and 49% in the ilioinguinal dissections.

Our lymph node retrieval rate in clinically node positive melanoma is higher in the axilla, but otherwise comparable with previously published data. In order to make a direct comparison, we will expand our study to include patients who had dissections after positive sentinel lymph nodes.

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Oncolytic vaccinia virus and irinotecan synergize to improve treatment of colorectal carcinomatosis. ***K. Ottolino-Perry, N. Tang, S.A. Acuna, F.A. Angarita, S. Zerhouni, J.A. McCart.*** **From the Institute of Medical Science, the Division of Experimental Therapeutics, Toronto General Research Institute, University Health Network, University of Toronto, the Division of General Surgery, Department of Surgery, University of Toronto, Toronto, Ont.**

Colorectal peritoneal carcinomatosis (PC) is an advanced disease with few effective treatment options. A recombinant vaccinia virus (vvDD) specifically kills tumour cells with minimal toxicity to normal cells and significantly improves survival in murine models of PC. The objective of this study is to evaluate chemotherapeutics that, when combined with vvDD, enhance therapeutic efficacy in models of colorectal PC.

vvDD combined with oxaliplatin (OX) or irinotecan (CPT-11) was evaluated in 3 colorectal cancer cell lines and 2 in vivo PC

models. The Chou–Talalay combination index was used to identify synergistic interactions. Plaque assays and flow cytometry were used to evaluate the effect of combination therapy on virus replication and cell cycle regulation, respectively.

OX+vvDD synergistically enhanced cell death in all cell lines. SN38 (CPT-11 active metabolite) and vvDD interacted synergistically in 2/3 cell lines. Combination treatment of mice was well tolerated; no significant weight loss, myelosuppression or hepatotoxicity was observed. In the xenograft model, combination vvDD+CPT-11 increased the median survival and resulted in 33% long-term survival despite decreased virus titers in tumours. In vitro synergy was not mediated by drug enhancement of virus replication. Instead, combination treatment resulted in a significant increase in the proportion of apoptotic cells relative to monotherapy. Furthermore, apoptosis was preferentially increased in uninfected cells following combination treatment. Cell cycle analysis revealed that vvDD treatment increased the proportion of s-phase cells in both the infected and uninfected populations. Given that CPT-11 is only effective s-phase cells, the increase in uninfected s-phase cells may account for the synergy between these treatments. Synergistic interactions between vvDD and CPT-11 may improve treatment outcomes and allow for CPT-11 dose reductions that could minimize dose-limiting toxicities.

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Oncolytic vaccinia virus as an adjuvant treatment to cytoreductive surgery for malignant peritoneal mesothelioma. ***S.A. Acuna, K. Ottolino-Perry, B. Çako, N. Tang, F.A. Angarita, J.A. McCart.*** **From the Division of Experimental Therapeutics, Toronto General Research Institute, University Health Network, Toronto, Ont., the Institute of Medical Science, University of Toronto, Toronto, Ont., the Division of General Surgery, Department of Surgery, University of Toronto, Toronto, Ont., the Division of General Surgery, Department of Surgery, Mount Sinai Hospital, Toronto, Ont.**

Malignant peritoneal mesothelioma (MPM) is an aggressive cancer with a dismal prognosis. Survival with current treatment options is limited. The focus of this study is to develop a novel approach to MPM using a combination of surgery and virotherapy. Oncolytic viruses are a promising therapy for cancer because of their ability to kill tumour cells with minimal toxicity to normal tissues. Here we examined the potential of modified vaccinia virus (VV) to treat MPM when administered alone or as an adjuvant treatment to surgery. Two aggressive murine mesothelioma cell lines (AC29, AB12), and normal fibroblasts (3T3) were used to study the effects of VV. Cytopathic effect, replication and selectivity were tested in vitro. Immunocompetent mice were injected intraperitoneally (i.p.) with murine MPM cells and treated with i.p. VV at 2 different time points: day 3 (microscopic disease) and day 10 (macroscopic disease). Tumour-bearing mice also underwent surgical debulking and/or were administered i.p. VV. The cytopathic effect of VV on MPM cell lines was significantly increased compared to control (viability: 10.5% and 26.1% v. 73.3%). Selective infection was confirmed by fluorescence imaging. When treated at advance stages of the disease, VV induced tumour regression in mice, prolonging median (+9 days) and long-term survival (33.3%). VV as adjuvant treatment to surgery was not superior to VV alone, likely due to the inability to completely remove macroscopic disease. When mice with microscopic disease were treated, VV prolonged median survival (+10 d) and long term survival (50%). We conclude that VV selectively kills MPM cells in vitro and in vivo, leading to improved survival and cures in immunocompetent murine models. Higher efficacy of the virus in the microscopic disease context warrants consideration of the use of the virus as an adjuvant treatment and further clinical development.

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Prognostic significance of symptoms in patients with metastatic gastric cancer: Do type or number of symptoms at presentations predict survival? ***A.L. Mahar, M. Dixon, J. Vasilevska-Ristovska, C.H. Law, L.K. Helyer, R. Viola, N.G. Coburn.*** **From the Department of Community Health & Epidemiology, Queen's University, Kingston, Ont., the Department of Surgery, Maimonides Medical Center, Brooklyn, New York, the Sunnybrook Research Institute, Sunnybrook Health Sciences Centre, Toronto, Ont., the Odette Cancer Centre, Sunnybrook Health Sciences Centre, Toronto, Ont., the Department of Surgery, Dalhousie University, Halifax, NS, the Palliative Care Medicine Program, Queen's University, Kingston, Ont.**

The majority of patients with gastric cancer in North America and Europe are diagnosed with metastatic disease. Little work has been done to understand the prognostic significance of symptoms in this patient population.

A population-based retrospective cohort study of American Joint Committee on Cancer metastatic (M1) stage IV gastric cancer (GC) in Ontario between Apr. 1, 2005, and Mar. 31, 2008, was performed. Signs and symptoms were collected three months prior to the date of first operation or the date of diagnosis if surgery did not occur and categorized into the following: asymptomatic, malnutrition, major obstruction, minor obstruction, pain, fatigue, nonspecific, bleeding, and signs of advanced disease. Survival analysis was performed using Kaplan–Meier and log-rank tests and multivariate analysis performed using Cox proportional hazard regression.

A total of 1433 patients were included. Less than 1% of patients were asymptomatic; the most common symptoms recorded were malnutrition (65%), pain (60%) and bleeding (58%). The majority of patients had between 2 and 4 categories of symptoms recorded. After adjustment for numerous covariates, the presence of any category of symptoms except for bleeding and minor obstruction was significantly associated with worse prognosis. The strongest predictor of increased rate of death was the presence of 5 or more symptom categories (HR 2.24; 95% CI 1.78–2.82), followed by pain (HR 1.48; 95% CI 1.32–1.67) and signs of advanced disease (HR 1.46; 95% CI 1.23–1.66).

Metastatic GC patients experience multiple symptoms, and most symptom categories and increased symptom burden portend worse prognosis. Future research must address how treatment impacts not only survival in these patients, but symptom relief to best guide clinical management.

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Taking control of cancer: why women are choosing mastectomy. ***A.M. Covelli, N. Baxter, M. Fitch, F. Wright.*** **From**

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Rates of both unilateral (UM) and contralateral prophylactic mastectomy (CPM) for early stage breast cancer have been increasing since 2003. Studies suggest that this is due to women playing a more active role in their decision-making; however, they do not describe why women are choosing this option.

We conducted a qualitative study using grounded theory to identify factors influential in women's choice for mastectomy. Purposive sampling was used to identify women across the Greater Toronto Area (Ontario, Canada), who were suitable candidates for breast conserving surgery (BCS) but underwent UM or CPM. Data were collected through semistructured interviews. Constant comparative analysis identified key ideas and themes.

Data saturation was achieved after 29 in-person interviews. Twelve interviewees were treated at academic cancer centres, 6 at an academic non–cancer centre and 11 at community centres. Fifteen women underwent UM; 14 underwent CPM. Median age was 55 years.

"Taking control of cancer" was the dominant theme that emerged. There were 7 subthemes: 1) the diagnosis of cancer was received with shock and fear, 2) during surgical discussion both BCS and UM were discussed and CPM was discouraged by the surgeon, 3) women misperceived risk, misunderstanding recurrence and survival rates, 4) women's choice for UM was due to fear of recurrence and/or radiation, 5) women's choice for CPM was due to fear of recurrence, "never wanting to do this again" and/or need for cosmetic balance, 6) sources of information varied in importance and previous cancer experience had the greatest impact and 7) women were actively controlling outcomes and more surgery was seen as greater control.

Women seeking UM and CPM for treatment of their early stage breast cancer manage their fear of recurrence and "never wanting to go through this again" by undergoing more extensive surgery. The patient's effort to control the cancer outcome is the driving factor behind women choosing mastectomy.

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Assessment of a Canadian breast cancer centre against European and American quality standards. ***J.-S. Pao, U. Kuusk, A. Cheema, C. Dingee, E. McKevitt.*** **From the Mount Saint Joseph Hospital, Vancouver, BC**

European Society of Breast Cancer Specialists (EUSOMA) and American College of Surgeons National Accreditation Program for Breast Centres (ACS-NAPBC) have published standards for breast centres and quality indicators that should be monitored in a breast program. Currently there are no published Canadian standards. We hypothesize that our Canadian centre should meet EUSOMA and ACS-NAPBC standards.

A prospective database was developed for all breast cancer cases seen at our centre. Published EUSOMA and ACS-NAPBC breast cancer quality indicators were calculated using both prospective surgeon data and hospital/provincial administrative data.

Surgeon data showed that 1130 breast surgery cases were performed at our centre in 2012 by 4 breast surgeons. Of these surgery cases, 704 were for malignancy. Ninety-six percent of patients had a preoperative core biopsy. Ninety-five percent of patients with preoperative negative nodes had a sentinel node biopsy.

Fifty-five percent of patients had breast conserving surgery (BCS). A total of 59%/62% of invasive cancer/DCIS patients eligible by EUSOMA guidelines had BCS, which is lower than recommended. The repeat surgery rate for BCS was 18%. A total of 309 patients (45%) had a total mastectomy with 147 having immediate reconstruction, 26 (15%) with autologous procedures, 121 (85%) implant based procedures. Administrative data showed 1048 breast surgery cases and 748 cancer cases with a surgical breast biopsy rate of 29% and a sentinel node rate of 83%.

Surgical breast cancer care at our centre is compliant with the quality indicators described by EUSOMA and ACS-NAPBC, except for EUSOMA recommendations for BCS, likely a result of different patient populations. Hospital administrative data gives inaccurate results for quality indicators in our province. In lieu of Canadian centre standards, breast cancer groups in Canada should maintain clinical data to benchmark against one or both of these standards.

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Discordance in estrogen receptor, progesterone receptor and HER2/neu status between primary and metastatic breast cancer: a systematic review. ***I.C. Yeung, M. Clemons, F. Haggar, C. Addison, B. Hutton, I. Kuchuk, X. Zhu, S. Mazzarello, A. Arnaout.*** **From the Department of General Surgery, The Ottawa Hospital, University of Ottawa, the Division of Medical Oncology, Department of Medicine, University of Ottawa, the Ottawa Hospital Research Institute, Ottawa, Ont.**

Systemic treatment choices for breast cancer patients with metastatic disease are usually based on the estrogen receptor (ER)/progesterone receptor (PR)/human epidermal growth factor receptor 2 (HER2) status of the primary cancer. Receptor discordance between primary and metastatic sites is well recognized and could have important therapeutic implications. A systematic review was conducted to assess the extent of discordance in ER/PR/HER2 receptor status between primary cancer and metastasis.

An electronic search of literature databases was conducted to identify studies reporting outcomes of ER/PR/HER2 receptor expression between primary and metastatic disease. Seven reviewers independently screened 5034 abstracts and full text articles identified by predefined selection criteria. Two reviewers performed data collection from all included studies. Eligible studies reported on receptor conversion between primary sites of breast cancer and metastasis of lymph node, liver, brain and bone marrow.

Preliminary results from eligible studies demonstrated discordance between primary and metastatic sites. General trend was for loss of hormone receptor. The PR status was most discordant (25.5%–40.7%) followed by ER (10.2%–32.5%) and HER2 (2.6%–14.5%). In general, higher ER/PR discordance was found in bone (40%–68%) and liver (0%–54%) when compared to other sites brain (36%), lung (9%–18%), GI (15%–40%). In prospective studies, biomarker discordance led to change in patient management in up to 20% of the patient population.

Our results demonstrate that biomarker discordance between primary and distant metastases does occur in breast cancer. The

PR was more frequently discordant. Further research is required to have a better understanding about the pathophysiology of the biomarker status change and its clinical implications.

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Persistence and adherence to anti-estrogen therapy in seniors: Are we selecting the right candidates for radiotherapy omission after breast-conserving surgery? ***S. Krotneva, A. Ramjaun, K. Reidel, T. Eguale, N. Trabulsi, N. Mayo, R. Tamblyn, A.N. Meguerditchian.*** **From the Clinical and Health Informatics Research Group, McGill University, Montréal, Que.**

In 2005, breast cancer (BC) treatment guidelines were revised to state that radiotherapy (RT) may be reasonably omitted in women 70 years of age or older with early-stage disease, treated with breast-conserving surgery (BCS), if they take antiestrogen therapy (AET) for 5 years. However, little is known about persistence and adherence in this age group. The purpose of this study was to assess 1) persistence in terms of rates and factors influencing it and 2) adherence in terms of medication possession ratio (MPR) changes over 5 years among women 70 years of age or older.

Quebec's hospital discharge database, medical and pharmacy service claims were used to identify seniors undergoing BCS (1998–2005), eligible for RT omission and having initiated AET within a year. Cox proportional hazards models were used to identify predictors of AET nonpersistence (discontinuation).

A total of 3180 women were included (mean age 77.5). Over 5 years, 32% discontinued AET, 2% filled only a single prescription and 22% switched AET drugs. The median follow-up time was 3.7 years (IRQ 2.1–5). At increased risk of nonpersistence were RT nonreceivers (HR 1.26, 95% CI 1.09–1.46), older women (HR 1.01, 95% CI 1.00–1.03), those with new prescriptions initiated (HR 1.01, 95% CI 1.00–1.02) and those hospitalized during AET (HR 1.08, 95% CI 1.05–1.11). Contrary, nonurban residence and medications at AET start lowered the risk. In a subanalysis of RT nonreceivers (n = 906), having hospitalizations during AET increased the risk for discontinuation (HR 1.07, 95% CI 1.02–1.12), while medications at AET start decreased it (HR 0.94, 95% CI 0.91–0.97). In women who persisted with AET for 5 years (n = 1536), the mean 5-year MPR was 80% and 78% of them attained an overall 5-year MPR greater than or equal to 80%.

When omitting RT in women 70 years of age or older with BC after BCS, attention should be paid to the fact that women who forgo RT and those experiencing hospitalizations during AET are at a higher risk of AET nonpersistence.

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Toll-like receptor activation in bacterial pneumonia increases cancer cell adhesion and metastasis formation. ***S. Gowing, S. Chow, J. Cools-Lartigue, C. Chen, B. Giannias, F. Bourdeau, S. Rousseau, S. Qureshi, L.E. Ferri.*** **From the LD MacLean Surgical Research Laboratories, McGill University Health Centre, the Meakins-Christie Laboratories, McGill University Health Centre, the Montréal General Hospital, McGill University Health Centre, Montréal, Que.**

Lung cancer is the leading cause of cancer-related death. Surgical resection remains essential for cure. However, postoperative infections particularly pneumonia remain high and confer an increased risk for metastasis. Emerging evidence implicates Toll-like receptor (TLR) signalling in tumour progression after systemic infection. We hypothesize bacterial pneumonia leads to increased cancer cell adhesion and metastasis formation and that these effects are mediated in part through TLR signalling.

Bronchial epithelial cells were stimulated with lipopolysaccharide (LPS), lipoteichoic acid (LTA), heat-inactivated *E. coli*, *S. pneumonia* alone or *S. pneumonia* with inhibition of TLR 2 or 4 signalling and the supernatant collected. Adhesion of supernatant treated H59 murine lung carcinoma cell lines to collagen 1, 4 and fibronectin was assessed. In vivo adhesion of treated cells to C57Bl6 murine liver sinusoids was assessed using intravital microscopy (IVM) postintrasplenic injection. In addition, C57Bl6 mice were nasotracheally inoculated with 10^5 CFU mL of *S. pneumonia*. Untreated H59 cell adhesion was assessed by IVM 10 minutes postinjection and gross metastases were quantified at 2 weeks.

H59 cell adhesion to collagen 1, 4 and fibronectin was increased 2–3 fold, 3–6 fold and 4–6 fold, respectively, versus control after supernatant stimulation. These effects were abrogated by blocking TLR2 and TLR 4 for appropriate conditions. In vivo adhesion of supernatant stimulated H59 cells increased adhesion 3–4 fold. These effects were negated by blocking TLR2 for *S. pneumonia* and TLR4 for *E. coli* conditions. Mice inoculated with S. pneumonia demonstrated 4-fold increased H59 cell in vivo adhesion and a 2–3 fold increase in gross hepatic metastases compared to control.

Bacterial pneumonia creates a favourable environment for circulating tumour cell adhesion and the formation of stable metastases. These effects are mediated in part through Toll-like receptor 2 and 4 activation.

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Analysis of human peritoneal carcinomatosis samples infected with a panel of oncolytic viruses. ***S. Zerhouni, N. Tang, F.A. Angarita, A. Cannell, C. Lefebvre, K.L. Mossman, D.F. Stojdl, R. Kirsch, J.A. McCarth.*** **From the University of British Columbia, Vancouver, BC, the Division of Experimental Therapeutics, Toronto General Research Institute, University Health Network, Toronto, Ont., the Institute of Medical Science, University of Toronto, Toronto, Ont., the Department of Surgery, Mount Sinai Hospital, Toronto, Ont., the Apoptosis Research Centre, CHEO Research Institute, Ottawa, Ont., the Department of Pathology and Molecular Medicine, McMaster University, Hamilton, Ont., the Department of Pathology, Mount Sinai Hospital, Toronto, Ont., the Department of Surgery, University of Toronto, Toronto, Ont.**

Peritoneal carcinomatosis (PC) is the spread of cancer within the abdomen. Current treatment strategies are limited and carry significant morbidity. Oncolytic viruses (OVs), which preferentially replicate and lyse tumours, are showing promising results in clinical trials and are a novel therapeutic for patients with PC. The aims of our study are 1) to evaluate susceptibility of patient PC samples to a panel of OVs, 2) to investigate tumour protein expression as a predictor of replication efficiency in these samples and 3) to detect delivery of vaccinia virus (VV) in PC of patients treated intravenously (IV) as part of a phase II trial.

Prospectively, patient PC samples were obtained from the operating room and infected ex vivo with VV, herpes virus, maraba virus and farmington virus for 48 to 72 hours. Samples were visualized under fluorescent microscopy and titered by plaque assay. Matched samples were stained by immunohistochemistry (IHC) for 4 proteins (ERK, thymidine kinase, interferon regulatory factor 3 and 7). The IHC score was correlated with fold titer change for each OV. Alamar blue assay was performed on all samples to determine viability. PC samples (ovarian) will be collected pre and post-IV-VV administration and analyzed with quantitative PCR, plaque assay and IHC for cellular and viral proteins.

Patient PC samples infected ex vivo with 4 OVs displayed variable levels of fluorescence. Fold titer variability was encountered between patients and between OVs suggesting that patient samples show a differential susceptibility to different viruses. Alamar blue assay confirmed sample viability at 72 hours. The IHC analysis is ongoing. Patient recruitment is anticipated in the spring of 2013.

Patient PC samples show variable susceptibility to a panel of OVs. As OVs are increasingly administered to patients, it will become imperative to identify markers of susceptibility in order to offer a personalized approach to OV therapy.

Canadian Society of Colon and Rectal Surgeons

Société canadienne des chirurgiens du côlon et du rectum

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Tissue factor pathway inhibitor 1 gene polymorphism-33TàC predicts improved disease-free survival in colorectal cancer. ***A. Bazzarelli, A.S. Scheer, L.-H. Tai, R. Seth, C. Tanese de Souza, D. Jonker; J. Maroun, M. Carrier, R.A. Auer.*** **From the University of Ottawa, the Ottawa Hospital Research Institute, Ottawa, Ont.**

Tissue factor pathway inhibitor 1 (TFPI1) is an anticoagulant protein exhibiting antimetastatic properties in preclinical models. The homozygous CC polymorphism on intron 7 of TFPI1 (33TàC) is associated with higher TFPI protein levels and a lower risk of venous thromboembolism (VTE). The present study is the first to evaluate the impact of the inherited TFPI1 polymorphism on disease-free survival (DFS) in cancer patients following curative resection. A prospectively maintained colorectal tumour bank in Ottawa with associated clinical data was used to identify patients who underwent curative surgery for colorectal cancer between 1994 and 2006. Germline DNA was extracted from formalin fixed, paraffin embedded normal colonic mucosa. Single nucleotide polymorphisms (SNPs) for Tissue Factor Pathway Inhibitor 1 (TFPI1, 33TàC), Factor V Leiden (FVL, G1691A), and Prothrombin (PT, G20210A) were determined by polymerase chain reaction. Disease-free survival was described using the Kaplan–Meier method. Multivariable regression analysis, with known prognostic factors, was performed using the Cox proportional hazards model. Of the 139 patients identified, the prevalence of the wildtype (TT) TFPI1 genotype was found in 57.3% of samples, the heterozygous genotype (CT) in 29.4%, and the homozygous genotype (CC) in 10.5%. The incidence of VTE was 21.6% in the TT/TC genotypes and 6.7% in the CC genotype ($p = 0.4$). The CC genotype was associated with superior DFS (HR 0.38, [95%CI 0.17–0.88]; $p = 0.02$) with 5-year DFS 56.3% versus 24.6% for CC versus TT/TC, respectively. In multivariate analysis female sex (HR 0.61, $p = 0.02$), node negative (HR 0.47, $p = 0.005$) and TFPI1 CC polymorphism (HR 0.35, $p = 0.01$) were independently associated with improved DFS. The prevalence of FVL (0.7%) and PT (2.2%) polymorphisms was too low to detect any interaction with TFPI1 polymorphism and DFS. These findings indicate that the inherited anticoagulant homozygous 33TàC TFPI polymorphism may protect against colon cancer recurrence.

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Rectal cancer surgery by high-volume surgeons results in improved oncologic outcomes and sphincter preservation. ***K.R. Klingbeil, M.S. Brar, I. Datta, J.A. Heine, A.R. MacLean, W.D. Buie.*** **From the University of Calgary, Calgary, Alta.**

Evidence suggests that outcomes in rectal cancer surgery are improved for patients undergoing resection by high-volume surgeons. The aim of this study was to review surgical treatment of rectal cancer in our province over the past 15 years, and assess surgeon volume and its effect on oncologic and surgical outcomes.

All patients diagnosed with invasive rectal cancer in 1997, 2007 and 2011 were identified within a provincial cancer registry. Patients who did not undergo definitive surgical resection were excluded. Charts were reviewed to extract data. Surgeons were coded and subsequently classified as high volume (HV) if they were in the highest quintile and low volume (LV) for all others. The 2 groups were then compared with regards to outcomes in 1997, 2007 and 2011.

A total of 192 rectal cancer surgeries were performed by 52 surgeons in 1997, which increased to 284 by 50 surgeons in 2007 and 365 by 55 surgeons in 2011. High-volume surgeons performed 32%, 71%, and 70% of cases in 1997, 2007 and 2011, respectively. There was no significant difference between the patients treated by HV or LV surgeons in each year with regards to age, stage at diagnosis or use of neoadjuvant chemoradiation. The mean lymph node harvest increased from 8 in 1997 to 17 in 2011, with no difference between HV or LV surgeons. However, by 2011 HV surgeons had a higher rate of pathologic grade 3 (complete) TME specimens (76% v. 63%; $p < 0.02$) and a lower rate of circumferential resection margin (CRM) positivity (6% v. 12%; $p < 0.01$). The 5-year local recurrence rate for surgery performed in 2007 by HV and LV surgeons was 3% versus 13% respectively. The APR rate was significantly lower in HV surgeons with no difference in leak rate or in 5-year overall survival.

The majority of rectal cancer surgery in our province is performed by HV surgeons. HV surgeons have higher rates of grade 3 TME resection, lower rates of CRM positivity, decreased local recurrence rates and increased sphincter preservation.

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Feasibility of using MRI-based outcomes for quality indicators (QI) for rectal cancer multidisciplinary cancer conference (MCC). ***J. Subendran, H. Huang, B. O'Connor, S. Thipphavong, B. Cummings, J. Brierley, K. Jhaveri, R. Kirsch, R.S. McLeod, E.D. Kennedy.*** **From the Mount Sinai Hospital, the University Health Network, the Princess Margaret Hospital, Toronto, Ont.**

Studies assessing the effectiveness of multidisciplinary cancer conference (MCC) for rectal cancer have shown little improvement when patient outcomes are used as QI. Therefore, the objective of this study was to assess the feasibility of using MRI-based outcomes as quality indicators (QI) for MCC for rectal cancer.

Weekly MCC rounds for primary rectal cancer were initiated on Sept. 19, 2012, to present, and were attended regularly by surgeons, radiation oncologists, pathologists and radiologists.

Patients presented at these rounds were identified by participating surgeons and radiation oncologists.

Over the 7 month time period, 23 rounds were planned; 18 were conducted and 5 were cancelled due to the unavailability of the radiologist. Forty-two patients were presented with mean age of 60 years (range 31–107). The majority were male (n = 29) with low (0–5 cm) tumours (n = 17) that were locally advanced (n = 24). Twenty-nine (69%) received preoperative chemoradiotherapy, and currently, 18 have had surgery (12 restorative, 6 APR). There was a complete response in 16% (3 of 18) and a positive CRM in 5.5% (1 of 18). While a baseline MRI was performed in 93% (39 of 42) of patients, only 36% (14 of 39) of MRI were done within 2 weeks of the initial consultation. Overall, 61.5% (24 of 39) of the MRI reports were synoptic and changes in MRI reporting at MCC were significantly less likely with synoptic MRI reports compared to standard MRI reports (8.3% [2 of 24] synoptic v. 100% [15 of 15] nonsynoptic, $p < 0.001$). Overall, MCC led to a significant change in management in 21.4% (9 of 42) of the patients presented.

In summary, the use of MRI based QI at MCC was feasible and indicated that there was opportunity for improvement at our centre. Furthermore, the rectal cancer MCC led to a change in management in 21% of presented cases and use of a synoptic MRI format led to more consistent and complete reports than a nonsynoptic MRI format.

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Delays in rectal cancer treatment: a growing multidisciplinary problem. ***K. Klingbeil, M.S. Brar, I. Datta, J.A. Heine, A.R. MacLean, W.D. Buie.*** **From the University of Calgary, Calgary, Alta.**

The incidence of newly diagnosed rectal cancer has doubled in Alberta over the past 15 years, straining health care resources. The aim of this study was to determine the effect of this increased incidence on time to first treatment, first treatment modality and treatment location over this 15-year period.

All patients diagnosed in Alberta with invasive rectal adenocarcinoma in 1997, 2002, 2007 and 2011 were identified and categorized based on the first treatment modality (radiation [RT], chemoradiation [CRT], chemotherapy [CT] or surgery). Data were extracted from patient charts. Initial and all subsequent treatment events were categorized as urban (Calgary, Edmonton) or rural (other). Trends in time to first treatment, first treatment modality, and location of treatment were then analyzed.

A total of 1259 patients met our inclusion criteria. Time to RT and CRT increased significantly from 1997 to 2007 (39.3 d–58.3 d, $p < 0.01$; 31.6 d–58.3 d, $p < 0.001$, respectively), before stabilizing in 2011 for RT (52.9 d) and decreasing for CRT (48.9 d, $p < 0.01$). This correlated with an increase in RT at rural centres from 0% in 2007 to 8% in 2011. Time to CT increased from 41.5 d in 2002 to 51.2 d in 2011, with no difference in treatment at rural centres noted (21% in 2002 and 2011). Time to surgery as first treatment increased significantly from 1997 to 2011 (26.2 d–44.4 d; $p < 0.001$), with an associated decrease in treatment at rural centres noted (35%–20%; $p < 0.001$). Use of CRT as the first modality increased from 16% in 1997 to 37% in 2011 ($p < 0.001$) while surgery decreased from 71% to 41% ($p < 0.001$).

Wait times for the treatment of rectal cancer have increased significantly over the past 15 years. While wait times for RT and CRT have plateaued, surgery wait times continue to rise. The increased incidence of rectal cancer requires a provincial multidisciplinary strategy to ensure that quality of care is preserved for all treatment modalities.

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Delays in diagnosis of anal cancer. ***S. Chiu, K. Joseph, D.E. Schiller.*** **From the University of Alberta, Cross Cancer Institute, Edmonton, Alta.**

Previous studies have suggested that delays in diagnosing anal cancer reduce disease-free and overall survival. The rarity of the diagnosis and overlapping symptoms with benign disease processes may contribute to diagnostic delays. Currently, little is known about the length of time to diagnosis or the factors responsible for delays. The purpose of this study is to quantify the time to diagnosis, identify the factors contributing to diagnostic delays, correlate delays in diagnosis with disease stage, and study the effect of delays on patient satisfaction.

A prospective questionnaire was conducted for all newly diagnosed patients with anal cancer at a tertiary care regional cancer centre in Northern Alberta. The data recorded included demographics, risk factors for anal cancer, patient actions between their first symptoms to their first access to the medical system, events between first access to the medical system to the diagnostic biopsy, and patient satisfaction. The pathology, stage, and date of biopsy were confirmed by a review of the patients' medical records.

Data were collected over 2 years. Twenty-two patients were interviewed. The average age was 60 years and 77% of patients were female. The time to seek medical attention showed a bimodal distribution, with 1 group of patients waiting less than 1 month, and the other waiting more than 6 months. There was also a bimodal distribution in the number of visits to a physician needed to obtain a diagnostic biopsy (1–4 visit, and 6–8 visits). When further investigations or referrals were arranged on the first medical visit, the number of visits until the diagnosis was significantly fewer. When a diagnosis of hemorrhoids was made on the first visit, the number of visits until diagnosis was significantly higher. The average time from patients first noticing their symptoms to a diagnosis was 6 (1–22) months. There was a trend to higher disease stages in patients who had longer times between symptom onset to diagnosis. Finally, 29% of patients felt that delays in diagnosis were caused by either inaction after their first medical visit or that the time to obtain tests or referrals was too long. Twenty-four percent of patients were either somewhat or very unsatisfied. Patients who perceived the delays to be the fault of the medical system were more likely to be unsatisfied.

The average time from the onset of symptoms to a diagnostic biopsy was 6 months. Two groups of patients were identified: those who sought medical attention promptly within a month and those who delayed for more than 6 months after onset of symptoms. Therefore, for some patients, not seeking timely medical attention can be an important factor in the delay in diagnosis. Further, after the first visit to a physician, there were also 2 groups, those who obtained a diagnosis within a few visits (including visits to the specialist), and those who required 6–8 visits. The factors that predicted the delays included an initial diagnosis of hemorrhoids on the first visit, and not arranging for tests or referrals on the first visit. Thus, it appears that the physicians' low level of suspicion contributed to the delay. Not performing a

digital rectal exam did not appear to contribute to the delay. There was a trend toward higher disease stages in patients with longer times to diagnosis. Finally, 24% of patients were unsatisfied with the care they received. Patients who felt the medical system was responsible for the delay were more likely to be dissatisfied. The limitations of this study are that only patients who were seen at the cancer centre for chemotherapy and radiation were interviewed and although questionnaires were conducted promptly after the diagnosis, it did rely on patients retrospectively recalling their experience prior to the biopsy.

Delays in diagnosis of anal canal cancers are the result of both patients delaying seeking medical attention and physicians assuming a benign disease process and thus not arranging for further tests or referrals. Long delays led to a reduction of patient satisfaction and were also associated with a trend toward more advanced disease at time of diagnosis. Increasing public awareness of anal cancer may reduce the time to seek medical attention. Finally, it is vitally important for primary care physicians to arrange investigations or referrals on the first visit in high-risk groups to expedite a diagnosis and increase patient satisfaction.

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Wait times for colorectal cancer surgery: Does the specialty performing the colonoscopy matter? *S. Rieder, R.V. Anantha, K. Leslie.* From the Western University, London, Ont.

Colonoscopy is the gold standard to detect colorectal cancer (CRC), and is performed by both general surgeons (GS) and gastroenterologists (GI). Given the establishment of provincial wait times for CRC treatment, we sought to determine if there were differences in time to surgery depending on whether a diagnostic colonoscopy was performed by a gastroenterologist or a general surgeon.

We conducted a retrospective review of all patients who were diagnosed with CRC on colonoscopy and subsequently underwent surgery between June 2007 and June 2012 at LHSC (an academic centre) our institution. We excluded patients who had a history of CRC or underwent neoadjuvant chemotherapy and/or radiation therapy. Statistical analyses were performed by Mann–Whitney U test or Pearson χ^2 test.

We also retrospectively reviewed all CRC patients who underwent a diagnostic colonoscopy by a gastroenterologist (GI) or a general surgeon (GS) at St. Joseph's (SJHC; a nonacademic centre) between 2007 and 2013. Colonoscopy characteristics and wait times for surgery were compared using the Pearson χ^2 test and Mann–Whitney U test. The p values less than 0.05 were considered statistically significant.

We reviewed 144 patients who met our inclusion criteria. The GIs performed 59% of colonoscopies. The location of the malignancy differed between the 2 groups ($p = 0.016$): patients in the GS group had more sigmoid cancers (43% v. 18% in the GI group), whereas patients in the GI group had more right-sided cancers (37% v. 24% in the GS group). There were no differences in stage of disease ($p = 0.27$), or rates of complications during colonoscopy or surgery ($p = 0.40$). The median times from colonoscopy to surgery were 29 days for GI and GS ($p = 0.16$) at LHSC.

At SJHC, we identified 382 diagnostic colonoscopies (101 by GS, 281 by GI) that met our inclusion criteria. The median time to OR was significantly shorter for the GS group (46 days versus 90 days for the GI group, $p = 0.0002$). There were no differences in sex or distribution of tumour, or surgical operation performed.

Performance of diagnostic colonoscopies by general surgeons or gastroenterologists did not affect wait-times for surgical treatment of colorectal cancer at LHSC but were significantly different at SJHC. It would appear that there is little difference within an academic centre but quite a significant difference in community centres. More data from both of these types of centres would help us elucidate this question more.

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Anastomotic leakage and perioperative nonsteroidal anti-inflammatory drug (NSAID) use after colorectal surgery. *F. Saleh, T.D. Jackson, L. Ambrosini, J.J. Gnanasegaram, J. Kwong, F.A. Quereshy, A. Okrainec.* From the Division of General Surgery, University Health Network, University of Toronto, Toronto, Ont.

Recent evidence suggests that postoperative nonsteroidal anti-inflammatory (NSAID) use after colorectal resection may be associated with anastomotic leakage after primary anastomosis.

A retrospective review between the years 2004–2011 was performed on patients who underwent colorectal surgery. Univariate analysis and multivariate logistic regression was used to evaluate the association between patients who did not receive any NSAIDs and those who received Ketorolac within the first 5 days postoperatively. A subgroup analysis among the patients receiving Ketorolac was performed to evaluate a possible dose-dependent relationship between Ketorolac use and anastomotic leakage.

A total of 731 patients were identified as having a colorectal resection with primary anastomosis: 376 (51.4%) received no NSAIDs and 355 (50.6%) received Ketorolac postoperatively, within 5 days after their surgery. The overall number of leaks was 24 (3.3%), with 12 leaks in both the no NSAIDs (3.2%) and Ketorolac (3.4%) groups, OR 1.06 (0.43, 2.62; $p = 0.886$). After adjusting for smoking, steroid use, and age, there remained no significant difference between Ketorolac use and leakage, OR 1.21 (0.52, 2.84; $p = 0.660$). In our multivariate model, only smoking was a significant predictor of postoperative leak, OR 3.34 (1.30, 8.62; $p = 0.012$). Both steroid use, OR 2.45 (0.68, 8.79; $p = 0.168$) and age in 10-year intervals, OR 1.25 (0.90, 1.74; $p = 0.179$) were not significant. In the subgroup analysis of patients who received Ketorolac; however, there appeared to be an association between total Ketorolac dose (measured in intervals of 15 mg of Ketorolac) and leak rates, OR 1.29 (1.00, 1.67; $p = 0.048$).

Overall, there does not appear to be a significant association between postoperative Ketorolac use and anastomotic leakage after colorectal surgery. Based on a subgroup analysis; however, there may be a dose-dependent relationship between Ketorolac use and leak rates although this trend requires further study.

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Redefining colorectal cancer care: a novel patient-centred diagnostic assessment and treatment program. *S.M. Ashamalla, B.-A. Maier, D.S. Fenech, S.M. Feinberg, P.K. Stotland, A.J. Smith.* From the Sunnybrook Health Sciences Centre, the North York General Hospital, Toronto, Ont.

This article describes the implementation and results of a colorectal cancer (CRC) management pathway that redefines the

traditional model of care. The goal of this Diagnostic Assessment and Treatment program (DAP) is an efficient patient-centred pathway in which the nurse navigator (NN) streamlines care to minimize clinic visits and guides patients through complex multidisciplinary oncologic management.

Patients referred from May 2011 to December 2012 were followed prospectively. Patients were contacted by NN after referral to explain steps of care. All preoperative tests and multidisciplinary cancer conference (MCC) discussions necessary for decision-making were arranged by NN in order to achieve a clinical visit in which definitive oncologic plan was recommended (purposeful visit [PV]). Dates of referral, first NN contact, clinic visits, PV, surgery and MCC were recorded.

One hundred and twenty-nine referrals were made to the DAP: 69 colon and 60 rectal cancers. Median time from referral to NN contact was 3 days (n = 129). Of the 60 rectal cancers, all were discussed in MCC and of these 95% (57 of 60) were discussed prior to the first clinical visit. Median time from first NN contact to first clinical visit was 10 days (n = 129). Mean number of surgical visits prior to OR in colon and non-neoadjuvant rectal cancer cases was 1 (n = 63) and median days from PV to OR was 16 (n = 63). Median number of preoperative surgical visits in rectal cancer patients receiving neoadjuvant treatment was 2 (n = 40). Patients reported high satisfaction with the program.

Coordinated navigation through the management of CRC allowed patients to receive expedited care that minimized visits prior to a PV. This patient-centred program has a direct point of contact throughout the cancer journey; it expedites all necessary tests prior to first contact with surgeon and consequently decreases wait times to surgery and increases patient satisfaction.

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Can administrative health care data predict unplanned emergency room visits in seniors undergoing colon cancer surgery? ***A. Ramjaun, S. Krotneva, H. Alabbas, A.N. Meguerditchian.*** **From the McGill Clinical and Health Informatics, Montréal, Que.**

Postdischarge emergency room visits (ERVs) are costly, associated with high morbidity and may be prevented by addressing certain gaps in quality of care. Seniors represent a high-risk group, often exhibiting frailty and multimorbidity, and frequently presenting in the emergency room (ER) with complications. We aimed to identify postdischarge ERV predictors in seniors undergoing colon cancer surgery. Hospital discharge data, medical service and pharmacy claims provided by Quebec's universal health care insurance program were used to identify patients 65 years old who underwent colon cancer surgery (2000–2006). Variables corresponding to domains assessed through a comprehensive geriatric assessment (CGA) and patterns of health care use were constructed from these data sources. A multivariate logistic regression was used to quantify predictors for PERVs occurring within 30 days of discharge. We included 3789 patients, of whom 17.18% made a postdischarge ERV. After adjusting for patient-specific variables and CGA risk factors, certain patterns of health care use emerged as most predictive of ERVs. Specifically, the number of ER visits unrelated to colon cancer made in the year before surgery independently predicted ERV (OR 1.09 [95% CI 1.05–1.19]). Whether a patient visited the ER within 30 days preceding surgery for colon cancer–related symptoms also predicted ERV (OR 1.24 [95% CI 1.04–1.48]). Finally, the number of unique medications prescribed within 6 months preceding surgery predicted postdischarge ERV (OR 1.04 [95% CI 1.02–1.07]). These findings indicate that past health care use may reliably predict unplanned ERVs compared to CGA. This has important implications in the development of electronic risk profiling tools, which may facilitate the optimization of preoperative care and judicious provision of health care resources.

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Radiation exposure from computed tomography in Crohn disease patients undergoing ileocolic resection. ***H. Wang, F. Bellolio, J. Bardsley, C. Brace, N. Jaffer, K. Jhaveri, J.C. Victor, R.S. McLeod, E.D. Kennedy.*** **From the University of Toronto, Toronto, Ont.**

The objective of this study was to determine the cumulative radiation exposure from computed tomography (CT) of the abdomen and pelvis in patients undergoing ileocolic resection (ICR) for Crohn disease (CD) at a tertiary care centre.

Patients with CD undergoing ICR between Jan. 1, 2000, and Dec. 31, 2010, were identified from a prospectively maintained clinical database and clinical information was linked with the hospital's electronic imaging system to obtain the total number of CTs/patient and the actual reported radiation dose for each CT or dose length product (DLP). The effective radiation dose (E) was calculated as: E (mSv) = k X DLP, where k = 0.015 mSv/MGy/cm. Descriptive statistics were used to report the participant characteristics, total number of CTs and cumulative radiation dose over time.

A total of 197 patients with CD were included in the study. The mean age of the patients at the time of surgery was 31.3 years (range 16.1–69.1), 55.8% were female and 72.1% underwent elective ICR. 87% (171 of 197) had at least 1 CT since the time of their diagnosis and the mean number of CTs per patient was 2.9. The average cumulative radiation exposure was 20.6 mSv (SD 18.2) in the year leading up to ICR, 23.2 mSv (SD 21.5) 1 year after ICR and 28.9 mSv (SD 28.7) 5 years after ICR. The percentage of patients with high exposure (i.e., > 50 mSv) was 3.8% in the year leading up to ICR, 6.0% 1 year after ICR and 12.9% 5 years after ICR. Regression analysis did not show any patient variables associated with increased radiation exposure.

While the average cumulative radiation exposure from CT increases in the 5 years following surgery, this is less than the average cumulative radiation exposure reported prior to surgery. Other imaging modalities including ultrasound and MRI as well as early surgical intervention may be strategies to reduce radiation exposure in this patient population.

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Combined endoscopic-laparoscopic surgery for complex colonic polyps: Are good outcomes maintained with an aggressive therapeutic endoscopy program? ***A. Crawford, I. Yang, R.C. Wu, H. Moloo, R.P. Boushey.*** **From the University of Ottawa, The Ottawa Hospital, Ottawa, Ont.**

The objective of the study was to evaluate the safety and outcomes of combined endoscopic-laparoscopic surgery for complex colonic polyps not amenable to conventional colonoscopic excision. All combined endoscopic-laparoscopic surgery patients from

our centre from 2009 to 2012 were followed prospectively. Each patient was assessed by a therapeutic endoscopist preoperatively, and was deemed unresectable based on size or location of the polyp. The main outcome measures were intraoperative and postoperative complications, length of hospital stay, and recurrence. Twenty-four consecutive patients underwent combined endoscopic-laparoscopic surgery. A total of 15 (63%) patients underwent laparoscopic-assisted colonoscopic polyp excision (8 of these excisions were facilitated by endoloop placement), 8 (33%) patients underwent colonoscopic-assisted laparoscopic cecectomy, and 1 (4%) patient was converted from a colonoscopic-assisted laparoscopic cecectomy to a laparoscopic ileocolic resection. One (4%) intraoperative complication was encountered (anaphylactic antibiotic reaction), and this patient required ICU admission, developed a pulmonary embolism requiring anticoagulation resulting in a polypectomy site bleed. One other patient experienced a postoperative complication (port site bleed). There were no long-term sequelae from these complications. The median length of hospital stay was 2 days (range 1–16). A total of 23 (96%) of the final pathology results were benign, with 7 (29%) results of high-grade dysplasia. One (4%) final pathology result was positive for a well-differentiated adenocarcinoma, requiring a laparoscopic right hemicolectomy. Three (12%) patients experienced recurrent benign polyps at the previous excision site. These were all removed by colonoscopy. The average time-to-detection of recurrence was 165 days. Combined endoscopic-laparoscopic surgery for complex colonic polyps is a safe procedure, with good clinical outcomes and low recurrence rates.

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Factors affecting compliance with endoscopic surveillance guidelines following colorectal cancer resection. ***M.S. Brar, K.R. Klingbeil, J.A. Heine, I. Datta, W.D. Buie, A.R. MacLean.*** **From the University of Calgary, Calgary, Alta.**

Following resection for colorectal cancer (CRC), current guidelines recommend surveillance endoscopy at 1 year. The purpose of this study was to determine the rate of compliance with these guidelines, and to identify factors affecting compliance.

Retrospective review of all patients who underwent curative resection for CRC in the Calgary Health Region from 2008–2010 was conducted. Exclusion criteria included transanal excision, total colectomy, stage 4 disease, hereditary nonpolyposis colorectal cancer, familial adenomatous polyposis and death within 1 year of resection. The primary outcome was the rate of endoscopic surveillance within 1 year of resection. Possible factors affecting compliance with guidelines were selected a priori. Univariate analysis was performed using Student t test, Fisher exact test, or χ^2 test, as appropriate. Multivariate logistic regression was also performed.

A total of 487 patients met our inclusion criteria; of these, 172 patients underwent surveillance endoscopy within 1 year (35%). On univariate analysis, patients who met guidelines were statistically more likely to have an incomplete preoperative colonoscopy (32.6% v. 15.6%, $p < 0.001$), and to have had surgery performed by a colorectal surgeon (94.2% v. 87.8%, $p = 0.027$), as compared to those who did not meet guidelines. On multivariate analysis, the following factors were associated with compliance to guidelines: incomplete preoperative colonoscopy (OR 3.41, 95% CI 5.53–2.10, $p < 0.001$) and surgery performed by a colorectal surgeon (OR 2.55, 95% CI 1.11–5.88, $p = 0.028$), whereas fecal diversion (OR 0.52, 95% CI 0.29–0.95, $p = 0.033$) was negatively associated with compliance.

Following CRC resection, only 35% of patients are meeting guidelines for endoscopic surveillance. Incomplete preoperative colonoscopy and surgery by a colorectal surgeon are associated with compliance with guidelines, though rates are still suboptimal. Strategies to improve compliance with surveillance guidelines should be initiated.

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Preoperative repeat endoscopy rate in colorectal cancer patients: an institutional experience and analysis of influencing factors. ***T. Al Abbasi, F. Saleh, T.D. Jackson, A. Okrainec, F.A. Quereshy.*** **From the University Health Network, University of Toronto, Toronto, Ont.**

This study serves to establish the repeat endoscopy rate in patients undergoing surgery for colorectal cancer at a tertiary academic centre, and to identify significant factors that may influence the decision for preoperative repeat endoscopy.

A retrospective review of 342 consecutive patients undergoing surgical resection for colorectal cancer was performed from January 2008 to December 2011. Descriptive statistics were used to define the patient population and to establish our institutional repeat endoscopy rate. Univariate and multivariate analysis was used to compare patients who underwent repeat endoscopy to those who did not.

Patients within the 2 comparison groups had similar demographic profiles. Excluding patients where the primary endoscopist was the operating surgeon, 122 of 299 patients (40.6%) underwent re-endoscopy. The most common reasons for re-endoscopy included tattooing of the lesion in 55 patients (45%), surgical planning in 43 (35.2%), and repeated therapeutic attempatients in 11 (9%). Significant factors associated with repeat endoscopy included left-sided colon cancers (compared to right-sided lesions, $p \leq 0.001$), patients referred from an outside institution ($p \leq 0.001$), and the absence of a tattoo after the first colonoscopy ($p \leq 0.001$). Patients who underwent laparoscopic colon resections demonstrated a trend toward repeat endoscopy ($p = 0.07$). Repeat endoscopy resulted in a change in surgical resection in 5 patients.

The preoperative repeat endoscopy rate in colorectal cancer patients at our tertiary academic centre is 40%. Re-endoscopy was associated with an initial failure to tattoo the lesion, left-sided colonic neoplasms, and a planned laparoscopic resection. While re-endoscopy has the potential to alter surgical planning, this theoretical advantage may be realized in a select group of patients. Further research is needed to help identify which patients would benefit from repeat endoscopy and where this may be safely omitted.

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A retrospective review of open versus Da Vinci assisted robotic proctectomy with coloanal anastomosis. ***S.T. Ali, B.M. Taylor, C.M. Schlachta.*** **From the Department of Surgery, London Health Sciences Centre, the Canadian Surgical Technology and Advanced Robotics, London, Ont.**

Robotic Da Vinci assisted proctectomy with a coloanal anastomosis (RPCA) is a new innovative technique of pelvic dissection for

low rectal cancer. This study's objective was to evaluate our early experience with this procedure compared with open proctectomy with coloanal anastomosis (OPCA).

A retrospective 5-year review comparing cases of RPCA with OPCA performed at our institute was conducted focusing on tumour characteristics, quality of surgery, analgesic requirements, average length of hospital stay (LOS), complications and long term outcomes. Three patients were RPCA while 25 were OPCA. Average tumour height from anal verge was 7 cm for OPCA and 4 cm for RPCA. Average operative time (OT) was similar (288 min RPCA, 285 min OPCA). Four OPCA patients had positive or very close margins and 2 patients had a mesorectal defect less than 5 mm. In RPCA no quality of surgery issues were identified. Length of stay was reduced by 2.5 days in RPCA group (p = 0.014). Average duration of epidural/PCA in OPCA was almost double that of the RPCA (2.67 d in RPCA, 5.16 d in OPCA, p = 0.0059). Average antiemetic use was also reduced by half in RPCA. Among the OPCA, 44% developed a wound infection, 32% had long-term incontinence, 24% a hernia and 1 patient had an anastomotic leak. A total of 28% of patients had a recurrence and 8% patients died all from consequences of recurrence. There were no perioperative complications in the RPCA group and all had negative margins, adequate lymph node retrievals with no long-term complications or recurrence recorded so far.

Each RPCA case, when matched to the open cases based on tumour and patient characteristics showed similar OT and deceased LOS.

This is our very early experience with RPCA. However, early indications are very encouraging, suggesting patients may receive a safe and oncologicaly reliable alternative to OPCA, with similar OT, and the added benefit of a minimally invasive procedure including decreased LOS and reduced postoperative analgesic requirements.

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Laparoscopic enterocolostomy is a viable and safe option in patients with malignant small bowel obstruction with incurable disease. ***N. Chima, J. Hopkins, A.A. Karimuddin, A. Hayashi, S. Malik.*** **From the University of British Columbia, Department of Surgery, Island Medical Program, Victoria General Hospital, Victoria, BC**

The surgical management of symptomatic malignant small bowel obstruction in patients with metastases is still uncertain. Due to the burden of systemic disease, treatment is usually palliative. Debate currently centres on whether tumour resection or intestinal diversion (bypass or stoma) is suitable treatment for malignant small bowel obstruction (MSBO). Furthermore, no studies have investigated the value of diverting stoma versus bypass therapy. We describe the largest case series of patients with malignant bowel obstruction in the setting of metastatic cancer who were treated surgically with laparoscopic enterocolostomy for the palliation of their symptoms.

Using a prospectively collected database, we retrospectively reviewed the data of all patients with incurable disease who presented with MSBO and were operated on by a single surgeon at the Victoria General Hospital from August 2009 to July 2012.

Four patients were identified: 3 with colorectal cancers and 1 with a gynaecological cancer. The median age of the patients was 80 years (range 74–87 yr). All patients presented with an MSBO and CT-proven distant metastases. Total laparoscopic intracorporeal enterocolostomy was performed in each case. All patients did well postoperatively and the mean postoperative stay was 8 days (range 7–9 d). The perioperative morbidity rate was 25% (1 of 4). The 30-day mortality and readmission rate was 0%. None of the patients required a second operation. The overall mortality in this series was 25% (1 of 4). The median time of follow-up was 2 years (range 3–48 mo).

Patients requiring surgery for symptomatic MSBO with incurable disease can be safely and effectively palliated with laparoscopic enterocolostomy. All patients tolerated palliative surgery and regained full GI function postoperatively. Furthermore, this technique is a viable and safe option in older patients with acceptable morbidity and mortality rates.

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Failing to reverse a temporary diverting stoma after low anterior resection. ***A. Chiu, C.J. Brown, A.A. Karimuddin, M.J. Raval, P.T. Phang.*** **From the St. Paul's Hospital, Vancouver, BC**

The primary objective of this study was to determine the incidence of patients who fail to undergo a reversal procedure for their temporary diverting stoma, thus being left with a permanent stoma. The secondary objective was to determine the risk factors associated with failing to undergo closure of a temporary stoma.

Using the St. Paul's Hospital colorectal cancer database, we identified all patients from 2006 to 2012 who presented with stage I–III rectal cancer and were treated with low anterior resection with diverting stoma. Inclusion criteria included a minimum of 13 months postoperative follow up. Exclusion criteria include stage IV rectal cancer and patients presenting with recurrent rectal cancer. Patients who had not undergone a reversal procedure or were not on a surgical waitlist for such at 13 months postoperative follow up were regarded as having a "permanent" stoma. Possible risk factors for nonclosure were statistically analysed using the Fisher exact test, Mann–Whitney U test as well as a multivariate analysis to assess for correlation between risk factors.

From 2006 to 2012, 164 met our inclusion criteria. The overall incidence of failing to reverse a temporary stoma was 14.6% (n = 24). Commonly cited reasons included recurrent cancer (n = 10), and anastomotic leak (n = 8), and patient choice (n = 1). Four patients underwent revision surgery for either anastomotic leak or local tumour recurrence resulting in an end colostomy. The mean interval time between initial tumour resection and stoma reversal surgeries was 346.73 days (range 59–1343). Postoperative leak (p = 0.006) and age greater than 65 years (p = 0.03) were significant independent risk factors for nonclosure of a temporary stoma.

The incidence of failing to reverse a temporary stoma is substantial. Postoperative leak despite a temporary diverting stoma, and age greater than 65 years are significant risk factors for nonclosure.

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Oral metronidazole for the prevention of posthemorrhoidectomy pain: a systematic review and meta-analysis. ***H.M.A. Emmerton-Coughlin, S.M. Coughlin, C. Vinden.*** **From the Western University, London, Ont.**

Hemorrhoidectomy is a common procedure that can be associated with significant postoperative pain. A multimodality

approach is often used for posthemorrhoidectomy pain management, including local anesthesia, oral analgesia and laxatives. Some researchers have advocated the use of oral metronidazole to improve posthemorrhoidectomy pain control, and several randomized controlled trials (RCTs) have been conducted to investigate this treatment. We performed a systematic review and meta-analysis to assess whether oral metronidazole decreases posthemorrhoidectomy pain.

MEDLINE, EMBASE and the Cochrane Central Register of Controlled Trials, as well as reference lists for textbooks and relevant articles were searched for randomized controlled trials comparing the effect of treatment with oral metronidazole with placebo or routine analgesia on pain control in patients undergoing hemorrhoidectomy. Trials were systematically assessed for eligibility and validity, and all data were extracted in duplicate. Data were pooled and analyzed using a random-effects model.

Our search yielded 639 studies, of which 4 RCTs met our eligibility criteria and are included in this review. Oral metronidazole significantly improved pain on postoperative days zero through 6, with the maximal effect seen on postoperative day 5 (weighted mean differences [WMD] –2.28 points on a 10-point visual analogue scale, with 95% confidence interval [CI] –3.05 to –1.50). This effect was not detected on postoperative day 7 (WMD –0.88 [95% CI –3.78 to 2.03]) and did not show a significant effect on time to return to normal activity (WMD 0.48 d later [95% CI –7.06 to 8.02]).

Metronidazole appears to decrease postoperative pain in the first week following hemorrhoidectomy, but does not accelerate return to normal activities.

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Multimodality treatment of locally recurrent adherent colon cancer with neoadjuvant chemoradiotherapy to optimize the achievement of R0 resection. ***J. Hallet, M. Cukier, H. Soliman, A.J. Smith, C.S. Wong.*** **From the Division of Surgical Oncology, University of Toronto, Toronto, Ont., Division of Surgical Oncology, Odette Cancer Centre, Sunnybrook Health Sciences Centre, University of Toronto, Toronto, Ont., the Department of Radiation Oncology, Odette Cancer Centre, Sunnybrook Health Sciences Centre, University of Toronto, Toronto, Ont.**

Local control of locally recurrent adherent colon cancer (LRACC) with surgery is challenging. Neoadjuvant chemoradiotherapy (N-CRT) is now standard for primary and recurrent rectal cancer, but there is a paucity of evidence regarding its role for colon cancer. The aim of this study was to evaluate the feasibility and outcomes of N-CRT for LRACC.

We retrospectively reviewed our institutional Colorectal Cancer Database, from January 2000 to July 2010, for with non-metastatic LRACC who received N-CRT followed by multivisceral resection. Patients were treated with 45–50 Gy in 25 daily fractions and concurrent 5-FU infusion (225 mg/m^2/d). Primary outcome was the achievement of R0 resection (negative microscopic margins). Secondary outcomes were toxicities, postoperative morbidity and mortality, local control, overall survival (OS) and disease-free survival (DFS).

Fifteen patients were retrieved with a median age of 60 (IQR: 50.5–70.5) and 60% male patients. Primary cancers were located in the sigmoid (53.3%) and the left colon (33.3%). En bloc multivisceral resection included between 2 to 5 adjacent organs/structures. All but 2 resulted in R0 resection. One patient (6.7%) experienced complete pathologic response and 1 (6.7%) had minimal residual tumour cells. Postoperative major morbidity was 33.3% and no mortality occurred. At a median follow-up of 33 months, 2 locoregional (13.3%) in non-R0 resections, and 2 distant recurrences (13.3%) occurred at on average of 21 months posttreatment. No grade 3 or 4 late toxicities were observed. Three-year OS and DFS were 87.6% and 63.7%, respectively.

In our experience, N-CRT followed by mutlivisceral resection is a feasible option for the treatment of LRACC to achieve a high rate of R0 resection, while maintaining acceptable treatment toxicity. Short-term oncological results appear satisfying, including good local control. Prospective studies are warranted to compare this approach to multivisceral resection alone.

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Improved health-related quality of life after surgical management of severe refractory constipation-dominant IBS. ***J.Y. Lam, B. Kidane, F. Manji.*** **From the University of Calgary, Calgary, Alta., Western University, London, Ont.**

Irritable bowel syndrome (IBS) is the most common of the functional gastrointestinal disorders (FGIDs). Despite its prevalence and health care costs, there are few effective therapies for patients with severe symptoms. Our objective was to determine whether surgical management would improve health-related quality of life (HRQOL) in severe refractory constipation-dominant FGIDs.

From 2003 to 2005, 6 patients referred for surgical management of a motility disorder, and 2 controls completed Short Form 36 (SF-36) and IBS-36 quality of life questionnaires preoperatively and postoperatively. The HRQOL in these patients was compared with age and sex matched Canadian norms using a Welch unpaired *t* test. Generalized linear models analyzed whether certain factors could significantly predict change.

Preoperative SF-36 Physical Health and Mental Health Summary Scores were significantly lower than the age- and sex-matched Canadian norms ($p < 0.0001$). Postoperative SF-36 Physical Health and Mental Health Summary Scores were not significantly different from the age and sex matched Canadian norms ($p = 0.50$ and $p = 0.57$, respectively). Predictors of improved postoperative HRQOL were evidence of diffuse motility rather than Crohn disease, having a colectomy and ileostomy rather than ileorectal anastomosis and evidence of an identifiable histopathological abnormality in the resected bowel.

Surgical management was successful in improving HRQOL in patients with severe constipation-dominant FGIDs from drastically below that of Canadian norms to a comparable level. This result questions the convention of avoiding operations in patients with FGIDs and demonstrates that specific surgical management may be suitable for the appropriately screened patient.

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Transanal endoscopic microsurgery for benign and malignant rectal tumour: single institution results in first 114 patients. ***A. Lebrun, S. Drolet, P. Bouchard.*** **From the Centre hospitalier universitaire de Québec (Saint-François d'Assise), Québec, Que.**

The aim of this study was to assess the safety of transanal

endoscopic microsurgery (TEM) for resection of benign and malignant rectal tumour in our centre.

All patients having resection of rectal tumour using TEM in our centre were included. A standardized retrospective chart review was performed. Primary outcome was 30-day morbidity and mortality. Secondary outcomes included length of hospital stay, margin status and requirement for additional surgery.

From April 2011 to Dec. 31, 2012, a total of 114 patients underwent TEM resection. Ninety benign neoplasms, 23 malignant lesions (T1 = 17; T2 = 2; T3 = 3) and 3 neuroendocrine tumours were excised. The majority of tumours (61%) were located in the mid rectum (6–10 cm). Mean tumour diameter after fixation was 4.3 cm (range 0.5–11 cm). The mean length of stay was 0.5 day with most of the procedures performed as a day surgery procedure (n = 80; 70%). Mean operative time was 62 min (11–256 min) and blood loss 26 mL (0–500 mL). There was no mortality. Morbidity was 24,6% including surgical complications, such as dehiscence (n = 5), stenosis (n = 4), bleeding (n = 3), abscess (n = 1) and rectovaginal fistula (n = 1), and also medical complications, such as urinary retention (n = 13) and delirium (n = 1). All lesions were removed with grossly negative margins; however, 13 were found to have positive microscopic margin on final pathology (12 benign; 1 malignant). In 12 patients final pathology revealed the presence of adenocarcinoma not diagnosed preoperatively. A total of 5 patients required additional radical surgery after final pathology assessment and risk stratification. Prior TEM resection did not adversely affected results of rectal resection in these patients.

Transanal endoscopic microsurgery is a safe procedure that can be performed in day surgery in most patients. It does not compromise additional radical resection when required after full pathologic assessment and risk stratification.

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Withdrawn

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Development of an evidence-based technical skills and cognitive knowledge curriculum for colorectal surgery — lessons learned from implementation. ***V. Palter, T.P. Grantcharov, N. Ahmed, A. Ryzynski, A.J. Smith, S.M. Ashamalla.*** **From the St. Michael's Hospital, University of Toronto, the Sunnybrook Hospital, University of Toronto, Toronto, Ont.**

With resident work hour restrictions, and ethical concerns with trainees practising skills for the first time on real patients, there is a growing emphasis on redirecting a certain degree of surgical training outside the operating room. Recently, our group conducted a randomized controlled trial demonstrating that residents who participated in a simulation-based curriculum for laparoscopic colorectal surgery showed improved technical performance in the operating room. Based on these positive results, we sought to further develop, expand and integrate this curriculum into the current general surgery core teaching curriculum for residents at our institution.

The 8-week curriculum was divided into a didactic and participatory component. Each week, the residents participated in a 2-hour didactic teaching session followed by a 2 hour simulation-based session in the surgical skills lab. The simulation-based sessions included proficiency training on a laparoscopic box trainer and a virtual reality simulator, as well as case-based learning, and the management of crisis scenarios. At the conclusion of the course, resident learning was assessed with a multiple-choice examination. Resident satisfaction was assessed with weekly surveys, and attendance was tracked on a weekly basis.

Over the 8-week curriculum, the average attendance was 86.8%. The lectures as a group received uniformly high scores across all domains of the resident satisfaction survey (> 4.5 on a Likert scale from 1–5). In addition, the educational value of all simulation-based components of the curriculum were rated as greater than 4.5.

The successful implementation this curriculum into our residency program was highlighted by the high resident attendance and satisfaction scores. This represents a significant change in the structure and content of our current model of resident teaching.

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Transanal endoscopic microsurgery for rectal lesions: Is it safe to use fast track protocol for early discharge? ***M. Paquin-Gobeil, S. Duhaime, I. Yang, R.A. Auer, I. Raîche, J. Mamazza, R.P. Boushey, H. Moloo.*** **From The Ottawa Hospital, University of Ottawa, Ottawa, Ont.**

To determine if discharge within 24 hours post–transanal endoscopic microsurgery (TEM) has worse outcomes than routine 72-hour admission.

We conducted a retrospective study of TEM patients at our tertiary institution between October 2009 and November 2012. Surgeries were performed by 2 colorectal surgeons with similar TEM training and experience but different postoperative care pathways. Patients in group A were sent home within 24 hours without prophylactic antibiotics while patients in group B were kept for 72 hours and discharged with antibiotics. For both groups, we looked at demographics, surgical pathology, operation time, tumour size, perioperative complications, length of stay, readmission rate and Clavien–Dindo classification at 30 days.

We had 27 patients for group A and 29 for group B. Demographic data were similar in each group except for ASA score (median of 3 in A and 2 in B). The 2 groups had similar pathologies. The operative time for group A was 111 minutes (with 3 conversions) versus 77 minutes for group B (no conversion). The median length of stay was 26 hours for group A and 77 hours for group B. The average size of the tumour was 2 cm ± 0.4 cm in each group. The 2 groups had similar intraoperative complications (1 patient needed transfusion in group A). One patient per group developed a fistula; both patients had previous pelvic surgery, while the group A patient also had neoadjuvant radiation. No patients in group A and 22 patients in group B were sent home with prophylactic antibiotics. Overall, 3 patients per group had other kinds of complications. The Clavien–Dindo classification at 30 days was zero in both groups and no patient died. Only 1 patient was readmitted to the hospital in group A.

In our experience, early discharge post-TEM procedure does not change outcomes despite patients in group A having more comorbidities (ASA 3). Also, antimicrobial therapy does not prevent postoperative complications. Early discharge is a safe approach to TEM and is cost-effective.

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Emergency surgery for colorectal cancer is associated with increased rate of recurrence, compared with elective surgery. ***S. Patel, S.V.B. Patel, M. Brackstone.*** **From the London Health Sciences Centre, London, Ont.**

The objective of this study was to determine if emergency surgery is associated with an increased rate of recurrence, after adjusting for stage and other confounders, compared with elective patients with colorectal cancer.

Using a prospectively collected database from a tertiary care centre, a cohort study was undertaken. The crude association between the nature of surgery (emergency v. elective) and the rate of recurrence was determined. A model was then constructed to determine the association between the nature of surgery and recurrence, after adjusting for important confounders. A prior risk factors for recurrence were identified. Those meeting a prespecified cut-off were incorporated into a forward stepwise strategy to construct a Cox regression model. Sensitivity analysis was completed after excluding 1) those who died within 30 days of surgery and 2) those who received neoadjuvant therapy.

A total of 1356 patients were included in the database. Of these, 12% (n = 167) underwent emergency surgery. The rate of recurrence was 239 per 1000 person years in the emergency group, compared with 87 per 1000 person years in the elective group (RR 2.7, 95% CI 2.1–3.6, $p < 0.0001$). The regression model identified pathologic stage, adjuvant chemotherapy, age group and positive margins as confounders. After adjusting for these confounders, the hazard ratio of patients undergoing emergency surgery was 1.5 (95% CI 1.1–1.9, $p = 0.006$) compared to the elective surgery group. Similar results were seen when excluding those who died within 30 days (HR 1.4, 95% CI 1.1–1.9, $p = 0.01$) and excluding those who received neoadjuvant therapy (HR 1.5, 95% CI 1.1–2.0, $p = 0.007$).

Patients who require emergency surgery are at increased risk of recurrence compared with those who present electively. There may be a role for more aggressive adjuvant therapy in this group, but further studies are needed to determine the benefits of this strategy.

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Emergency surgery for colorectal cancer does not result in nodal understaging, compared with elective surgery. ***S.V.B. Patel, S. Patel, M. Brackstone.*** **From the London Health Sciences Centre, London, Ont.**

The objective of this study was to compare the adequacy of nodal staging in patients undergoing emergency surgery compared with elective surgery for colorectal cancer.

Using a prospectively collected colorectal cancer surgery database at a tertiary care centre, a cohort study was undertaken. The mean number of lymph nodes harvested were compared between patients undergoing elective and emergent surgery. In addition, the proportion of patients who had inadequate staging (< 12 nodes harvested) were compared between groups. A Mantel–Haenszel analysis of adequacy of nodal staging was also completed, stratifying by both malignancy site and type of operation.

Of the 1356 enrolled patients, 1279 (94%) had nodal data available for analysis. There were 161 (13%) emergency surgery patients and 1118 (87%) elective surgery patients. The mean number of nodes removed was higher in the emergency surgery group (mean difference +2.8, 95% CI 0.6–5.1, $p = 0.01$). The proportion of patients with inadequate nodal staging did not differ between groups (emergent 16%, elective 17%, $p = 0.79$). The odds of adequate node staging, after stratifying by malignancy location (right, transverse, left/sigmoid, rectum) showed no difference between groups (OR 0.87, 95% CI 0.54–1.41, $p = 0.57$). Similarly, stratifying by surgery type (right hemicolectomy, left/sigmoid resection, low anterior resection/abdominoperineal resection/Hartmann, subtotal colectomy, segmental colectomy) showed no difference in the odds of adequate node staging (OR 0.81, 95% CI 0.50–1.31, $p = 0.40$).

Despite some surgeons' beliefs that emergency surgery more commonly under stages colorectal malignancies, we found no evidence that this is true. In actuality, emergency surgery resulted in a significant increase in the average number of nodes harvested, with no difference in the proportion of inadequate nodal staging.

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Withdrawn

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Nonsteroidal anti-inflammatory drug (NSAID) use and anastomotic leak following elective colorectal surgery. ***J. Subendran, N. Siddiqui, J.C. Victor, R.S. McLeod, A. Govindarajan.*** **From the Mount Sinai Hospital, University of Toronto, Toronto, Ont., the Institute of Health Policy Management and Evaluation, University of Toronto, Toronto, Ont.**

Nonsteroidal anti-inflammatory drugs (NSAIDs) have been shown to decrease postoperative pain and opioid consumption. The objective of the study was to determine if use of postoperative NSAIDs is associated with increased anastomotic leaks following elective colorectal surgery.

We used a matched case–control study design. Using a prospectively collected database, we identified all patients having elective colorectal surgery at an urban academic hospital between January 2001 and June 2012. Cases and controls were defined based on the identification of a postoperative anastomotic leak. Controls were chosen using 1:1 matching with cases based on underlying disease, type of surgery, age, and year of surgery. The primary exposure was use of any postoperative NSAID, and a secondary analysis considered use of intravenous ketorolac specifically. Conditional logistic regression was used to determine the unadjusted and adjusted odds ratio.

A total of 262 patients were included (76.7% inflammatory bowel disease, 23.3% cancer). Anastomoses performed included ileal pouch–anal anastomoses (46.6%), colonic (29.9%) and rectal (23.8%). Preoperative steroids were used by 13.7% of patients. There was no significant difference in anastomotic leaks between cases and controls receiving any NSAID (OR 1.71, 95% CI 0.94–3.10, $p = 0.08$). Similar results were found after adjusting for preoperative steroids and smoking (OR 1.81, 95% CI 0.98–3.37, $p = 0.06$). In secondary analyses, use of IV ketorolac was associated with a significant increase in anastomotic leaks in unadjusted (OR 2.00, 95% CI 1.10–3.65, $p = 0.024$) and adjusted analyses (OR 2.09, 95% CI 1.12–3.89, $p = 0.021$). There was no significant association between anastomotic leaks and cumulative NSAID dose.

These data suggest that there may be an association between postoperative NSAIDs and risk of anastomotic leaks after colorectal surgery. Further research is needed to better elucidate this relationship to clarify the implications for patients.

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Complete response versus partial response postneoadjuvant chemoradiation in locally advanced rectal cancer: Does the degree of response influence the outcome? ***J.T. Groom, J.-F. Latulippe, M. Poirier, J. Gaboriault, S. Dubé, M. Henri.***
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Locally advanced rectal cancer is frequently treated with neoadjuvant chemoradiation (NCR) to reduce local recurrence rates and possibly improve long-term survival. The tumour response to NCR is variable and may influence the prognosis postcurative surgery. While pathologic complete response (pCR) to NCR improves prognosis after surgery, very few studies have evaluated the outcome following pathologic partial response (pPR). This study compared long-term results of pCR and pPR to NCR in patients operated for low and mid-rectal adenocarcinoma.

A single-centre colorectal cancer database was retrospectively queried for patients with primary rectal cancer undergoing NCR followed by total mesorectal excision (TME) with curative intent between 2000 and 2006. Patients were stratified into pCR, pPR and no response groups. Criteria for pPR were a down staging of T value ± a down staging in the *n* value or a stable T value with a down staging of *n* value as compared to the pretreatment MRI. Local and distant recurrence, and 5-year overall survival were calculated, and analysed using the Fisher exact test and log-rank test.

One hundred and five patients underwent TME for low and mid-rectal cancer after NCR consisting of 45 to 50 Gy of radiation combined with 5FU. Of these, 20 patients (19%) achieved pCR, 27 patients (25.7%) achieved pPR, and 58 had no response. At 5 years postsurgery (median follow-up 6.2 yr), the pCR group compared to the pPR group had a cumulated local recurrence rate of 5.3% versus 4% ($p = 0.56$), and a distant recurrence rate of 7.7% versus 23.5% ($p = 0.17$). Five-year overall survival rates were 85% (pCR) versus 77.8% (pPR; $p = 0.31$). Patients with no response to NCR had a distant cancer recurrence rate of 42.3% (compared to pCR, $p < 0.0001$; compared to pPR, $p = 0.0007$) and a 5-year overall survival rate of 74.1%.

Pathologic partial response and complete response to NCR offer similar outcomes in locally advanced cancer.

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Withdrawn

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